Cleat Test – for Tire Modeling

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 is written to describe, in general terms, the Cleat Test – for Tire Modeling. This test is required as input to the various tire models, such as Swift-Tyre (SWIFT) and Flexible Ring Tire (FTIRE) modeling codes. These models are used for simulating load prediction, ride and handling.

1.2 Applicability. It is restricted to controlled laboratory tests on passenger and light truck tires.

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.

TYDEX Format Description and Reference Manual,
http://www.fast.kit.edu/download/DownloadsFahrzeugtechnik/TY100531_TYDEX_V1_3.pdf

3 Resources

3.1 Facilities. Any test facility (General Motors or outside) that is providing data to GM for the Cleat Test – for Tire Modeling. Any outside testing facilities must have demonstrated an acceptable correlation with GM, prior to submitting data into the test system.

3.2 Equipment.

3.2.1 Equipment required for Cleat Test – for Tire Modeling, consists of a 1.7 m (67 in) or larger diameter laboratory test dynamometer, as well as the associated controllers and instrumentation as required for the test method in use. The roadwheel is surfaced with 80 grit 3M-ite to provide a surface more representative of highway surfaces.

3.2.2 Four roadwheel “cleats”, built to the following descriptions, and shown in the illustration (Figure 1) and images (Figures 2 and 3). Ensure that the cleat has 100% contact across the drum (a pre-bent cleat producing higher contact pressures at the center of the drum is sometimes used to ensure full contact).

- Four (4) cleat sizes, for installation on roadwheel. Sections shown in Figure 1.
- Five (5) mm, section shown in Figure 1 (dimensions in millimeters), straight across roadwheel.
- Ten (10) mm, section shown is Figure 1 (dimensions in millimeters), straight across roadwheel, shown in Figure 2.
- Five (5) mm oblique = 5 mm cleat at 45 degrees, as shown in Figure 3.
- Ten (10) mm oblique = 10 mm cleat at 45 degrees.

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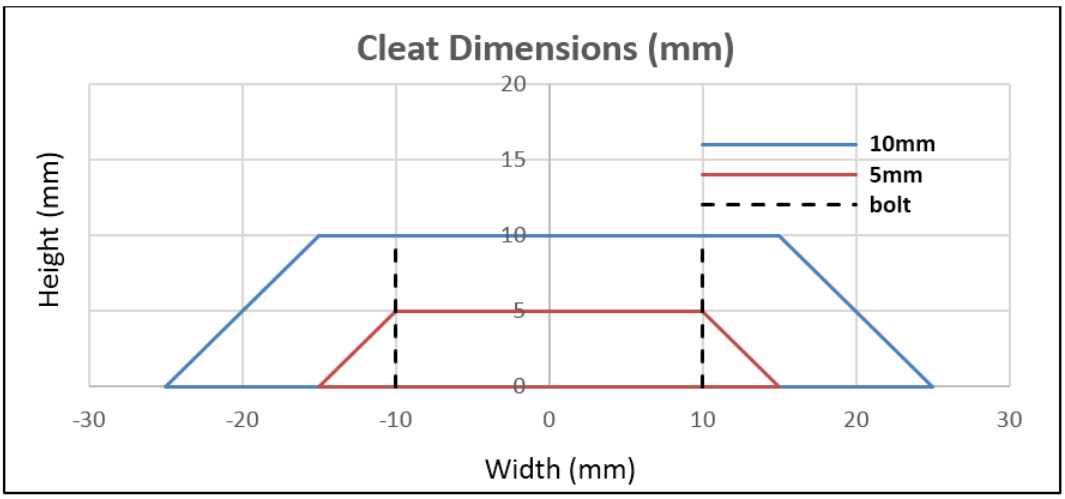

Figure 1: Sections Illustration with Dimensions in Millimeters

Figure 2: Ten (10) mm Cleat

Figure 3: Five (5) mm Oblique Cleat

3.2.3 Equipment shall have optical encoders with a minimum of 1024 counts per revolution installed on both tire spindle and roadwheel.

3.2.4 Equipment shall have a force measurement upper limit equal to or greater than the following:

Fz: 20 000 N

Fx: 10 000 N

3.2.5 Equipment structure should have a minimum first resonance frequency for all channels of 125 Hz, given an inertia mass (metal object) of 25 kg applied to the spindle.

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3.3 Test Vehicle/Test Piece. A tire-wheel assembly is required to run a Cleat Test – for Tire Modeling. The test requester will either specify the exact part number of a wheel provided, or specify the width and diameter of the test wheel that they want to be used.

3.4 Test Time.

Calendar time:	1 day
Test hours:	2 hours
Coordination hours:	1 hour

3.5 Test Required Information. Required information includes tire size, construction number, load rating, service description, wheel width, test load and test pressure. If a specific wheel is provided, the wheel part number should also be provided. Additional information required may vary by test site.

3.6 Personnel/Skills. Test operator should have adequate training and be familiar with the local operator's procedure.

4 Procedure

4.1 Preparation.

4.1.1 Tires must be mounted on the appropriate wheels (see 3.3).

4.1.2 All tires must be mounted in the proper orientation with respect to the front face of the test wheels. Whitewall tires must be mounted whitewall out with respect to the front face of the wheels. Blackwall tires must be mounted with the cosmetic or intended outboard sidewall mounted out with respect to the front face of the test wheels.

4.1.3 All tires must be balanced and bead seated prior to testing.

4.1.4 Assemblies or individual tires and wheels should be at ambient room temperature (24.0 °C ± 3.0 °C) for a minimum of 2 h prior to testing.

4.2 Conditions.

4.2.1 Environmental Conditions. Ambient temperature must be kept at 24.0 °C ± 3.0 °C. A method for monitoring ambient temperature must be in place.

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 Load. Tires must be tested to the standard set of loads, defined as percentages of the supplied load on the test request, unless otherwise stated. The load provided on the test request is most often a two (2) passenger vehicle load.

The standard loads are 70% provided load, 100% provided load, and 130% provided load (Newtons), to be run in that order.

4.2.2.2 Pressure. The pressure is most often the cold placard pressure, increased by 20 kPa, to reflect the warm pressure requested for the test. The requester provides this pressure on the test request.

4.2.2.3 Speed. There are four (4) standard speeds for tire modeling cleat tests: 2 km/h, 30 km/h, 60 km/h and 80 km/h, run in that order.

4.2.2.4 Cleats. Five (5) mm, 10 mm, 5 mm oblique, and 10 mm oblique, run in that order.

4.3 Instructions.

4.3.1 Starting the Test.

4.3.1.1 The assembly should always be mounted on the Highway Speed Uniformity (HSU) machine in the standard position, in which the valve stem is aligned with the zero (0) mark on the spindle. If this is not possible because the spindle studs do not line up with the boltholes, the assembly is rotated Clockwise (CW) until the studs and boltholes do line up. The angle through which the assembly was rotated is recorded and then used to correct the phase angles of the Fast Fourier Transform (FFT).

4.3.1.2 Minimizing the radial runout is very important to minimize mounting contribution to uniformity. Follow local mounting instructions using expandable collets, and other mounting hardware in order to optimize the centering of the tire/wheel mounting to the machine.

4.3.1.3 The tire is manually set to the specified tire pressure and capped, prior to starting the test.

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