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Safety performance requirements and test methods of automobile wheels

汽车车轮安全性能要求及试验方法

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Safety performance requirements and test methods of automobile wheels

1 Scope

This Standard specifies the marking safety performance requirements and test methods for automobile wheels.

This Standard applies to automobile wheels which are sold on the market; it does not apply to wheels supplied by the vehicle manufacturer.

2 Normative references

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

GB/T 2933-2009, *Wheels and rims for pneumatic tyres - Vocabulary, designation and marking*

GB/T 2977, *Size designation, dimensions, inflation pressure and load capacity for truck tyres*

GB/T 2978, *Size designation, dimensions, inflation pressure and load capacity for passenger car tyres*

3 Terms and definitions

For the purposes of this document, the following terms and definitions and those given in GB/T 2933 apply.

3.1

wheels supplied by the vehicle manufacturer

wheels which are supplied by the vehicle manufacturer and marked with permanently visible trademark and part number of the vehicle manufacturer.

determined:

a) wheels are incapable of continuing to bear loads;

b) original cracks occur, extends or new visible cracks occur (using the dye penetration inspection or other acceptable methods, such as fluorescent nondestructive testing);

c) before the cycle index required, the offset increment of load points exceeds 10% of the original load offset.

5.1.1.2.2 Failure criteria for light alloy wheels

Conduct test as specified in 6.2.1; during the test or after the minimum cycle index as specified in table 1, in one of the following cases, the failure of test wheels is determined:

a) wheels are incapable of continuing to bear loads;

b) original cracks occur, extends or new visible cracks occur (using the dye penetration inspection or other acceptable methods, such as fluorescent nondestructive testing);

c) before the cycle index required, the offset increment of load points exceeds 20% of the original load offset.

5.1.2 Dynamic radial fatigue performance requirements

5.1.2.1 Strengthening factor and minimum cycle index

For strengthening factor and minimum cycle index of dynamic radial fatigue test see Table 2.

Table 2 – Requirements for strengthening factor and minimum cycle index of dynamic radial fatigue test

Strengthening factor *K*	Minimum cycle index
2.25[a]	500,000
2.00	1,000,000
[a] Strengthening factor of prior selection.	

5.1.2.2 Failure criteria

Conduct test as specified in 6.2.2; during the test or after the minimum cycle index as specified in table 2, in one of the following cases, the failure of test wheels is determined:

a) wheels are incapable of continuing to bear loads;

b) original cracks occur, extends or new visible cracks occur (using the dye penetration

d – inner offset or outer offset of wheels (inner offset is positive; outer offset is negative), in m;

F_v – wheels' rated load as specified by the wheel manufacturer, in N;

S – strengthening factor (see Table 1).

6.2.1.3 Test procedure

6.2.1.3.1 Clamp wheels firmly on test fixture.

6.2.1.3.2 Connecting parts of test apparatus are connected to the mounting surface of wheels using unlubricated studs and nuts (or bolts); the mounting shall be equivalent to the actual working conditions when they are mounted onboard. Use the star tightening method to tighten wheel nuts (or bolts) to the torque values as specified by the wheel manufacturer. The mounting surface of test apparatus connecting parts and the mounting surface of wheels shall be clean, smooth.

6.2.1.3.3 Under no load, jerk value of wheel loading points shall not exceed 0.15 mm.

6.2.1.3.4 Wheels' bolts and nuts can be tightened once again during test.

6.2.1.3.5 Terminate test when the cycle index requirements of Table 1 are complied with or after the failure of wheels.

6.2.2 Dynamic radial fatigue test method for passenger vehicles

6.2.2.1 Test apparatus

Tester shall be provided with a device with which a constant radial load can be applied during the rotation of wheels. See Figure 2. A driven rotary drum shall be mounted, which has a smooth surface wider than the cross section of tyres. The recommended minimum rotary drum outer diameter is 1,700 mm. Test apparatus shall make loading direction perpendicular to outer surface of rotary drum; and loading direction passes the center lines of test wheels and rotary drum. The axes of rotary drum and test wheel shall be parallel. Accuracy of loading system shall be controlled within the range of ± 2.5%.

6.2.3.3.1 During the whole process of test, ambient temperature shall be maintained within the range of 10°C ~ 30°C.

6.2.3.3.2 Use tubeless radial tryes of minimum nominal sectional width applicable to wheels as specified in GB/T 2978. The inflation pressure is 200 kPa ± 10 kPa.

6.2.3.3.3 Mount test wheel and tyre assembly to tester to ensure that impact loads can be applied to wheels' flange. Axes of wheels shall form an angle of 13°± 1° to the vertical direction; the highest point of flange shall face directly to punch hammer.

