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Road vehicles - Brake lining friction materials - Drag test method for friction performance

道路车辆 制动衬片摩擦材料

摩擦性能拖曳试验方法

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Road vehicles - Brake lining friction materials - Drag test method for friction performance

1 Scope

This standard specifies the test equipment, test type, test device, test procedure, result report of the friction performance test of the brake lining materials of road vehicles using the drag test method.

This standard applies to the friction performance test of brake linings (hereinafter referred to as linings) used in category M, N, O, L vehicles.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

GB/T 5620 Road vehicles - Braking of automotive vehicles and their trailers - Vocabulary (GB/T 5620-2002, idt ISO 611:1994)

GB/T 15089 Classification of power-driven vehicles and trailers

JB/T 7498 Coated abrasives - Abrasive paper

QC/T 556 Automotive brake - Temperature measurement and thermocouple installation

3 Terms and definitions

The terms and definitions defined in GB/T 5620 and GB/T 15089 AND the following terms and definitions apply to this document.

3.1

Braking cycle

A braking process which consists of several braking runs, each braking operation consisting of 5 s braking and 10 s idling.

idling, it shall be not less than 600 r/min at full load.

4.5 During the test, it should use the embedded thermocouple to measure the temperature of the brake disc. The installation and measurement shall be in accordance with QC/T 556. Other temperature measuring devices and methods can also be used, but they must meet the specified requirements for measurement accuracy.

4.6 The radial runout and axial runout of the brake disc during equipment operation shall not exceed 0.08 mm.

5 Test type and test device

5.1 Test type

The test type is divided into the original sample test and the sampling method test. The original sample test is to test the specimen of original size, the sampling method test is to prepare the specimen into the sample block of the specified size to perform test.

The test of the disc linings for categories M_1, M_2, N_1, O_1, O_2, L vehicles may be carried out by the original sample method or by the sampling method.

The test for disc linings and drum linings for categories M_3, N_2, N_3, O_3, O_4 vehicles are carried out by the sampling method.

5.2 Test device for disc linings for categories M_1, M_2, N_1, O_1, O_2, L vehicles

5.2.1 When performing the original sample test, the brake disc and brake caliper used in the test shall be the brake disc and brake caliper according to the drawings and technical documents. The roughness of the friction surface of the disc shall be less than 15 μm, the thickness shall not be less than 90% of its original thickness.

5.2.2 When performing the sampling test, it shall install a fixed-type disc brake caliper on the test machine, the piston diameter is 36 mm. The distance between the center of the sample block and the center of the brake disc after installation is 116.5 mm. The brake disc used in the test shall meet the following technical requirements:

a) The brake disc is a solid body (non-ventilated type) which has a diameter of (278 ± 2) mm and a thickness of (9 ± 0.5) mm;

b) The material of the brake disc body is HT250, the hardness of the friction surface is 180 HBW ~ 250 HBW.

5.3 Test devices for disc linings and drum linings for categories M_3, N_2, N_3,

When $A_k \leq 18.1\ cm^2$, $M_d = 150\ N \cdot m$; when $A_k > 18.1\ cm^2$, $M_d = 300\ N \cdot m$.

6.1.1.1.2 Determination of torque in constant torque mode

The brake's output torque (M) is calculated according to the formula (3).

$$M = \frac{(T_E - T_A) \cdot \alpha \cdot A_{BS}}{\left[1 - \exp\left(-\frac{\alpha \cdot A_{BS}}{c_p \cdot G_{BS}} \times t\right)\right] 2 \cdot \pi \cdot n} \qquad \cdots\cdots(3)$$

Where:

M - Brake's output torque, in Newton meters (N • m);

T_E - End temperature of brake, in degrees Celsius (°C);

T_A - Initial temperature of brake, in degrees Celsius (°C);

α - The thermal conductivity of the brake disc, in joules per square meter of second Kelvin [J/(m² • s • K)];

A_{BS} - The heat conduction area of the brake disc, in square meters (m^2);

c_p - The specific heat capacity of the brake disc, in joules per Newton Kelvin [J/(N • K)];

G_{BS} - The mass of the brake disc, in Newton (N);

t - Braking time, in seconds (s);

n - The speed of the brake disc, in revolutions per minute (r/min).

For the brake disc which is made of HT250 gray cast iron, α is 59.7 J/(m² • s • K) and c_p is 51 J/(N • K).

The constant torques are taken at different test stages, which are regarded as M_1, M_2, M_3, respectively. When calculating M_1, (T_E - T_A) is 125 °C, t is 25 s; when calculating M_2, (T_E - T_A) is 225 °C, t is 25 s; when calculating M_3, (T_E - T_A) is 450 °C, t is 50 s.

6.1.1.2 Determination of test pressure and torque by sampling method

The pressure per unit area of the friction surface of the sample block under constant pressure mode is 75 N/cm², the pressure of the brake pipeline is 0.89 MPa;

In the constant torque mode, M_1 takes the value of 103 N • m, M_2 takes the value of 186 N • m, M_3 takes the value of 194 N • m.

6.2.1.1 Determination of pressure

The pressure per unit area of the friction surface of the sample block is 75 N/cm^2 and the pressure of the brake lining is 1.17 MPa.

6.2.1.2 Treatment of the surface of brake disc

Before each test, the surface of the brake disc shall be treated by the sandpaper which has a grain size of P240 or finer in JB/T 7498, so that the surface of the brake disc has no obvious wear marks and rust; use a soft cloth and absolute ethanol to remove the dust and oil stains from the surface of the brake disc.

6.2.1.3 Preparation of sample block

Randomly take 2 linings from the sample, take a sample block which has a length of (84.0 ± 0.2) mm, a width of (52.0 ± 0.2) mm, a thickness of not less than 6.0 mm from the middle of each lining, tightly embed them in the dedicated backplate. If the lining is relatively smaller and it cannot take the sample block of 84 mm × 52 mm, it can sample another two linings, use the two small linings to assemble to the specified size. The difference of thickness of the two small sample blocks shall not exceed 0.05 mm. Identify 4 points at the non-friction surface of each lining, to determine the measurement points of the lining thickness, as shown in Figure 3. Care shall be taken to avoid oil, water, stains or breakage on the friction surface of the lining.

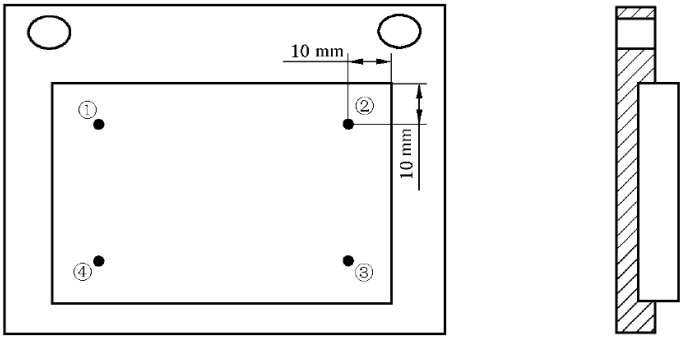

Figure 3 -- Schematic diagram of the location of the measurement points of dedicated backplate and sample block's thickness

6.2.2 Run-in of sample block

The lining or sample block shall be run-in before the formal test, until the contact area of the sample block with the brake disc is not less than 80%. The surface temperature of the brake disc during running-in shall not exceed 200 °C.

The procedure for run-in of sample block is as shown in the test number 1 (run-in) in Table 3.

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