



Wheel Inboard Rim Flange Vertical Impact

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 documents parameters for light alloy wheel inboard rim flange vertical Impact testing.

1.2 Applicability. This standard applies to all light alloy wheels.

2 References

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

2.1 External Standards/Specifications.

AS 1638 JIS D4103

2.2 GM Standards/Specifications.

GMW16590

2.3 Additional References.

- GM K-PAC best practice TIRE-WHEL-17 Global Common Standard Wheel Interfaces Drawing
- VS200 Velocity Monitor and Optical Sensor. GHI Systems Incorporated 916 N. Western Ave., Suite 201 San Pedro, CA 90732, USA (<http://www.ghisys.com/>)

3 Resources

3.1 Facilities. Laboratory capable of performing tests as documented in this specification.

3.2 Equipment.

3.2.1 Appropriate drop test fixture as shown in Appendix A and as specified in AS 1638/JIS D4103.

Note: The impact tests described by standards AS1638 and JIS D4103 are different than the impact test described by this GMW, as they are 30 degree impacts, while this GMW specifies a 90 degree impact.

3.2.1.1 The sprung weight system consists of the following components:

- A main mass of 900 kg $\pm$ 10 kg.
- An auxiliary mass of 100 kg $\pm$ 5 kg.
- Springs with a combined rate of 1.05 MN/m $\pm$ 0.02 MN/m.
- The impacting faceplate of the striker system shall be at least 150 mm wide and at least 380 mm long. It shall laterally cover the inboard half of the tire tread and circumferentially cover the whole contact patch of tire tread when it impacts tire. The impacting face shall be parallel to the horizontal within $\pm$ 0.5 degrees.

Note: The total impact mass of these items shall be 1000 kg $\pm$ 15 kg.

3.2.2 Torque wrench capable of applying and measuring requested torque values according to specified by requestor.

3.2.3 Guiding system of striker mass constrained to the machine shall be perpendicular to earth and impact support fixture base plate. Constraining system must not absorb energy during drop or impact of the striker mass.

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3.2.4 A system for measuring striker mass velocity, recorded time (in millisecond), shown in Appendix E.

3.2.4.1 The striker mass velocity is described as the time it takes for a 25.4 mm (1.0 in) gate timing blade to pass through a sensing gate when the blade exits the gate at an approximate height of 1 mm to 2 mm above the highest point of tire-wheel assembly.

3.2.4.2 Gate timing blade and sensing gate shall be calibrated as a unit every two (2) years, and have less than $\pm 2\%$ error.

3.2.4.3 GM approved velocity monitoring system: VS200 Velocity Monitor and Optical Sensor.

3.2.5 A system for measuring tire pressure having a minimum accuracy of ± 2 kPa (± 0.5 psi).

3.2.6 A steel ruler for measuring the wheel inboard flange deformation having a minimum accuracy of 1 mm.

3.2.7 Wheel adapters for specified fastener sizes and wheel bolt patterns (See GM K-PAC best practice TIRE-WHEEL-17 Global Common Standard Wheel Interfaces Drawing).

3.3 Test Vehicle/Test Piece.

3.3.1 Test wheel sample has a tire mounted on the wheel. Tire size is representative of size used on subject test wheel for production.

3.3.2 Test wheel sample. Test wheel and test tire to be representative of production manufacturing processes, dimensions, and materials.

3.3.3 Wheel. At least two (2) samples are required for each tire size used in production.

3.3.3.1 Test wheel samples to be free from any cracks.

3.3.4 Tire. At least two (2) samples are required for each wheel size used in production.

3.3.5 If more than one tire size is used on the subject test wheel for production, each tire size needs to be tested. For each additional tire size used on subject test wheel for production, a new test wheel (and tire) is to be used for testing.

3.4 Test Time.

Calendar time: 2 days

Test time: 8 hours

Coordination time: 4 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Technician shall be knowledgeable in operation of test equipment specific to this specification.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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 Mount tire to wheel.

4.3.2 Inflate assembly. Inflate tire to $255 \text{ kPa} \pm 10 \text{ kPa}$ ($37.0 \text{ psi} \pm 1.5 \text{ psi}$). If assembly usage cold inflation pressure on-vehicle at Gross Axle Mass Rating is greater than 255 kPa, then inflate tire to usage cold inflation pressure $\pm 10 \text{ kPa}$ ($\pm 1.5 \text{ psi}$).

4.3.3 Measure the inner diameter of the wheel rim inboard flange by steel ruler, shown as in Appendix D, Figure D1.

4.3.4 Mount to test standard using appropriate adaptor plates, as shown in Appendix A, Figures A1 and A2.

4.3.4.1 Position wheel assembly such that the striker will impact the vent window that contains the valve stem (see Appendix F, Figure F1).

