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**Rubber shoes - Test method for shock attenuating properties of
athletic shoes**

胶鞋 运动鞋减震性能试验方法

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1 Scope

This document describes the test principles for the shock-attenuating properties of rubber shoes and athletic shoes under specified test conditions, and specifies the test equipment, test specimens, test specimen conditioning, test procedures, test results and test report contents.

This document is applicable to the evaluation of the shock-attenuating effect of rubber shoes and athletic shoes.

2 Normative references

GB/T 2941

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Cushioning system

One or more sole components that distribute pressure and/or attenuate shock.

NOTE. The sole components are the insole, innersole, midsole and outsole or their combination.

3.2 Tup

It is in contact with the sample during the impact process and is the most important component of the impact device of the equipment.

3.3 Impact

Collision between the tup and the cushioning system.

3.4 Drop height

The height from which the impact device is dropped.

NOTE. The distance between the upper surface of the test specimen and the lower end of the tup.

3.5 Maximum energy applied

The energy applied to a sample to produce its maximum compressive displacement.

3.6 Absorb energy

The energy absorbed by a cushioning system during a single impact cycle.

3.7 Moderate impact

The reaction force of the ground is greater than or equal to 1.5 times and less than 3 times the wearer's body weight, and the peak axial acceleration of the lower limbs is greater than or equal to 4 gravitational accelerations (4g) and less than 8 gravitational accelerations (8g).

3.8 High impact

The reaction force of the ground is greater than or equal to 3 times the wearer's body weight, and the peak axial acceleration of the lower limbs is greater than or equal to 8 gravitational accelerations (8g).

4 Test principle

The test specimen is fixed on a hard platform and continuously impacted by a falling impact device. The sensor is used to measure the force and displacement when the tup impacts the test specimen during the impact cycle and record them as a related curve.

The peak value and the rebound rate of the tup during the impact process are calculated from the collected data to evaluate the shock-attenuating effect of the test specimen.

6.1 Specimen preparation

The upper of the specimen is cut off at $10.0\text{ mm} \pm 5.0\text{ mm}$ above the adhesive line between the upper and the sole. The remaining upper shall not affect the falling of the impact device. If it affects the falling of the impact device, the remaining upper shall be cut off.

To avoid interference with the cushioning system during the removal of the upper, the bonding between the sole and the upper (which may affect the shock attenuating properties) shall be retained to serve as a fixing device for any loose parts of the cushioning system.

6.2 Specimen shape

The specimen shall have a flat plane and be circular with a diameter of at least 65.0 mm.

The center of the plane shall be aligned with the center of the tup. When the tup contacts the specimen, there shall be a spacing of not less than 10.0 mm between the edge of the tup and the edge of the specimen on all sides.

NOTE. The shape of the specimen varies with the design of the shoe itself. The shape of the shoe is a factor that affects the shock-attenuating properties, and this factor may be detected by this test method.

Therefore, this document does not specify a standard specimen shape; the results obtained from samples of different shapes, thicknesses and sizes are not comparable.

6.3.1 Heel

When testing the shock-attenuating properties of the heel, as shown in Figure 4, the center of the tup is aligned with a point on the surface of the specimen (shoe). The point is at a distance from the heel that is 12% of the inner length of the upper surface of the specimen. The distance between this point and the two sides of the specimen is equal, and the deviation shall not exceed 2.0 mm.

6.3.2 Forefoot

When testing the shock-attenuating properties of the forefoot, as shown in Figure 4, the center of the tup is aligned with a point on the surface of the specimen (shoe). The point is at a distance from the heel that is 75% of the inner length of the upper surface of the specimen. The distance between this point and the two sides of the specimen is equal, and the deviation shall not exceed 2.0 mm.

8.1 Method A

8.1.1 Fix the specimen on the fixed platform device, with the center of the impact position to be tested being aligned with the center of the tup, and it shall not move during impact.

8.1.2 Select and adjust the test instrument according to the maximum energy applied to the specimen. In method A, a maximum energy of $5.0 \text{ J} \pm 0.5 \text{ J}$ is generally applied to the specimen.

8.1.3 For athletic shoes that are subjected to moderate impact during normal wear, an energy of 5.0 J is applied. For athletic shoes that are subjected to high impact, an energy of 7.0 J is applied. If an energy different from 5.0 J or 7.0 J is used, it shall be stated in the test report. The deviation of the maximum energy applied to the athletic shoes shall not exceed 10%.

NOTE. The impact test is a test method designed to simulate the impact of energy, pressure and load speed on the cushioning system of athletic shoes during daily wear. For general-purpose athletic shoes, a reference energy of 5.0 J is more suitable. However, the reference energy value may also change with the model of the athletic shoes to be tested and the different parts to be tested (heel or forefoot). For athletic shoes that are subjected to moderate impact on the cushioning system during normal wear, the reference energy value is 5.0 J , including running shoes (heel) and multi-functional fitness shoes (heel and forefoot); for those subjected to high impact, the reference energy value is 7.0 J , including basketball shoes, tennis shoes and volleyball shoes.

8.1.4 Lower the tup and lightly touch it on the upper surface of the specimen, reset the displacement sensor, and then adjust the tup drop height to $50.0 \text{ mm} \pm 2.5 \text{ mm}$.

NOTE. If the impact energy is 7 J , the drop height of the tup shall be $70.0 \text{ mm} \pm 2.5 \text{ mm}$. If other impact energies are used, the appropriate drop height shall be adjusted according to the impact energy.

8.1.5 Start the instrument and impact 30 times continuously. The first 25 times are used as adjustments for the specimen, and the shock attenuating property data is collected during the 26th~30th cycles. Record the force-displacement test data of the last 5 impact cycles.

8.1.6 Remove the specimen from the instrument, and observe and record any damage

or loss on the specimen surface.

8.2 Method B

8.2.1 Fix the specimen on the fixed platform device so that the tup is aligned with the center of the impact position on the specimen to ensure that the specimen does not move when impacted.

8.2.2 Lower the tup and lightly touch it on the upper surface of the specimen, reset the displacement sensor, and then adjust the tup drop height to $50.0 \text{ mm} \pm 2.5 \text{ mm}$, recorded as H_y , to ensure that the displacement sensor displays the corresponding height.