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NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA

ICS 83.160.10

G 41

GB/T 34378-2017

Dynamic balance test method for motorcycle tyres

摩托车轮胎动平衡试验方法

Issued on: September 29, 2017

Implemented on: August 01, 2018

Issued by: General Administration of Quality Supervision, Inspection and Quarantine;

Standardization Administration of the People's Republic of China.

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Dynamic balance test method for motorcycle tyres

1 Scope

This Standard specifies the terms and definitions, test equipment, test conditions, test procedures and test records for motorcycle tyre dynamic balance test.

This Standard applies to motorcycle tyres.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB 518, Motorcycles tyres

GB/T 2983, Series of motorcycle tyres

GB/T 6326, Tyre terms and definitions

GB/T 6444, Mechanical vibration. Balancing. vocabulary

GB/T 13202, Series of motorcycle rims

GB/T 25158, Dynamic balancing machine for tyre

3 Terms and definitions

Terms and definitions determined by GB/T 6326 and GB/T 6444, and the following ones are applicable to this document.

3.1 Static unbalance value

Product of the tyre mass multiplied by the center of gravity eccentricity.

Note 1: When the tyre rotates at a certain speed, the static unbalance produces a force perpendicular to the axle. Calculate the static unbalance value according to Formula (1):

$$M = (I_a - I_d) \times \sin\alpha \times \left(\frac{\pi n}{30}\right)^2 \times 10^{-7} \dots\dots\dots (3)$$

Where:

$\sin\alpha$ -- when α is small enough to be expressed in radians, $\sin\alpha \approx \alpha$;

M -- unbalanced moment, in newton meters (N·m);

I_a -- axial inertia, in gram square centimeter (g·cm²);

I_d -- radial inertia, in gram square centimeter (g·cm²);

α -- the angle between the main inertia axis and the axle centerline, in degrees (°);

n -- rotating speed, in revolutions per minute (r/min);

π -- Pi.

Note 3: Since the tyre is deformed under the action of rotation, the axial inertia and the radial inertia can be used as the function of the rotating speed.

3.4 Couple unbalance value

Dynamic unbalance value divided by the distance between compensating sides.

Note: The unit is expressed in g·cm.

3.5 Couple unbalance mass of each side

Couple unbalance value divided by the compensating radius.

Note: The unit is expressed in g.

3.6 Compensating side

Two rotation planes symmetrical on both sides of the tyre for balance weight (for the tyre in a horizontal attitude, it can be divided into an upper compensating side and a lower compensating side).

3.7 Distance between compensating side

Distance between two compensating sides.

Note: The distance between compensating sides is expressed by Formula (4):

$$W = C + B \times 2 \dots\dots\dots (4)$$

U_s -- static unbalance value, in gram centimeter (g·cm);

U_c -- couple unbalance value, in gram centimeter (g·cm);

γ_s -- heavy point positioning angle of static unbalance, in degrees (°);

γ_c -- heavy point positioning angle of couple unbalance, in degrees (°);

R -- compensating radius, in centimeters (cm).

3.10 Heavy point positioning angle

The circumferential angle BETWEEN the heavy point which produces unbalance AND the specified reference point.

Note: Formula (8) and Formula (9) can be used respectively to calculate the heavy point positioning angle of the upper compensating side AND the heavy point positioning angle of the lower compensating side.

$$\gamma_u = \gamma_c \pm \cos^{-1} \left\{ \frac{1}{2m_u U_c / R} \left[m_u^2 + \left(\frac{U_c}{R} \right)^2 - \left(\frac{U_s}{2R} \right)^2 \right] \right\} \quad \dots\dots\dots (8)$$

$$\gamma_l = \gamma_c + 180^\circ \pm \cos^{-1} \left\{ \frac{1}{2m_l U_c / R} \left[m_l^2 + \left(\frac{U_c}{R} \right)^2 - \left(\frac{U_s}{2R} \right)^2 \right] \right\} \quad \dots\dots\dots (9)$$

Where:

γ_u -- heavy point positioning angle of the upper compensating side, in degrees (°);

γ_l -- heavy point positioning angle of the lower compensating side, in degrees (°);

The interpretation of other symbols is the same as in Formula (6) and Formula (7).

In Formula (8) and Formula (9), the superposition of the two angles is calculated by such method -- the heavy point positioning angle of the couple unbalance value is taken as the starting point; addition is used for those of clockwise direction; and subtraction is used for those of counter-clockwise direction.

4 Test equipment

4.1 The test equipment is a dynamic balance test machine for motorcycle tyres. It adopts the method which measures the unbalanced force and the moment when the tyre rotates under the action of centrifuge, to measure the unbalance and heavy point positioning angle of the tyre.

minimum value; take the minimum value).

5.3.2 The calibration diameter of the rim in the test shall comply with the provisions of GB/T 13202. However, in order to facilitate loading and unloading and to properly position the tyre bead, the calibration diameter of the test rim may be slightly smaller than the calibration diameter of the measuring rim, and the difference shall not be greater than 1.2 mm.

5.3.3 Before the test, the unbalance and heavy point positioning angle of the rim and axle assembly in the test shall be measured on the test machine.

5.3.4 In order to ensure that the tyre is properly seated on the test rim, the surface of the tyre bead or the rim bead seat or both may be evenly coated with a suitable lubricant.

5.4 Test pressure

The test pressure of the motorcycle tyre is 250 kPa, and the allowable deviation of the test pressure shall be within ± 50 kPa.

6 Test steps

6.1 Set tyre unbalance compensating radius and distance between compensating side for the test machine.

6.2 Mount the tyre on the dynamic balance test machine; inflate the tyre so that the tyre can fully expand and properly seat on the rim; then adjust to the test pressure specified in 5.4.

6.3 Make the tyre rotate at a speed that is determined by the equipment provider within the range that is specified in 4.2, so to measure the static unbalance value and couple unbalance value along the circumference of the tyre.

6.4 Subtract the unbalanced amount of the rim and the axle assembly from the measured value, and the maximum difference is the tyre's static unbalance value and couple unbalance value. The position of the maximum value on the circumference of the tyre is the heavy point positioning angle of above two unbalanced values, respectively.

6.5 Stop the tyre from rotating. Print a light dot mark on the sidewall of the tyre as needed.

7 Test record

The following parameters shall be recorded after the test:

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