Road vehicles - Service brake - Dynamometer-simulated mountain fade test procedure

1 Scope

This standard specifies the simulated mountain fade dynamometer test procedure for normally operating service brakes of automobiles excluding trailers and motorcycles.

2 Normative reference

The following standards, when referenced in this standard, constitute provisions of this standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JASO C406	Passenger car - Braking device - Dynamometer test procedures
JASO C407	Truck and bus - Braking device - Dynamometer test procedures
JIS D0210	General rules of brake test method of automobiles and motor cycles

3 Definitions

Definitions of main terms used in this standard shall be based on **JIS D0210** and as follows.

3.1

Initial brake temperature

Temperature when brake application is initiated. When more than one brake is used and tested at the same time, the initial brake temperature shall be the highest of all the brakes.

3.2

Soak test

Test conducted in a standstill condition to investigate the temperature of various parts of the brake at high temperatures.

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4 Vehicle classification

Test vehicles are classified as shown in **Table 1** according to nominal maximum speeds, seating capacity, and gross vehicle mass.

Table 1 Vehicle classification

Type	Category	Nominal maximum speed and gross vehicle mass
Passenger car	P1	Over 140 km/h
	P2	Over 110 km/h to 140 km/h or less
	P3	Over 90 km/h to 110 km/h or less
	P4	90 km/h or less
Class 1 bus	M2	Seating capacity of 10 or more, 5 t or less
Class 2 bus	M3	Seating capacity of 10 or more, over 5 t
Class 1 truck	N1-A	2.5 t or less, over 130 km/h
	N1-B	2.5 t or less, under 130 km/h Over 2.5 t to 3.5 t or less
Class 2 truck	N2	Over 3.5 t to 12 t or less
Class 3 truck	N3	Over 12 t

5 Test conditions

5.1 Brake condition

Brake device condition in the test shall be as follows.

a) The brake shall be a genuine part that conforms to the manufacturer's specifications and is correctly assembled.

b) Brake linings or pads, and drums or discs shall be new parts that have been finished in accordance with the manufacturer's specifications.

5.2 Inertia

The equation and setting of inertia shall be as specified in **7** in **JIS D0210**. However, depending on the type of test equipment used, such as a dual or single dynamometer and test methods, the test load shall be changed as follows.

a) Front and rear combined test with dual dynamometer

One half of gross vehicle mass

b) Test with single dynamometer or left and right combined test with dual dynamometer

Value obtained by distributing one half of the gross vehicle mass (gross vehicle mass when tested with a dual dynamometer) by the braking force ratio of the front and rear wheels at a braking deceleration of 3.0 m/s^2.

5.3 Braking torque

Braking torque shall be as specified in **7** in **JIS D0210**. The calculated values used shall be recorded in the recording sheet.

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5.4 Measurement of temperature

a) The temperature of the frictional material shall be generally measured on the fixed side in accordance with **6** in **JIS D0210**. When measuring the temperature on the rotating side (of drums or discs) for reference, follow **6** in **JIS D0210**.

b) For measurement of brake fluid temperature, install thermocouples on each brake (an installation example is shown in **Annex A**).

5.5 Cooling air velocity

Cooling air velocity shall be adjusted to obtain the same brake temperature as in an actual vehicle. If the brake temperature is not clear, use the values in **Table 2**. In addition, adjust the velocity so that the air blows uniformly and continuously against the projected area of the brake when seen from the front in the installed state. The air temperature shall be set to the room temperature. An air velocity of 11m/s may be adopted for the burnish test. The cooling air velocity used shall be recorded in the recording sheet.

Table 2 Cooling air velocity

Unit: m/s

Type	Category	Front wheel	Rear wheel
Passenger car	P1	2	2
	P2	2	2
	P3	2	2
	P4	2	2
Class 1 bus	M2	2	2
Class 2 bus	M3	14	2
Class 1 truck	N1-A	2	2
	N1-B	2	2
Class 2 truck	N2	14	11
Class 3 truck	N3	14	11

6 Test procedure

6.1 Preparation for test

Make sure that no abnormalities are found on the brake before installing it on the test equipment. Make also sure that grease, paint, or any other foreign matter is not adhered onto the linings.

In order to ensure accurate measurement of lining wear amounts, measuring points shall be specified beforehand on the shoes or the pads (5 points on one side (10 points in total) for each shoe, and 4 to 6 points for each pad). The friction surface of the drums or discs shall be cleaned using acetone, etc. Thermocouples shall be attached to the specified locations on the shoes or pads (drums or discs) and the bleeder (for measurement of brake fluid temperature). The brake shall be attached onto the test equipment and centered, and drum or disc deflection shall be recorded.

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6.2 Test items and test sequence

The test items and test sequence shall be as follows. Items **d)** to **f)**, **g)** to **i)** and **k)** to **l)** shall be tested continuously without interruption.

a) Initial measurement

Measure and record the thickness of the linings or pads, and the dimensions of other brake components as necessary.

b) Burnish

Burnish shall be performed as follows.

- See **5.2** in **JASO C406** for P1, P2, P3 and P4.
- See **5.2** in **JASO C407** for M2, M3, N1-A, N1-B, N2, and N3.

c) First effectiveness check

1) Initial and final speeds

50 km/h → 0, 80 km/h → 0 for P1, P2, P3, and N1-A vehicles

50 km/h → 0 for P4, M2, M3, N1-B, N2, and N3 vehicles

2) Braking deceleration

Constant at 4.5 m/s^2 or constant pressure to obtain 4.5 m/s^2 for P1, P2, P3, and N1-A vehicles

Constant at 3.0 m/s^2 or constant pressure to obtain 3.0 m/s^2 for P4, M2, M3, N1-B, N2, and N3 vehicles

3) Initial brake temperature

80°C

4) Number of brake applications

3 times under each test condition

d) First simulated mountain fade test

The first simulated mountain fade test shall be as follows.

1) Initial and final speeds

50 km/h → 0, constant braking deceleration of 3.0 m/s^2 or constant pressure to obtain 3.0 m/s^2

2) Initial brake temperature

60°C for first time only

3) Braking intervals

20 seconds for P1 and P2 vehicles

30 seconds for P3 and N1-A vehicles

40 seconds for M2, M3, N1-B, N2 and N3 vehicles

60 seconds for P4 vehicles

4) Number of brake applications

60 times

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