



Wheel Trim Removal Force Test

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 standard is to evaluate the retention of wheel trim in the laboratory.

1.2 Applicability.

1.2.1 Method A. To determine wheel trim removal forces correlated to the European market road systems.

1.2.2 Method B. To determine wheel trim torque to turn and removal forces correlated to the Australian market road systems.

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

2.3 Additional References.

- Kistler Instrument Corporation, Amherst, New York

3 Resources

3.1 Facilities. Roofed building with wheel holding fixture (including stand).

3.2 Equipment.

3.2.1 Suitable removal force gauge.

3.2.1.1 Electronic force measurement gauge. Piezoelectric force transducer from Kistler Instrument Corporation (type 9021) or equivalent. Amplifier from Kistler Instrument Corporation (type 5007) or equivalent.

3.2.1.2 Alternatively, a 600 N (minimum capacity) spring scale.

3.2.2 Lifting crane or loading fixture.

3.2.3 Appropriate bracket(s) to attach to center of center caps for removal force measurement.

3.2.4 Method Specific Equipment.

3.2.4.1 Method A. Not applicable.

3.2.4.2 Method B. Torque measurement gauge and appropriate bracket(s) with provision to measure torque to turn for center caps and/or covers.

3.3 Test Vehicle/Test Piece.

3.3.1 Method A. The quantity of wheel trim to be tested shall be agreed with the responsible requesting engineer. Production representative measurement wheel (depending on wheel trim type and/or diameter, 330 mm, 356 mm, 381 mm, (13 in, 14 in, 15 in) etc., for covers).

3.3.2 Method B. Testing to be performed on the following combinations for worst case tolerance conditions:

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- Maximum Retention Condition: Maximum outer retention diameter wheel trim with minimum inner retention diameter wheel.
- Minimum Retention Condition: Minimum outer retention diameter wheel trim with maximum inner retention diameter wheel.

3.3.2.1 Testing must only be conducted on samples after conditioning for a period of 24 h to 72 h in a standard atmosphere of $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $65\% \pm 5\%$ relative humidity, unless otherwise stated by the requesting engineer.

3.3.2.2 Batches of wheel trim produced for validation purposes must be of a reasonable run size, e.g., 25 samples to 30 samples approximately.

3.4 Test Time.

Calendar time: 1 day

Test hours: 3 hours

Coordination hours: 1 hour

3.5 Test Required Information. See Appendix A, B, C and D (Data Sheets A1, B1, C1 and D1).

3.6 Personnel/Skills. Test operator shall be qualified on the basis of appropriate education, training, experience, and/or demonstrated skills.

4 Procedure

4.1 Preparation.

4.1.1 The wheel holding fixture (including stand) shall be appropriately secured to the floor.

4.1.2 The measurement wheel shall be fastened to the wheel holding equipment.

4.1.3 The bracket for the removal force gauge shall be fastened to the center of the center cap test pieces. Use of this bracket is not applicable for covers.

4.1.4 Method Specific Preparation.

4.1.4.1 Method A. Not applicable.

4.1.4.2 Method B. Bracket fastened to center caps to include provision to measure torque to turn.

4.2 Conditions.

4.2.1 Environmental Conditions. The test shall be performed at $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

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 Method A. The test piece shall be installed on the measurement wheel. Attach the removal force gauge to the hook of the lifting crane.

4.3.1.1 For Center Caps. The hook of the removal force gauge shall be positioned on the bracket centered to the test piece.

4.3.1.1.1 The test piece shall be removed from the wheel by the lifting crane at a low speed (20 mm/s). The removal force shall be recorded on Appendix A, Data Sheet A1.

4.3.1.1.2 The test piece shall be installed on the measurement wheel again.

4.3.1.1.3 The procedure described in 4.3.1.1.1 to 4.3.1.1.2 shall be repeated two (2) times.

4.3.1.2 For Wheel Covers. Place hook of the removal force gauge vertical to the test part, at the outmost edge of the vent hole closest to position (pos) one (1) as shown in Figure 1.

4.3.1.2.1 Use lifting crane to pull wheel cover from the wheel at a low speed (20 mm/s). Record removal force on Appendix B, Data Sheet B1.

4.3.1.2.2 Reinstall the wheel cover on the test wheel.

4.3.1.2.3 Repeat the procedure in 4.3.1.2.1 to 4.3.1.2.2 two (2) more times.

4.3.1.2.4 Repeat the procedure described in 4.3.1.2.1 to 4.3.1.2.3 in positions two, three and four (2, 3 and 4) as shown in Figure 1.

