

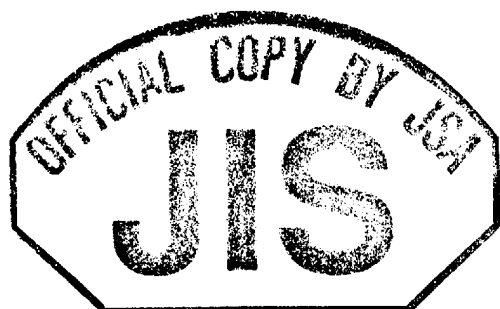
JIS

This standard was revised in 12, 1995

JAPANESE INDUSTRIAL STANDARD

Testing Methods for Thermoplastic Polyurethane Elastomers

JIS K 7311—1987



This copy is an English version of Japanese Industrial Standard prepared by Japanese Standards Association, the copyright holder. Any further reproduction without permission is prohibited.

Translated and Published

by

Japanese Standards Association

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

J I S

Testing Methods for Thermoplastic
Polyurethane Elastomers

K 7311-1987

1. Scope

This Japanese Industrial Standard specifies the testing methods for thermoplastic polyurethane elastomers.

Remark: In this standard the units and numerical values in { } are in accordance with the conventional units and are standardized values.

2. Test Items

The test items specified in this standard shall be as follows.

- (1) Specific gravity test
- (2) Tension test
- (3) Tear test
- (4) Hardness test
- (5) Impact resilience test
- (6) Abrasion test
- (7) Flow test

Applicable Standards and Reference Standards: See page 21.

3. General Conditions for Test

3.1 Standard Condition of Laboratory The standard condition of laboratory shall be, as a rule, the Grade 2 of standard temperature condition ($23 \pm 2^\circ\text{C}$) and the Grade 2 of standard humidity condition ($50 \pm 5\%$) specified in JIS K 7100.

3.2 Preparatory Conditioning Time for Sample The sample shall be submitted to the test after the preparatory conditioning for 88 h or over under the standardized condition in the laboratory specified in 3.1 after forming. In this case, other conditioning may be carried out in accordance with the agreement between the parties concerned.

3.3 Sample for Preparation of Test Pieces Principally, the test pieces shall be taken from the plate-type sample which is formed as at least 100 mm x 100 mm in size and 2 to 3 mm in thickness by means of an injection molding. When preparing test pieces, it shall be avoided to take the test pieces near the gate of the injection molding.

The injection molding shall be carried out under suitable conditions according to the type and grade of the elastomer to be tested.

3.4 Rounding off of Test Results The test results obtained at each test shall be rounded-off according to JIS Z 8401, and be represented by the number of figures specified in Table 1.

Table 1. Rounding-off of Test Results

Measuring items	Test results to be obtained
Specific gravity	Three significant figures
Tensile strength MPa { kgf/cm^2 }	One decimal place whole number
Elongation %	Two significant figures
Tensile stress MPa { kgf/cm^2 }	One decimal place whole number
Tear strength kN/m { kgf/cm }	One decimal place whole number
Hardness	Whole number
Impact resilience %	Whole number
Abrasion loss mg	Whole number
Flow value cm^3/s	Two significant figures

4. Specific Gravity Test

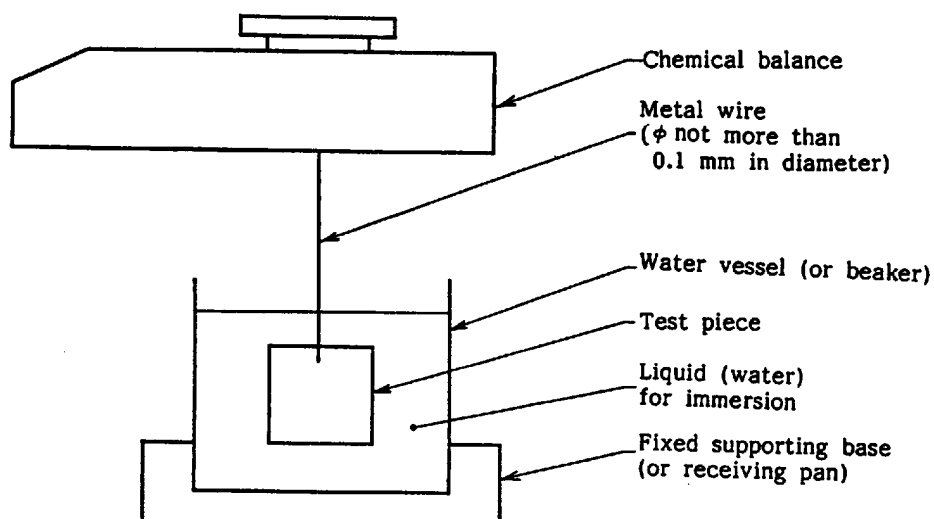
4.1 Test Piece Test pieces shall be prepared from the sample specified in 3.3 by means of cutting into the size suitable for the beaker or water vessel used for measurement.