6.2.3.3.4 The mounting of wheels on tester shall be equivalent to the actual working conditions when they are mounted onboard; use the star tightening method to tighten wheel nuts (or bolts) to the torque values as specified by the wheel manufacturer.

6.2.3.3.5 Because of the diversity of design of wheels' central part, select sufficient positions on wheels' rim circumference to carry out impact test to ensure the integrity of evaluation of central part, at least including the positions of window and spoke. Use brand new wheels for each test.

6.2.3.3.6 Punch hammer shall be above tyres and overlap flange for 25 mm ± 1 mm. Lift punch hammer to 230 mm ± 2 mm above the highest point of flange; then release punch hammer; impact.

6.2.3.3.7 After finishing impact, carry out determination as specified in 5.1.3.

6.3 Safety performance test method for commercial vehicles

6.3.1 Dynamic bend fatigue performance test method

6.3.1.1 Test apparatus

Tester shall be provided with a driven rotary device; wheels can rotate under a stationery bending moment or wheels stay stationery while they are subjected to one rotary bending moment, see Figure 5. Loading arm of force shall have sufficient rigidity, the length of which shall be between 0.76 m and 1.4 m. Measuring system is capable of continuing measurement of the displacement of arm shaft. Accuracy of loading system shall be controlled within ± 5%.

S – strengthening factor (see Table 3).

6.3.1.3 Test procedures

6.3.1.3.1 Clamp wheels firmly on the test fixture.

6.3.1.3.2 Connecting parts of test apparatus are connected to the mounting surface of wheels using unlubricated studs and nuts (or bolts); the mounting shall be equivalent to the actual working conditions when they are mounted onboard. Use the star tightening method to tighten wheel nuts (or bolts) to the torque values as specified by the wheel manufacturer. The mounting surface of test apparatus connecting parts and the mounting surface of wheels shall be clean, smooth.

6.3.1.3.3 Under no load, jerk value of wheel loading points shall not exceed 0.3 mm.

6.3.1.3.4 Wheels' bolts and nuts can be tightened once again during test.

6.3.1.3.5 Terminate test when the cycle index requirements of Table 3 are complied with or after the failure of wheels.

6.3.2 Dynamic radial fatigue performance test method

6.3.2.1 Test apparatus

Tester shall be provided with a device with which a constant radial load can be applied during the rotation of wheels. See Figure 2. A driven rotary drum shall be mounted, which has a smooth surface wider than the cross section of tyres. The recommended minimum rotary drum outer diameter is 1,700 mm. Test apparatus shall make loading direction perpendicular to outer surface of rotary drum; and loading direction passes the center lines of test wheels and rotary drum. The axes of rotary drum and test wheel shall be parallel. Accuracy of loading system shall be controlled within the range of ± 5%.

6.3.2.2 Determination of radial load

Radial load F_r is determined in accordance with Equation (5), in N:

$$F_r = F_V K \qquad \cdots\cdots (5)$$

where:

F_V – wheels' rated load as specified by the wheel manufacturer, in N;

K – strengthening factor (see Table 4).

6.3.2.3 Test procedures

6.3.2.3.1 Select test tryes as specified in GB/T 2977.

Annex A

(Informative)

Supplementary instructions to impact tester calibration

A.1 Calibration of punch hammer's vertical drop velocity

Use a time measuring instrument passing metrological verification to measure the actual time for punch hammer to drop for a certain distance; theoretical time for punch hammer to drop for the distance is calculated in accordance with Equation (A.1); difference between actual time and theoretical time for punch hammer to drop is calculated in accordance with Equation (A.2), which shall not exceed 2.0% of theoretical time.

$$t_c = \sqrt{\frac{2h_d}{g}} - \sqrt{\frac{2(h_d - h_b)}{g}} \qquad \cdots\cdots (A.1)$$

where:

t_c – theoretic time for punch hammer to pass the timing distance h_b, in ms;

h_d – distance between punch hammer releasing position and timing end point, in mm. Timing end point is generally 1 mm ~ 2 mm above tyres;

h_b – timing distance, in mm;

$h_d - h_b$ – distance between punch hammer releasing position to timing start point;

g – gravitational acceleration, being 0.00981 mm/ms^2.

$$\Delta t = t_p - t_c \qquad \cdots\cdots (A.2)$$

where:

t_p – actual time for punch hammer to pass the timing distance h_b, in ms;

Δt – difference between actual time and theoretical time, in ms.

A.2 Calibration of punch hammer's vertical drop acceleration

Install an acceleration sensor on punch hammer to measure drop acceleration; actual measured acceleration shall not be less than 96% of gravitational acceleration.

A.3 Selection of calibration methods

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