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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 23663-2020

Replacing GB/T 23663-2009

**Test method for the longitudinal and lateral stiffness of motor
vehicle tyres**

汽车轮胎纵向和横向刚性试验方法

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1 Scope

China's national test method for the longitudinal and lateral stiffness of vehicle tyres. It specifies the terms and definitions, the test equipment, the test conditions, the test procedure and the reporting for determining these two stiffnesses. A tyre is the only connection between a vehicle and the road, and every force that accelerates, brakes or turns a car passes through a contact patch the size of a hand. The tyre is not rigid, so those forces deform it, and the stiffnesses measured here describe by how much: the longitudinal stiffness is the force required to displace the contact patch fore and aft relative to the wheel, and the lateral stiffness the force to displace it sideways. Both matter for reasons a tyre buyer never sees but a vehicle engineer cannot avoid. Longitudinal stiffness determines the slip a tyre needs to generate a given braking force, which is what an anti-lock braking system's control loop is tuned against - a system calibrated for one tyre stiffness behaves differently on another. Lateral stiffness governs the cornering response and the way a car settles into a turn, and together with the suspension geometry it determines whether a vehicle understeers or oversteers at the limit. These are also the parameters that a vehicle dynamics model needs, and a simulation is only as good as them. Because both depend on the inflation pressure, the vertical load, the temperature and the rate at which the force is applied, the standard fixes all of those along with the test rig, the measurement of the small displacements involved and the reporting. Issued on 14 December 2020 and in force since 1 November 2021, it replaces GB/T 23663-2009.

This Standard specifies the terms and definitions, test equipment and its accuracy requirements, test conditions, test procedures and test reports for the test of longitudinal and lateral stiffness of static motor vehicle tyres under load. This Standard applies to all

passenger car radial tyres and truck radial tyres.

2 Normative references

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

GB/T 6326, Tyre terms and definitions

GB/T 8170, Rules of rounding off for numerical values & expression and judgment of limiting values

GB/T 12549, Terms and Definitions for Vehicle Controllability and Stability

3 Terms and definitions

Terms and definitions determined by GB/T 6326 and GB/T 12549, as well as the following ones, are applicable to this document.

3.1 Experimental equipment A device that is capable of loading tyres and producing relative motion between the tyre and the contact platform.

3.2 Contact platform A non-smooth rigid platforms of different roughness which is installed on the experimental equipment to simulate different road surfaces. 3.3

4.1.4.1 The contact platform shall completely accommodate the entire part in contact with the tyre; the contact platform stroke shall be able to meet the test requirements.

4.1.4.2 The contact platform and its supporting structure shall have sufficient stiffness to ensure that when the loading device exerts a vertical force on the tyre, the platform shall not be deformed in the lateral, longitudinal and bending aspects.

4.1.4.3 The contact platform shall have sufficient roughness.

4.2 Accuracy requirements of test equipment

4.2.1 The angle between the vertical loading direction and the contact platform of the experimental equipment is 90°; the deviation is not more than 0.05°.

4.2.2 The accuracy of vertical force, longitudinal force and lateral force loading device is $\pm 1.0\%$ of full scale.

4.2.3 The accuracy of vertical displacement, longitudinal displacement and lateral displacement is $\pm$

0.5 mm.

4.2.4 The accuracy of vertical movement speed is $\pm$

4.2.5 The maximum range of the inflation pressure gauge for passenger car tyres is at least 500 kPa, and the accuracy is ± 5 kPa; the maximum range of the inflation pressure gauge for truck tyres is at least 1 000 kPa, and the accuracy is ± 10 kPa.

5 Test conditions

5.1 The tested tyres shall be parked for more than 24 h after vulcanization and before assembly.

5.2 The test rim should be the measurement rim specified in GB/T 2977 or GB/T 2978. Before installation, ensure that the bead seat and the mating surface of the tyre are clean and dry; it is not allowed to apply lubricants and other lubricating materials for the convenience of assembly.

5.3 The test load should be the maximum load of the tyre (when there are two conditions of use for single and double tyres, use the single tyre load).

5.4 Inflate the passenger car tyres with the air pressure specified in Table 1. Inflate the truck tyres with the air pressure corresponding to the maximum load. If agreed, it may be stipulated otherwise. Table 1 - Inflation pressure for longitudinal and lateral stiffness test of passenger car tyres in kilopascals Where: a_1 - longitudinal stiffness, in Newtons per millimeter (N/mm); y - longitudinal force, in Newtons (N); x - longitudinal displacement, in millimeters (mm).

6.1.5 The longitudinal stiffness result is accurate to one decimal place; the longitudinal force is accurate to an integer place; the longitudinal displacement is accurate to two decimal places. The measurement and calculation results are rounded according to provisions of GB/T 8170.

6.1.6 Unload and adjust the air pressure to the specified value.

6.1.7 Repeat the process of 6.1.1 ~ 6.1.5, in which steps

6.1.2 are loaded to the maximum load of the tyre.

6.1.8 Repeat the process of 6.1.1 ~ 6.1.5, in which steps

6.1.2 are loaded to 120% of the maximum load of the tyre.

Note: When necessary, the test can be carried out according to the vertical loading load different from the above.

6.2 Lateral stiffness test

6.2.1 Install the test tyre rim assembly on the corresponding test device and lock it. Apply a vertical force to the tyre at a speed of 50 mm/min; load it to 80% of the maximum load of the tyre; keep it for 5 s and then unload. Repeat the pre-test 3 times; adjust the tyre

pressure to the specified value of

5.4 after the pre-test.

6.2.2 Apply a vertical force to the tyre at a speed of 50 mm/min; load it to 80% of the maximum load of the tyre; keep it for 1 min.

6.2.3 Move the contact platform along the Y' axis; the moving speed of the contact platform shall be 30 mm/min ~ 50 mm/min, until relative sliding occurs between the contact platform and the tyre or the maximum travel of the contact platform is reached. Take the lateral displacement as the abscissa and the lateral force as the ordinate, to draw the lateral force-lateral displacement curve.