



Inertia Calculation Procedure for Brake Dynamometer Testing

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.

Note: The applicable Subsystem Technical Specification (SSTS) or Component Technical Specification (CTS) provides program specific information and acceptable criteria for systems/parts tested according to this procedure. In the event there is a disagreement between this procedure and the SSTS/CTS, the SSTS/CTS shall take precedence.

1.1 Purpose. To define the method for calculating the inertia used for dynamometer testing of the brake corner assembly.

1.2 Foreword. The effects of dynamic load transfer are comprehended in the calculations. The method for calculating half vehicle inertia for use in Federal Motor Vehicle Safety Standard (FMVSS)135 Hydraulic Circuit Failure is also defined.

1.3 Applicability. This procedure is applicable to all passenger car and light truck front and rear disc and drum brakes corner assemblies.

2 References

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

2.1 External Standards/Specifications.

FMVSS 135

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities. Not applicable.

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.

3.2 Equipment. Not applicable.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

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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. Not applicable.

5 Data

5.1 Calculations.

5.1.1 Inertia Calculation.

5.1.1.1 Tire Dynamic Rolling Radius Calculation. The rolling radius is calculated as follows:

$$RR = \frac{10^6}{2 \cdot \pi \cdot RPK}$$

Where:

RR = Rolling Radius (mm)

RPK = Revolutions Per Kilometer (1/km)

5.1.1.2 Front Brake Corner Inertia Calculation. If a front brake corner is being tested, the inertia is calculated as follows:

Static Front Axle Load (kg):

$$W_{fs} = GVM \left(\frac{C_{\%f}}{100\%} \right)$$

Dynamic Load Transfer (kg):

$$W_d = D_x \left(\frac{h}{L} \right) GVM$$

Dynamic Front Axle Load (kg):

$$W_f = W_{fs} + W_d$$

Where:

$C_{\%f}$ = Percent Front GVM Distribution (%)

D_x = Maximum Deceleration Rate (G)

GVM = Gross Vehicle Mass (kg)

h = Height of vehicle center of gravity (mm)

L = Wheel base of vehicle (mm)

W_d = Dynamic Load Transfer (kg)

W_f = Dynamic Front Axle Load (kg)

W_{fs} = Static Front Axle Load (kg)

The dynamic front axle load accounts for the additional load transferred to the front axle due to vehicle pitching during a braking event.

Front Brake Corner Inertia (kg-m²):

$$I_f = \frac{W_f}{2} \left(\frac{C_{\%b}}{100\%} \right) \left(\frac{RR}{1000} \right)^2$$

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