4.2 Liquid for Immersion The liquid for immersion shall be the distilled water newly prepared or the distilled water boiled immediately before test to expel air.

4.3 Testing Apparatus The following shall be used for testing apparatus (Refer to Fig. 1).

- (1) Chemical balance Sensitivity 0.1 mg.
- (2) Beaker or water vessel
- (3) Fixed supporting base or receiving pan

Fig. 1. Example of Apparatus for Specific Gravity Test



4.4 Testing Method The testing method shall be the displacement method in water, and the procedures shall be as follows.

- (1) Suspend a test piece to the arm of a chemical balance using a metal wire of 0.1 mm or less in diameter, and weigh accurately its mass in air to the nearest 0.1 mg.
- (2) After putting the immersion liquid that has been made free from air in a beaker or water vessel, and place it on a fixed supporting base or receiving pan lest the water vessel should contact with the movable part of the balance.

- (3) Immerse the test piece tied with metal wire in immersion liquid, and suspend other end of the wire to the arm of chemical balance.
- (4) Expel completely the air bubbles attaching on the test piece using such as a thin metal wire, and then weigh its weight to the nearest 0.1 mg.
- (5) Specific gravity shall be calculated according to the following formula:

$$S = \frac{a}{a-b}$$

where

S : specific gravity

a : mass of test piece in air (g)

b : mass of test piece weighed under being suspended in water (g)

4.5 Presentation of Test Result Three test pieces shall be tested, and their average shall be used for the test results.

4.6 Record The following items shall be recorded on the test results.

- (1) Specific gravity
- (2) Temperature for testing
- (3) Temperature of immersing liquid
- (4) Other necessities

5. Tension Test

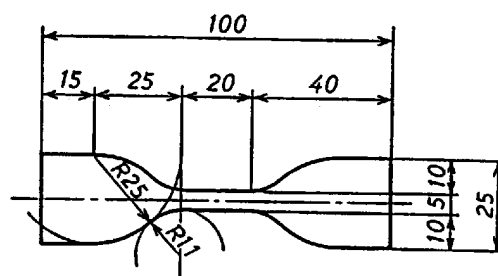
5.1 Test Piece

5.1.1 Shape and Dimension of Test Piece The test piece shall be dumbbell shape as shown in Fig. 2, and punched with an adequate punching die.

When punching, the longitudinal direction of a dumbbell-type test piece shall be in parallel with its flow direction of sample.

Fig. 2. Dumbbell-Type Test Piece

Unit: mm



5.1.2 Measurement of Thickness and Width The thickness and width of a test piece shall be measured as follows:

- (1) A thickness tester shall be graduated to 0.01 mm and its pressurizing surface shall be smooth and a circular flat measuring 5 mm in diameter.
The pressurizing load of this tester, principally, shall be 0.785 N (80 gf), and not fluctuate not less than $\pm 15 \%$ within a measuring range.
- (2) Measure the thickness of a test piece at several points of parallel part, and adopt the minimum value out of the measured values as the thickness of the test piece. In this case, avoid such measurement as the center of pressurizing surface extrudes outside from the edge of the test piece.
- (3) Use the width of a test piece as it has been punched by means of a punching machine (inside width of cutter).
- (4) Calculate the sectional area of a test piece by multiplying thickness (cm) by width of parallel part (cm).

5.1.3 Marked Line for Elongation Measurement The marked line for an elongation measurement, hereinafter referred to as the "marked line" shall be attached as follows.

- (1) The gauge length (the distance between two marked lines) shall be 20 mm.
- (2) The marked line shall be attached clearly and accurately on the parallel part of a test piece with making the center of the test piece coincide with the center of marks.

5.2 Testing Apparatus The testing apparatus shall be the tensile testing machine satisfying the following requirements:

5.2.1 Mechanism of Testing Machine The testing machine shall be equipped with an indicator for the maximum load and with the grips capable of fastening automatically a dumbbell-type test piece.

5.2.2 Capacity of Testing Machine The maximum load of the testing machine when testing shall fall within the range from 15 to 85 % of its capacity.

5.2.3 Tensile Speed The separation rate of the grips for a test piece, principally, shall be 0.0050 ± 0.0003 m per second (300 ± 15 mm per minute).

5.2.4 Tolerance on Load Graduation of Testing Machine The tolerance on the load graduation of a testing machine shall be $\pm 2 \%$.

5.2.5 Inspection of Testing Machine The testing machine shall be installed accurately and be inspected once a year at least.