



Brake Thermal Abuse Inertia Dynamometer Test

1 Scope

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. Durability test of ventilated brake rotors and solid brake rotors and inspection of brake pads for heat cracks.

1.2 Foreword. Previous tests of brake systems revealed that the occurrence of heat cracks on the friction surface can considerably reduce the service life of brake rotors. The combined effect of plastic hardness, elasticity, thermal conductivity and the composition of the brake pad are important.

1.3 Applicability. This standard is applicable to all passenger car and light truck front and rear disc brake corners. This standard is not applicable for drum brakes.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14974 GMW15142

2.3 Additional References.

None

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.3 Brake dynamometer test laboratory.

3.2 Equipment.

3.2.1 Inertia Brake Dynamometer. An inertia brake dynamometer capable of performing torque controlled brake applies, has variable inertia weights or simulated inertia capability and can provide cooling air.

3.2.2 Data Recording. The following measurements shall be made and digitally recorded at 100 Hz (minimum):

3.2.2.1 Dynamometer speed (km/h).

3.2.2.2 Brake apply pressure (kPa).

3.2.2.3 Brake torque (Nm).

3.2.2.4 Brake rotor temperature (°C).

3.2.2.5 Fluid displacement (mm³) (optional).

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3.2.2.6 Cooling Air Speed (km/h).

3.2.3 Cooling Air Blower. Capable of providing the cooling air speed specified in paragraph 4.2.2.2.

3.3 Test Vehicle/Test Piece. Production representative brake corner hardware shall be used to produce the tailstock assembly.

3.3.1 Brake Systems. Brake systems with ventilated brake rotors or solid rotors. At least four (4) rotors should be tested.

3.3.2 Brake Pads. Production or development brake pads.

3.3.3 Brake Caliper. Production brake caliper assembly.

3.3.4 Brake Rotor. Production or development brake rotor.

3.4 Test Time.

Calendar time: 5 days

3.5 Test Required Information. Test request form and vehicle information to calculate the test Inertia loading according to GMW15142.

3.6 Personnel/Skills. One (1) technician trained for the operation of an inertia brake dynamometer.

4 Procedure

4.1 Preparation.

4.1.1 Thermocouple. Thermocouples should be installed according to GMW14974 rubbing style only. Rubbing style thermocouples are needed to avoid cracks that could propagate from a thermocouple hole needed by imbedded thermocouples.

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise stated, the test shall be performed at $(+23 \pm 5) ^\circ\text{C}$.

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.

4.2.2.1 Initial Braking Speed. 160 km/h.

4.2.2.2 Cooling Air Speed. 120 km/h.

4.2.2.3 Deceleration. Stops should be 0.62G average deceleration with 20 000 kPa/s pressure apply rate.

4.2.2.4 Inertia Loading. Calculate Inertia loading according to GMW15142.

4.2.2.5 Maximum Brake Temperature. Maximum brake temperature (T_{max}) $\geq +500 ^\circ\text{C}$ after repeated brake applications.

4.2.2.6 Cooling Air. Cooling air should be provided during the entire braking procedure.

4.2.2.7 Heating Cycle. Perform repeated brake applications to obtain a brake rotor temperature of $\geq +500 ^\circ\text{C}$.

4.3 Instructions.

4.3.1 General. Brake applications from 160 km/h (vehicle linear speed) at a deceleration of 0.62G shall be performed. The heating cycle should consist of repeated stops until the rotor temperature is $\geq +500 ^\circ\text{C}$. At $+550 ^\circ\text{C}$ rotor temperature, brake pressure is released. This is the cutoff point if the previous stop does not reach $+500 ^\circ\text{C}$. If a particular stop exceeds $+500 ^\circ\text{C}$ at the end of the brake application, then that will end the brake application portion of the heating cycle. No further stops shall be performed and the brake cooldown cycle shall begin. The rotor should be cooled to $\approx +80 ^\circ\text{C}$ as quickly as possible to obtain a high temperature gradient. 10 km/h cooling air should be provided during all of the brake applications and 120 km/h cooling air should be provided during the cooldown cycles.

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