



Tire Cold-Cracking Impact 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. This document describes the test equipment requirements and test methodology for measuring the temperature at which a tire will crack under impact.

1.2 Applicability. This procedure applies to summer-only performance tires, and in some region-specific cases, all-season, all-terrain, or mud-terrain tires.

1.3 Remarks. The Glass Transition Temperature (GTT) is a property of the tire compound. High performance tires tend to have higher temperature GTTs. If the tire is chilled below the GTT, there is a risk of cracking in the rubber surface under load or impact. This cracking has been found to be cosmetic, but is cause for warranty returns. The quantification of the temperature at which cracking may occur on a tire will help indicate the warranty risk associated with the tire, reducing warranty expenses and improving customer satisfaction.

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.

- European Tyre and Rim Technical Organisation (ETRTO) Guidelines (www.etrto.org)
- Rubber Manufacturers Association (RMA) (www.rma.org)
- Tire and Rim Association (T&RA), Incorporated Yearbook, Copley, Ohio (www.us-tra.org)

3 Resources

3.1 Facilities. A test lab with a thermal chamber as described by 3.2.1 and test stand as described by 3.2.2.

3.2 Equipment.

3.2.1 A thermal chamber capable of -40 °C (-40 °F) and large enough to accommodate one or more tire/wheel assemblies.

3.2.2 A fixture/stand capable of causing a specific impact magnitude to the assembly, see 4.2.6.1. Type of machine and fixtures used for testing should be documented in an appropriate facilities manual or operator's procedure.

3.2.3 Tire inflation gauge, accuracy of ± 2 kPa (± 0.3 psi).

3.3 Test Vehicle/Test Piece.

3.3.1 Tire to be program-specific and provided by the requestor. Should meet all Tire and Rim Association (T&RA) or European Tyre and Rim Technical Organisation (ETRTO) guidelines.

3.3.2 The test wheel should be highest mass program-specific wheel available.

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3.3.3 If no program-specific wheel is available, a wheel of equal or greater mass and identical dimensions may be substituted.

3.4 Test Time.

Calendar time: 5 days (maximum)

Test hours: 3 hours

Coordination hours: 1 hours

Note: Calendar time is the overall time from start to finish assuming the parts are available. Test hours are the actual time for test setup, test execution, and test breakdown. Coordination time is the time for coordinating the test request, part procurement, part modification, analysis, and part disposition.

3.5 Test Required Information. Requestor should provide vehicle specific tire pressure, test tire, and test wheel and/or wheel specifications.

3.6 Personnel/Skills. Test technician or test engineer.

4 Procedure

4.1 Preparation.

4.1.1 Sample Preparation. The test tire must be free of all tags, tape, stones and other foreign objects.

4.1.1.1 The tire bead must be lubricated prior to mounting.

4.1.2 Mount the tire on the wheel using Rubber Manufacturers Association (RMA) recommended practice. Never inflate a tire over 275 kPa (40 psi) to seat the beads.

4.1.3 Inflate to the program-specific tire pressure.

4.1.4 Mark reference position on the tire sidewall.

4.1.4.1 For tires with Department of Transportation (DOT) mark, select and mark the **O** in the **DOT** as the reference point.

4.1.4.2 If the tire does not have a DOT mark, select a location that can easily be found as the reference point.

4.1.5 Mark and number additional measurement locations at equally spaced intervals around the tire circumference. Exactly three (3) impact locations are required.

4.2 Conditions.

4.2.1 Environmental Conditions. Tire should be chilled according to Table A1 in Appendix A for a minimum of 16 h prior to testing.

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.

4.2.3 Tires standardized by an organization other than T&RA and ETRTO are to be tested at the same inflation pressure as the equivalent T&RA and ETRTO size.

4.2.4 Impact Surface Geometry.

4.2.4.1 The surface that impacts the tire should be a flat plate, larger than the tire contact patch under load.

4.2.4.2 The surface that impacts the tire should simulate a camber angle of either +2 degrees or -2 degrees. Either angle can be used, but must be recorded in the data sheet (5.3.1).

4.2.5 Test Inflation Pressures. The pressure should be set to the pressure as specified by the vehicle platform the tire is used on.

4.2.6 Test Impact.

4.2.6.1 The load application device should produce a filtered impact acceleration of $35G \pm 1G$ in a free-fall condition.

4.2.6.2 The total fixture mass being accelerated should be $80\text{ kg} \pm 10\text{ kg}$, this excludes the tire-wheel assembly. The wheel and tire assembly mass should be equal to or greater to that of the tire and wheel assembly used on the vehicle platform being tested.

4.2.7 Tire Condition. The tire should be "like-new", no prior testing that is considered destructive having been performed.

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