



Pothole No. 3 Test for Wheels and Tires

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. The purpose of this test is to assess the performance of tires and wheels in association with the vehicle suspension and body structure using Pothole Number (No.) 3, used for durability testing.

1.2 Applicability. This test applies to cars, wagons, crossovers, sport utility vehicles (SUV), passenger vans, pickup trucks, and cargo vans. It can be used as a component test or a vehicle system test.

1.3 Remarks. Typically, two tire and wheel assemblies are assessed (one impact for each assembly) in this test, one on the front corner and the other on the rear, and both on the same side of the vehicle.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3238

GMW15445

GMW16590

2.3 Additional References.

- DR.MF.PZ – Milford Proving Grounds Driving Instruction
- GM Drawing Number 9590710, Drawing Name: Wheel Spec - Wheel Uniformity and Low Point Marking

3 Resources

3.1 Facilities. Pothole test facility as described in GMW3238, Global Pothole Test Facilities.

3.2 Equipment.

3.2.1 Wheel uniformity machinery capable of measuring wheel uniformity coefficients as described in Appendix A, Section A1.

3.2.2 Position measurement machinery capable of determining wheel bead seats radial and lateral coordinates as described in Appendix A, Section A2.

3.2.3 Tire pressure gage.

3.2.4 Ballast which conforms to appropriate proving ground ballasting procedures.

3.2.5 Device capable of correctly indicating vehicle speed, such as the vehicle speedometer, radar unit, Global Positioning System (GPS) device, etc.

Note: Whenever instrumentation is placed in a test vehicle, its installation and use must be governed by the appropriate proving ground driving regulations.

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3.3 Test Vehicle/Test Piece.

3.3.1 Test wheels should be minimum stock condition unless otherwise specified by the requestor. Wheels must be free from significant dents. However, it is not necessary that the pretest wheels meet design specifications for wheel uniformity as stated on the wheel drawing.

3.3.2 Test tires should be sufficient for test wheels. Ideally, the test tires should be the production intent tires or if unavailable, the most up to date construction of the production intent tires. The test tires must match the production intent tire dimensions.

3.4 Test Time.

Calendar time: 2 days

Test hours: 14 hours

Coordination hours: 7 hours

3.5 Test Required Information.

3.5.1 Tire size(s).

3.5.2 Tire pressure(s).

3.5.3 Test assembly locations on the test vehicle.

3.5.4 Front and rear axle weights specified for test or if not specified, front and rear Gross Axle Weight Rating (GAWR) for the vehicle for which the test assemblies are intended.

3.5.5 Gross Vehicle Weight (GVW) for the test vehicle to be used.

3.5.6 Front and rear GAWR for the test vehicle to be used.

3.6 Personnel/Skills. Personnel should have the following training or credentials:

3.6.1 Vehicle lift/hoist operation.

3.6.2 Must meet appropriate Proving Grounds Driving Regulations to operate a vehicle to and from and in the pothole test facility.

4 Procedure

4.1 Preparation.

Note: Follow Vehicle Security Process Requirements. Since this test requires a test vehicle, follow the security measures required for all pre-production vehicle properties.

4.1.1 Perform pretest assessment of test wheels. Test requestor should be informed of the results in order to determine whether or not a wheel should be accepted or rejected for use.

Note: If the test is for compact/temporary use/spare assemblies, it is unnecessary to measure uniformity coefficients or bead seats coordinates.

4.1.1.1 Measure and record pretest uniformity coefficients as described in Appendix A, Section A1.

4.1.1.2 Measure and record pretest bead seats radial and lateral coordinates as described in Appendix A, Section A2.

4.1.2 Perform pretest assessment of test tires.

4.1.2.1 Inspect for visible damage and damage perceptible by touch on the exterior of the tires. If a tire has visible damage, it should not be used as a test specimen. Document the tires as production intent or not, and if not, describe how they differ; also note if they are new or not.

4.1.3 Mount each test tire on its respective test wheel.

4.1.3.1 Inspect for visible damage and damage perceptible by touch on the exterior of the tires, after the tires have been mounted and inflated. If a tire has visible damage, it should not be used as a test specimen.

