



Wheel Bearing Vacuum/Pressure Testing of Seal Case and Cap Interfaces

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 describes a laboratory procedure for evaluation of the static seal interfaces on wheel bearings. This procedure can also be used to establish the burst pressure of the dynamic seals.

1.2 Applicability. This standard is applicable for tests performed during product development, Design Validation (DV) and Product Validation (PV), of wheel bearings to be used on General Motors vehicles.

1.3 Remarks. This standard includes general descriptions of the laboratory test procedure for evaluating static sealing of passenger vehicle wheel bearings. Associated measurements, inspections, analyses and monitoring procedures are also given (see Appendix A, Table A1).

The applicable wheel bearing Statement of Requirements (SOR) or Component Technical Specification (CTS), provides program specific information and acceptance criteria for bearings tested per this standard. In the event there is disagreement between this standard and the SOR or CTS, the SOR or CTS has precedence.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15264 GMW15760

3 Resources

3.1 Facilities. Facility with Test Improvement Process (TIP) approved test machine shall be used.

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.

3.1.2.1 Test facilities must be certified per the GM Test Improvement Process (TIP).

3.2 Equipment. The test equipment shall be capable of accurately applying the environmental conditions and the pressure and vacuum evaluations as described in this standard. The pressure gage must have at least a discrimination ratio of 7 kPa or 1 psi. The vacuum gage must have a minimum discrimination of 20 mm Hg (2.5 in Hg).

3.3 Test Vehicle/Test Piece.

3.3.1 Parts are specified in this standard for three (3) purposes:

- For determining the static sealing ability of the static seal interfaces utilizing pressure and vacuum.

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October 2017

Page 1 of 9

- For determining the reliability/durability of the static seal interfaces of the bearings when exposed to a specific vacuum level with simulated environmental factors to induce corrosion and temperature fluctuations that the bearings would see under vehicle test conditions.
- To evaluate the seal opening or burping pressure that can be utilized to evaluate potential variation in the seal lip pressures related to seal wear.

3.3.2 The pressure and vacuum testing should be completed on new parts or subassemblies that have gone through the normal production process. The seal leak pressure may be utilized to evaluate bearings that have undergone other conditioning to be compared to new parts.

3.3.3 Test parts used for DV are to be from production tooling and processes to the extent possible. PV requires parts to be from production tooling and processes unless an exception is approved in writing by the GM contact specified in the SOR document.

3.3.4 Selection of parts undergoing PV shall be made per GMW15760.

3.3.5 The part selection concepts in GMW15760 should also be applied, if possible, during the assembly of components for DV.

3.3.6 Within each phase (DV and PV), the number of test parts for each test shall be at least six (6). During PV, the sample size shall be six (6) bearings or a minimum of two (2) bearings from each shift (produced a minimum of 3 h apart) on each wheel bearing assembly line (from all assembly facilities). Critical parts (balls or rollers, races, seals, grease, etc.) should come from as many of the planned or actual production sources (suppliers, production lines, shifts, etc.) as possible.

3.4 Test Time.

Calendar time: 18 days total

Test time: 216 h (9 days) per group of bearings for 3 years of corrosion exposure.
1 h per bearing for pressure testing.
24 h per bearing for vacuum testing

Coordination time: 2 h per bearing

3.5 Test Required Information.

3.5.1 The Supplier is required to have written local procedures consistent with the procedure description in Section 4.3 of this standard.

3.5.2 There are four (4) main categories of procedures listed in this standard:

- Pressure and vacuum exposure to look for leaks between the static seal interfaces with no environmental exposure.
- Environmental exposure utilizing GMW15264 corrosion exposure under vacuum to evaluate rust paths and sealing between the static interfaces.
- Pressure exposure to look for seal opening or burping pressure for correlation to drag and sealing requirements.
- Inspections, measurements and analyses used to determine the properties and/or condition of new and/or tested bearings.

3.6 Personnel/Skills. Personnel performing the testing and measurements to validate parts for GM shall be trained by the Supplier.

4 Procedure

4.1 Preparation. Build appropriate fixtures and/or rework test wheel bearings to effectively isolate the appropriate interface for evaluation. A safety case or container should be utilized to capture the cap or seal case if it becomes dislodged from the bearing during the evaluation. Refer to Appendix A, Figures A1 and A2 for examples of the test fixture and safety case.