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- 4.3.4.2** The tire must not be in contact with the ground, at least 25.4 mm (1 in) is recommended.
- 4.3.5** Set up the velocity sensor at the position that striker impacting face is 1 mm to 2 mm above the tire highest point, as shown Appendix E, Figures E1 and E2.
- 4.3.6** Determine the drop height and raise the striker to the required height. The height from the underside of the striker faceplate to the highest point of the tire should be set to Drop Height (DH).
- 4.3.6.1** Drop Height (DH) in millimeter units = $0.22 \times$ Maximum Static Wheel (Corner) Load in kilogram units.
- 4.3.7** Drop mass onto the tire/wheel assembly.
- 4.3.8** Measure tire pressure and read the time of velocity sensor
- 4.3.9** Record results in Appendix B, Data Sheet B1.
- 4.3.10** Dismount tire from assembly.
- 4.3.11** Measure the deformation of the wheel rim inboard flange by steel ruler, shown as in Appendix D, Figure D1.
- 4.3.12** Check wheel for cracks.
- 4.3.12.1** Use Zyglo or equivalent dye penetrant crack inspection media.
- 4.3.13** Repeat 4.3.1 through 4.3.12 on another untested wheel, but the wheel should be positioned such that the striker will impact the spoke (or spoke group for dual spoke theme wheel) which is clockwise circumferentially next to the valve stem hole when looking at the face of the wheel (see Appendix F, Figure F2).
- 4.3.14** Repeat 4.3.1 through 4.3.13 for any additional tire sizes to be tested for the supplied wheel part number subject wheel.

5 Data

5.1 Calculations.

- 5.1.1** Striker DH. Refer to 4.3.5.
- 5.1.2** Velocity sensor drop time calculation. Refer to Appendix E.
- 5.1.3** Wheel rim inboard flange deformation. Refer to Appendix D.

5.2 Interpretation of Results.

- 5.2.1** After test, no tire inflation pressure loss greater than 50% of initial tire inflation pressure within 30 s.
- 5.2.2** No wheel crack allowed.
- 5.2.3** Velocity sensor time record should meet requirement in Appendix E (Section E1.2).

5.3 Test Documentation.

 The test results documentation should include the following:

- Test results report.
- Test result data files (Extensible Markup Language (XML) format).
- Completed test sheets.
- Photographs.

Example data sheets and reports are given in Appendix B, Data Sheet B1 and Appendix C, Data Sheet C1 respectively.

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

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

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7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

DH	Drop Height
GSSLT	Global Subsystem Leadership Team
GTWTS	Global Tire Wheel Test System
XML	Extensible Markup Language

8 Coding System

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

Test to GMW15321

9 Release and Revisions

This standard was originated in April 2006. It was first approved by the Tire Global Subsystem Leadership Team in November 2006. It was first published in January 2007.

Issue	Publication Date	Description (Organization)
1	JAN 2007	Initial Publication.
2	MAY 2007	Replacing only section 2.1.3.2 of ETITM0212 and ETS.DM.004. (Tire and Wheel Global Subsystem Leadership Team)
3	APR 2012	Removed Method B from standard. Corrected ETITM document number in Issue 2 Description in the Release and Revisions Section. (Tire and Wheel Global Subsystem Leadership Team)
4	AUG 2017	Update impacting face plate size in section 3.2.1.1d. Adding the striker velocity measuring requirement in section 3.2.4. Update tire inflate pressure in section 4.3.2. Adding the wheel inboard rim flange deformation measurement requirement in section 3.2.6 and 4.3.9. Adding clarification on impact position in section 4.3 and appendix F. (Chassis - Wheel Global Subsystem Leadership Team (GSSLT))