4.1.4 For tests of road wheels, install each test assembly on the test vehicle in the position requested and inflate every tire on the vehicle to the pressure requested. If position is not specified, typical placement is left front and left rear. For tests of compact temporary use/spare assemblies, see 4.1.4.1. Record the positions of the specific test assemblies. Note that for some vehicles the front and rear design intent assemblies may differ in their

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dimensions and pressures, and this intent should be reflected in setup. If the pressures are not specified, use pressure specifications for the vehicle for which the test assemblies are intended.

4.1.4.1 Tests of compact temporary use/spare assemblies. Since only one spare assembly is expected to be used on a vehicle at a time, install only one at a time in each of the typical Left Front (LF) and Left Rear (LR) positions. Two impact runs will be required to test both positions. It is recommended to use a road assembly for the remaining LF or LR position that was not supplied with the vehicle, since this position will also go over the pothole, and could be damaged.

4.1.5 Ballast vehicle per appropriate proving ground ballasting procedures and driving regulations.

4.1.5.1 References. An example of a ballasting procedure is GMW15445 Vehicle Ballast.

4.1.5.2 Passengers. Water containers or equivalent ballast weights used to simulate passengers may be placed in all design intent passenger seating locations.

4.1.5.3 Axle Loading. Adjust ballast in vehicle to achieve test requestor's specified axle loading. If not specified, adjust to achieve front and rear GAWR for the vehicle for which the test assemblies are intended.

4.1.5.4 Corner Loading. It is recommended to distribute ballast so that the left and right front corners weigh close to the same and the left and right rear corners weigh close to the same. Record all four corner weights.

4.1.5.5 Test Vehicle Load Capacity. If the test loads required exceed the capacity of the test vehicle, obtain permission from the provider of the test vehicle before proceeding with ballasting.

4.2 Conditions.

4.2.1 Environmental Conditions. Pothole facility must be free of snow and ice, and the potholes cannot have standing water.

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 Drive to the pothole facility. Coat the edge(s) of the exit ramp(s) of the pothole(s) to be used with a solid paint marker or other suitable material in order to indicate the impact location on the tire. Immediately before driving through the pothole, check tire pressures at the closest location allowed and record. This is done, because in driving to the test facility, tire pressure may change.

4.3.2 Drive through the pothole(s) at 40 km/h (25 mph) so that each test assembly undergoes one pothole impact. Under some circumstances, the test requestor may ask that more than one impact be performed. Note that permission from the provider of the test vehicle should be obtained if any test assembly is going to be subjected to more than one impact. An example procedure detailing the use of the pothole test facility to provide one impact for every assembly on a vehicle is DR.MF.PZ, Pothole No. 3.

4.3.3 Immediately after driving through the pothole, check tire pressures at the closest location allowed and record. For compact temporary use/spares, check tire pressures 1 minute after impacts and record. Check tire pressures for road wheels 30 minutes after impacts and record. Note that the intent of this is to determine if an assembly has a slow leak after the pothole impact. Assembly pressures may change due to temperature changes. For example, bringing assemblies into an air conditioned area in the summer may cause a drop in pressure that is not due to air loss. Bringing the assemblies into a heated area in the winter may cause an increase in air pressure that could hide air loss. One way to compensate for temperature effects is to allow an assembly's temperature to stabilize, measure a new initial pressure, and then check the pressure 30 minutes after that. Record the pressures.

4.3.4 Remove each test assembly from the vehicle for posttest evaluation. Inspect each test assembly for damage and record observations. Photograph as appropriate. Mark the position of the each tire on each wheel before dismounting. Inspect for visible damage and damage perceptible by touch on the exterior of the tires at the impact location indicated by paint (see 4.3.1), before the tires have been deflated and dismounted. Photograph as appropriate. Once dismounted, if there is no visible damage or damage perceptible by touch, then record as: "No visible damage or damage perceptible by touch on exterior of tire". If there is damage, record a description of it, take photographs, and set aside the tire to be inspected by a tire engineer.