4.2 Conditions.

4.2.1 Environmental Conditions. Applicable conditions are specified in Section 4.3.

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October 2017

Page 2 of 9



Documents

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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.

4.2.2.1 This test is intended to assess the sealing capability of wheel bearing static seal interfaces and end caps. GMW15264 will be utilized to induce corrosion and thermal cycling that is typical of the vehicle exposure.

4.3 Instructions.

4.3.1 Complete Bearing Pressure Test Evaluations.

4.3.1.1 Test Sample Preparation. The test bearing should be drilled and tapped to port the bearing so that air pressure and or vacuum can be applied to the internals of the bearing for testing.

Note: For bearings that utilize a between-the-row sensor, the sensor hole can be utilized to apply the vacuum and/or pressure when evaluating the bearing seals and seal case interfaces.

4.3.1.2 Pressure Evaluation. An air line with a variable pressure regulator should be applied to the bearing. The bearing shall then be submerged underwater in a container. The pressure should be slowly raised until a bubble can be formed by air escaping from the bearing.

4.3.1.2.1 Evaluation Criteria for Static Interfaces. The air bubble or release must be through the seal lips and cannot be present between any of the static interfaces. The minimum pressure a static interface must be able to withstand before a leak is specified in the CTS.

Note: If the seals burp or leak prior to reaching these pressure levels, the seals interface must be isolated and sealed off to assess the static interface.

4.3.1.2.2 Evaluation Criteria for Seal Burst Pressure. The air bubble or release must be through the seal lips and cannot be present between any of the static interfaces. The pressure at which one of the seals burps or starts releasing an air bubble must be noted. For drive bearings, this pressure must be established for both the inboard (IB) and the outboard (OB) seals separately by sealing off the other seal with epoxy or Room Temperature Vulcanizing (RTV) sealant.

4.3.2 Outer-Ring-Only Pressure and Vacuum Test Evaluations.

4.3.2.1 Test Sample Preparation. The test bearing should be disassembled in such a manner as to not disturb the static interface between the seal case and the outer ring. For evaluations of a cap on the IB side of a bearing, the roll form must be removed prior to assembly or any other means of clamp load retention left off, so that the outer ring can be removed from the bearing to evaluate the cap. The bearing should then utilize the production process to install the cap, especially for PV validation.

4.3.2.2 Test Fixture Preparation. A test fixture should be constructed so that the outer ring can be clamped to a fixture base that will seal off the opposite side of the outer ring to evaluate one interface at a time. A cap that can be adhered to the seals utilizing a cyanoacrylate (Super Glue, or similar) adhesive and/or RTV so that the seal case can be evaluated must be constructed. A retention screw through the center of the cap can be utilized, if necessary, to help secure the cap and offset the force from the pressure applied. Refer to Appendix A, Figures A1, A2 and A3 for examples of the test fixture and set up for the pressure and vacuum testing.

4.3.2.3 Pressure Evaluation. An air line with a variable pressure regulator should be applied to the bearing. The bearing should then be submerged underwater in a container. The pressure should be slowly raised until a bubble can be formed by air escaping from the bearing between the seal case and outer ring or the maximum pressure is reached as specified in the CTS.

4.3.2.3.1 Evaluation Criteria for Static Interfaces. The minimum pressure a static interface must be able to withstand before a leak is specified in the CTS.

4.3.2.4 Vacuum Evaluation. A line with a vacuum gage should be attached to test equipment that will pull a vacuum and then shut off. The outer ring and fixture assembly should be evacuated to the 500 mm Hg. The assembly should then be evaluated for a 24 h period and the decrease in vacuum should be noted in the test record.

Note: Care must be maintained to ensure that the assembly is held at a constant temperature and to ensure that there are no leaks in the test equipment.

4.3.2.4.1 Evaluation Criteria for Static Interfaces. The minimum loss in vacuum over the 24 h period shall be no greater than 40 mm Hg.

4.3.2.5 Environmental Exposure under Vacuum Evaluation. A test fixture that will allow a vacuum to be pulled and then shut off is to be utilized. The outer ring and fixture assembly should be evacuated to the 500 mm Hg.

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October 2017

Page 3 of 9