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Appendix A

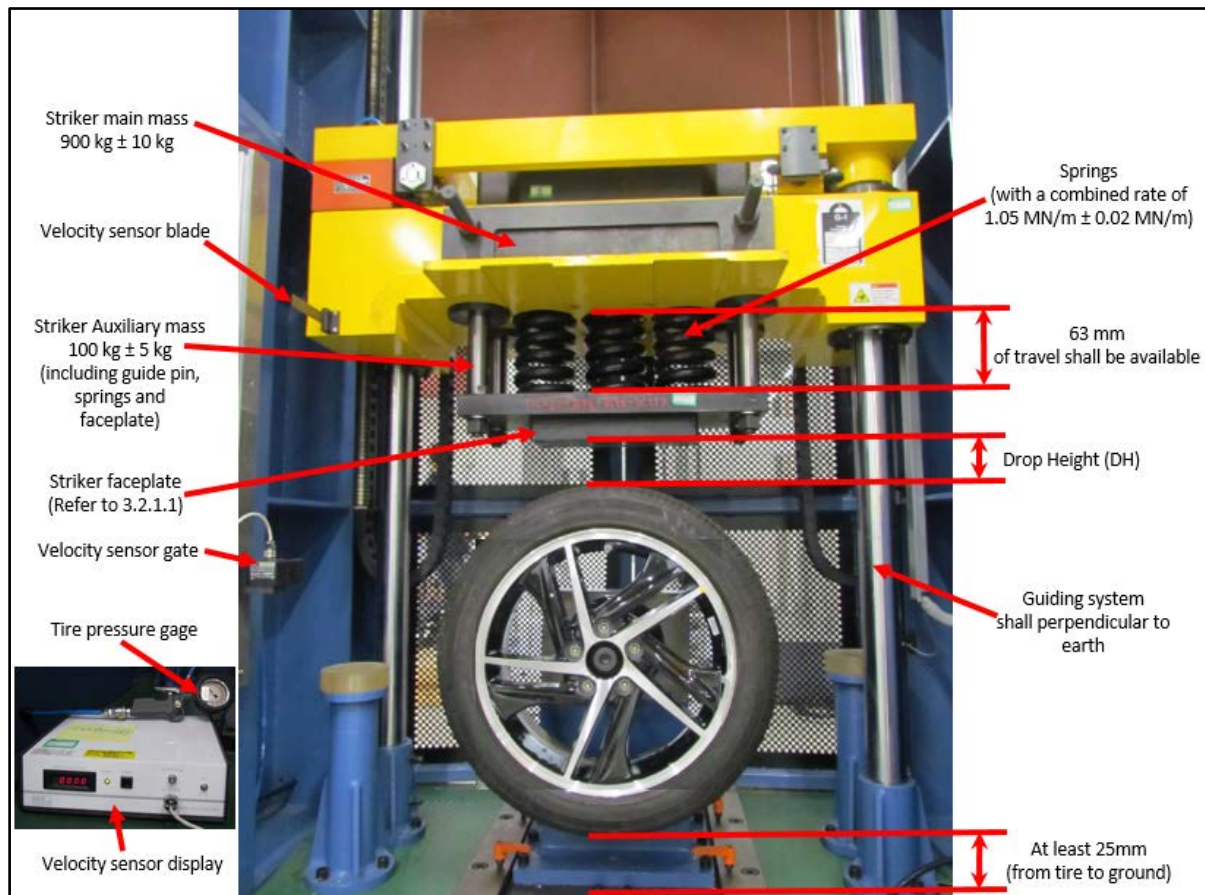


Figure A1: Test Equipment Configuration

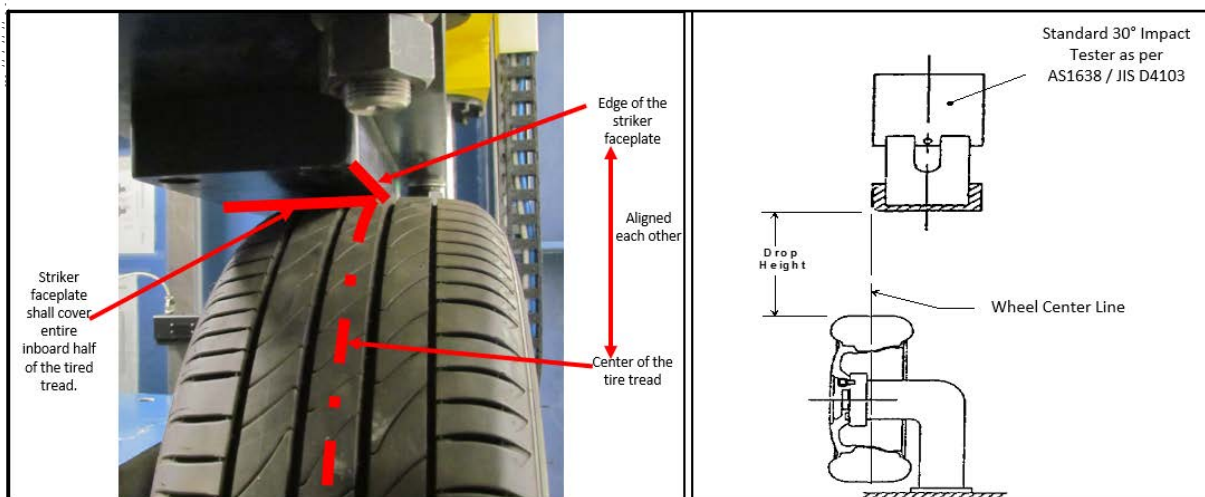


Figure A2: Test Equipment Graphic Figures

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