4.3.5 Perform Posttest Assessment of Test Wheels.

Note: If the test is for compact/temporary use/spare assemblies, it is unnecessary to measure uniformity coefficients or bead seats coordinates.

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4.3.5.1 Check each wheel for visible deformation on inboard and outboard flanges and record observations. Photograph as appropriate. Inspect each wheel for cracks using dye penetrant or equivalent, and photograph as appropriate.

4.3.5.2 Measure and record posttest uniformity coefficients as described in Appendix A, Section A1.

4.3.5.3 Measure and record posttest bead seats radial and lateral coordinates as described in Appendix A, Section A2.

5 Data

5.1 Calculations.

5.1.1 Calculate the differences between the pretest and posttest uniformity coefficients as pretest values subtracted from the posttest values. These differences are referred to as the changes in uniformity coefficients.

5.1.2 Calculate the differences between the pretest and posttest bead seat radial and lateral coordinates as posttest values subtracted from the pretest values. The maximum difference is referred to as the bead seat dent depth, and will usually (but not always) be the radial difference for the inboard bead seat.

5.2 Interpretation of Results. See sourcing documents.

5.3 Test Documentation. The test results documentation should include the following:

5.3.1 Test results reports (generated by Global Tire-Wheel Test System (GTWTS) if submitting extensible markup language (XML) files).

5.3.2 Test result data files (XML format).

5.3.3 Completed datasheets.

5.3.4 Photographs.

Note: A sample data sheet for the pothole test is given in Appendix B, Data Sheet B1, and a sample report for the pothole test is given in Appendix C, Test Report C1. A sample report for the uniformity results is given in Appendix D, Report D1.

Note: For data being loaded into the GTWTS, submit electronically the test results data files (XML format) and other supporting files listed in 5.3. GMW16590 defines the electronic file details (e.g., file types, file naming convention, and detailed file formats) for the GTWTS.

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 Physical Safety. Review all appropriate proving grounds driving regulations relevant to this test prior to entering any test road system.

6.2 Ergonomic Safety. Do not attempt to lift or move items that are so heavy or resistant that this would cause injury.

6.3 Hazardous Materials. When hazardous materials are present, take necessary precautions to prevent exposure above safe limits.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

#	Number
GAWR	Gross Axle Weight Rating
GPS	Global Positioning System
GSSLT	Global Subsystem Leadership Team
GTWTS	Global Tire-Wheel Test System

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GVW	Gross Vehicle Weight
ID	Identification
LF	Left Front
LR	Left Rear
LRI	Left Rear Inside
LRO	Left Rear Outside
No.	Number
P/N	Part Number
PQMS	Performance and Quality Management System
RF	Right Front
RR	Right Rear
RRI	Right Rear Inside
RRO	Right Rear Outside
SUV	Sport Utility Vehicle
TIR	Total Indicated Runout
TR	Test Request
TWS	Tire-Wheel System
XML	Extensible Markup Language

8 Coding System

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

Test to GMW15439

9 Release and Revisions

This standard was originated in October 2006. It was first approved by the Wheel Global Subsystem Leadership Team in October 2006. It was first published in September 2007.

Issue	Publication Date	Description (Organization)
1	SEP 2007	Initial publication.
2	JUN 2013	Revised to current template. Made the following significant changes: 4.1: Removed the pre-test wheel crack inspection. 4.3.1: Added an instruction to mark the pothole before the test with a material to indicate the impact location on a tire. 4.3.3: Added a note that a change in ambient temperature may affect tire pressure between the time of impact and a pressure measurement 30 minutes later. 4.3.4: Added an instruction to inspect for damage perceptible to touch at the impact location on a tire. (Tire and Wheel GSSLT)
3	SEP 2015	2.3, 4.1: Added reference to the vehicle security process. 3.3.1: Added note of typical practice of allowing pretest wheels that do not meet uniformity specifications and not allowing significantly dented wheels. 4.1.1, 4.1.4, 4.3.5: Added specific instructions for tests of compact temporary use/spare assemblies. (Chassis Tire and Wheel Global Subsystem Leadership Team (GSSLT))

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