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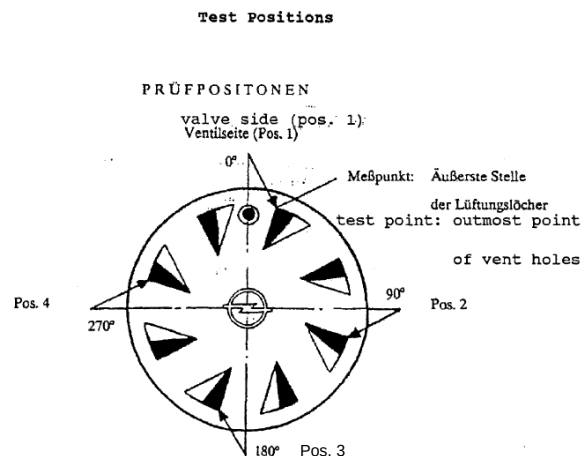


Figure 1: Wheel Cover Test Positions

4.3.2 Method B. The maximum retention condition test piece shall be installed on the maximum retention condition measurement wheel.

4.3.2.1 For Center Caps.

4.3.2.1.1 Attach the torque measurement gauge to the wheel trim bracket. Measure the torque to turn the test piece in the wheel (breakaway torque) and record on Appendix C, Data Sheet C1.

4.3.2.1.2 The hook of the removal force gauge shall be positioned on the bracket centered to the test piece.

4.3.2.1.3 The test piece shall be removed from the wheel by the lifting fixture at a low speed (20 mm/s). The removal force shall be recorded on Appendix C, Data Sheet C1.

4.3.2.1.4 The test piece shall be installed on the measurement wheel again.

4.3.2.1.5 The procedure described in 4.3.2.1.1 to 4.3.2.1.4 shall be repeated five (5) times.

4.3.2.1.6 The minimum retention condition test piece shall be installed on the minimum retention condition measurement wheel.

4.3.2.1.7 The procedure described in 4.3.2.1.1 to 4.3.2.1.5 shall be repeated for the minimum retention condition.

4.3.2.2 For Wheel Covers.

4.3.2.2.1 Measure the torque to turn the test piece in the wheel (breakaway torque) and record on Appendix D, Data Sheet D1.

4.3.2.2.2 Place hook of the removal force gauge vertical to the test part, at the outermost edge of the cover in line with the valve hole.

4.3.2.2.3 Use lifting fixture to pull wheel cover from the wheel at a low speed (20 mm/s). Record removal force on Appendix D, Data Sheet D1.

4.3.2.2.4 Reinstall the cover on the test wheel.

4.3.2.2.5 Repeat the procedure in 4.3.2.2.1 to 4.3.2.2.4 for 29 more times.

4.3.2.2.6 Repeat the procedure in 4.3.2.2.2 to 4.3.2.2.5 but at 90 degrees from the valve hole and without measuring torque to turn.

4.3.2.2.7 The minimum retention condition test piece shall be installed on the minimum retention condition measurement wheel.

4.3.2.2.8 The procedure described in 4.3.2.2.1 to 4.3.2.2.5 shall be repeated for the minimum retention condition.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results.

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5.2.1 Method A.

5.2.1.1 For Center Caps. The test piece has demonstrated compliance with the test conditions, if the ratio of removal force to the wheel center caps mass is above 1.5 N/g.

5.2.1.2 For Wheel Covers. The tested wheel cover has demonstrated compliance with the test conditions, when the removal force at all four test positions is ≤ 220 N.

5.2.2 Method B.

5.2.2.1 For Center Caps.

5.2.2.1.1 Torque to turn > 0.5 N·m.

5.2.2.1.2 Removal forces < 600 N.

5.2.2.1.3 No cracking, distortion, or delamination of protective/decorative coating is permissible.

5.2.2.1.4 Where cap incorporates an anti-rotation device, the device must be able to withstand a torque of at least 5 N·m. The cap must not rotate by more than 1.2 mm (measured at the outermost edge of the cap) in either direction at 5 N·m.

5.2.2.1.5 If cap is an assembly (made of multiple pieces) there shall be no audible rattles or squeaks when the assembly is shaken vigorously by hand.

5.2.2.2 For Wheel Covers.

5.2.2.2.1 Rotation of the cover is not permissible if the trim touches the valve stem or if maximum rotation exceeds 10 mm (measured at the outermost edge of the cover). Torque to turn cover on wheel shall not decrease by more than 20%.

5.2.2.2.2 Removal force ≥ 177 N.

5.2.2.2.3 No cracking, distortion, or delamination of protective/decorative coating is permissible.

5.2.2.2.4 Where cover incorporates an anti-rotation device, the device must be able to withstand a torque 2.5 times the torque to turn without damage under rapid and slow oscillation of cover in wheel in both directions.

5.2.2.2.5 If cover is an assembly (made of multiple pieces) there shall be no audible rattles or squeaks when the assembly is shaken vigorously by hand.

5.3 Test Documentation. With reference to this test procedure, the results of the measurements shall be presented in a test report per Data Sheets A1, B1, C1 or D1, in Appendix A, B, C or D, respectively.

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.

CW	Clockwise
CCW	Counter Clockwise
pos	Position
TPMS	Tire Pressure Monitoring System

8 Coding System

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

Test to GMW15435

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