

INTERNATIONAL STANDARD



4672

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Rubber products — Hoses — Low-temperature flexibility tests

Produits en caoutchouc — Tuyaux — Essais de souplesse à basse température

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FOREWORD

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4672 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in February 1977.

It has been approved by the member bodies of the following countries :

Australia	Hungary	Spain
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The member body of the following country expressed disapproval of the document on technical grounds :

U.S.A.

Rubber products — Hoses — Low-temperature flexibility tests

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies two methods for assessing whether a rubber hose retains adequate flexibility at low temperatures.

In method A, the stiffness of a test piece at low temperature is compared with its stiffness at standard laboratory temperature to give a quantitative assessment.

Method B is a simpler qualitative method suitable for control tests.

2 REFERENCES

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 3383, *Rubber — General directions for achieving elevated or sub-normal temperatures for tests.*

3 METHOD A — LOW-TEMPERATURE STIFFNESS TEST

3.1 Apparatus (see the figure)

3.1.1 Torque wheel, having a diameter equal to twice the minimum bend radius specified for the hose, provided with equipment for holding the hose tangential, a suitable device to bend the hose around the wheel, and a strain gauge and graphical recorder to measure the torque with an accuracy of $\pm 3\%$.

3.1.2 Coolant container, equipped with an agitator, a temperature-measuring device and a roller having a diameter of 50 mm for guiding the hose.

The coolant shall not affect the hose to be tested and shall be used as prescribed in ISO 3383.

A suitable liquid would be, for example, methanol or ethanol with crushed dry ice (solid carbon dioxide) added. Gaseous media may be employed as the coolant when the design of the apparatus is such that tests using such media will give equivalent results to those obtained with liquid media.

3.2 Test pieces

3.2.1 Type

The test pieces shall be cut from the hose under test with a length equal to about twenty-five times the bore of the hose.

3.2.2 Number

At least three test pieces shall be used for each test.

No test shall be carried out less than 24 h after manufacture of the hose.

3.3 Procedure

Clamp the test piece on the wheel (3.1.1) in a straight position. If the hose has natural curvature, this curvature shall follow that of the wheel.

Without coolant in the container (3.1.2), determine the torque required to turn the test piece through 180° round the wheel at the standard laboratory temperature (chosen from those given in ISO 471). The time for bending shall be 12 ± 2 s. Repeat the test with the container filled with coolant at the chosen temperature of test (see 3.4). Condition the test piece in a cold chamber at the test temperature for 24 h, followed by conditioning at the test temperature in the apparatus for at least 30 min before testing.

3.4 Temperature of test

The temperature of test shall be selected from the following :

- $0 \pm 2^\circ\text{C}$
- $-10 \pm 3^\circ\text{C}$
- $-25 \pm 3^\circ\text{C}$
- $-40 \pm 3^\circ\text{C}$
- $-55 \pm 3^\circ\text{C}$

3.5 Expression of results

For each test piece, calculate the mean torque at standard laboratory temperature and the mean torque at test temperature by calculating the mean of the peak values contained in the central 50 % of the respective torque traces.

Calculate the stiffness, S , expressed as the ratio of the mean torque at the test temperature to that at the standard laboratory temperature, as follows :

$$S = \frac{M_t}{M_0}$$

where

M_t is the torque at test temperature (mean value from three tests);

M_0 is the torque at standard laboratory temperature (mean value from three tests).

If the individual values of the three test pieces do not agree within 15 % of the mean value at each temperature, the test shall be repeated.

3.6 Test report

The test report shall include the following particulars :

- reference to this International Standard;
- a full description of the hose and its origin;
- the dimensions of the test pieces;
- the coolant used;
- the standard laboratory temperature and test temperature;
- the torque at standard laboratory temperature;
- the calculated value of the stiffness.

4 METHOD B – COLD BEND TEST

4.1 Apparatus

4.1.1 Mandrel, having an outside diameter equal to twice the minimum bend radius specified for the hose, or a former consisting of an arc of at least 180°.

4.1.2 Conditioning chamber, capable of being maintained at the specified temperature.

4.2 Test piece

The test piece shall be cut from the hose under test with a length adequate to provide a grip at each end in addition to the 180° arc around the mandrel.

The test piece shall be discarded on completion of the test.

No test shall be carried out less than 24 h after manufacture of the hose.

4.3 Procedure

Condition the mandrel (4.1.1) and the test piece in the conditioning chamber (4.1.2) at the chosen temperature of test (see 4.4) for 24 h. Without removing from the conditioning chamber, bend the test piece 180° round the mandrel, taking 10 ± 2 s to do so. Hoses of nominal bore size greater than 22 mm may be bent through 90°.

Observe whether any cracking or breaking of the hose lining or cover occurs.

After bending, allow the test piece to regain ambient temperature, and apply the specified proof test pressure to confirm whether or not any cracking or breaking of the lining or cover has occurred.

4.4 Temperature of test

The temperature of test shall be selected from the following :

- $0 \pm 2^\circ \text{C}$
- $-10 \pm 3^\circ \text{C}$
- $-25 \pm 3^\circ \text{C}$
- $-40 \pm 3^\circ \text{C}$
- $-55 \pm 3^\circ \text{C}$

4.5 Test report

The test report shall include the following particulars :

- a reference to this International Standard;
- a full description of the hose and its origin;
- the dimensions of the test piece;
- the test temperature;
- the results of the visual examination of the test piece after bending;
- the results of the visual examination after the proof pressure test.