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

GB/T 7759.2-2014

**Rubber, Vulcanized or thermoplastic -- Determination of
compression set at low temperatures
(English Translation)**

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1 Scope

This Part of GB/T 7759 specifies the test method for determining the compression set characteristics of vulcanized rubbers or thermoplastic rubbers at low temperature.

This method is intended to measure the ability of rubbers of hardness within the range of 10 IRHD ~ 95 IRHD to maintain their elasticity after continuous compression at specified temperature and compression rate (usually 25 %). When the rubber hardness is greater than 80 IRHD, a lower compression rate shall be used: compression rate of

15 % for 80 IRHD ~ 89 IRHD, compression rate of 10 % for 90 IRHD ~ 95 IRHD.

NOTE: Rubber undergoes physical and chemical changes when compressed. When the compression force disappears, these changes prevent the rubber from returning to its original state, thus generating compression set. The magnitude of compression set depends on the temperature and time of compression, as well as the temperature and time of recovery. At low temperatures, glass transition and crystallization effects are the main causes of compression set in rubber. Since these effects gradually disappear as the temperature rises, all measurements must be made at the test temperature.

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 2941-2006 Rubber - General procedures for preparing and conditioning test pieces for physical test methods (ISO 23529:2004, IDT)

- Type A: a cylinder of diameter $29\text{ mm} \pm 0.5\text{ mm}$ and height $12.5\text{ mm} \pm 0.5\text{ mm}$;
- Type B: a cylinder of diameter $13\text{ mm} \pm 0.5\text{ mm}$ and height $6.3\text{ mm} \pm 0.3\text{ mm}$.

The results obtained from the two specifications of test pieces may not be the same, and the test results obtained cannot be compared.

Type A test pieces are suitable for measuring test pieces with relatively low compression permanent deformation. Using large-sized test pieces can obtain more accurate data.

Type B test pieces are suitable for test pieces cut from finished products. Unless otherwise specified, when cutting, the test piece shall be taken from the center of the finished product as much as possible. If possible, when cutting, the axis of the test piece shall be parallel to the compression direction of the finished product when in use.

5.2 Preparation of test pieces

Whenever possible, each test piece shall be prepared by molding. When preparing test pieces by cutting and laminating, the lamination shall not exceed three layers. When using laminated test pieces for finished product performance control, the consent of all relevant parties shall be obtained.

Cutting of test pieces shall comply with the requirements of GB/T 2941-2006. When cutting is difficult (forming a concave surface), the shape of the test piece can be improved by dividing the cutting into two steps: first, cut a large-sized test piece, and then trim the test piece to the specified size with another cutter.

Laminated test pieces shall be cut from a thin film according to the size specified in 5.1 and then laminated. Each layer shall not be bonded. The laminated test piece is compressed for 1 min at a compression rate of a few percent to combine the test piece into a whole. The laminated test piece shall not exceed three layers. Then measure the total height.

Test pieces prepared by the above different methods may obtain different test results, and the test results cannot be compared.

NOTE: Special attention shall be paid to the significant effect of vulcanization conditions on the compression set results. When preparing test pieces using films of different thicknesses and different molds, the vulcanization conditions shall be adjusted appropriately.

5.3 Number of test pieces

Test 3 test pieces, which can be carried out individually or simultaneously according to the purpose of the test.

5.4 Interval between vulcanization and test

For all tests, the minimum time between vulcanization and test is 16 h.

Place the compression apparatus (4.1) at a standard laboratory temperature and carefully clean the operating surfaces. Apply a thin coating of lubricant to the surface of the compression plates (4.1.1) in contact with the test pieces. The lubricant used shall not have any effect on the test pieces, and the lubricant used shall be stated in the test report (see Clause 10).

NOTE: The kinematic viscosity of silicone oil or fluorosilicone liquid at standard laboratory temperature is 0.01 m²/s, which is a suitable lubricant for most tests.

If a lubricant is not used for some reason, it shall be stated in the test report.

7.2 Height measurement

Measure the height at the center of each test piece at standard laboratory temperature, to the nearest 0.01 mm.

7.3 Applying compression

Tighten the compression apparatus so that the compression plates are evenly close together until the selected compression height is reached. Whether a spacer is required for this operation depends on the design of the compression apparatus.

Except for test pieces of high hardness, the compression rate is (25 ± 2) % of the original height of the test piece. The compression rate of test pieces of high hardness shall be (15 ± 2) % or (10 ± 1) % (see 4.1.2).

7.4 Start of test

Immediately place the compression apparatus containing the test piece in the low-temperature cabinet (4.2) that has reached the specified test temperature (see 6.2).

7.5 End of test

After the test time is reached, release the compression apparatus and start the timing device (4.3) at the same time. The time taken to release the compression shall not exceed 10 % of the total time between the start of release and the first height measurement (see 7.6). However, when the relationship between the height of the test piece and the time needs to be determined, the compression shall be released as soon as possible.

7.6 Measurements

The height of the test piece can be measured without removing it from the low- temperature cabinet, to the nearest of 0.01 mm. One measurement method is used for product quality control, and the measurement is carried out $30 \text{ min} \pm 3 \text{ min}$ after compression release; the other measurement method is to measure once every specified time after rapid compression release until 2 h after release. The latter measurement method can draw a graph of the relationship between height and time logarithm (recommended measurement time is 10 s, 30 s, 1 min, 3 min, 10 min, 30 min and 2 h).

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