INTERNATIONAL STANDARD

ISO 1402

Third edition
1994-12-01

Rubber and plastics hoses and hose assemblies — Hydrostatic testing

Tuyaux et flexibles en caoutchouc et en plastique — Essais hydrostatiques

Reference number
ISO 1402:1994(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1402 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This third edition cancels and replaces the second edition (ISO 1402:1984), which has been technically revised.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Rubber and plastics hoses and hose assemblies — Hydrostatic testing

1 Scope

This International Standard specified methods for the hydrostatic testing of rubber and plastics hoses and hose assemblies, including methods for the determination of dimensional stability.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 471:—[1] *Rubber — Times, temperatures and humidities for conditioning and testing.*

ISO 4671:1984, *Rubber and plastics hose and hose assemblies — Methods of measurement of dimensions.*

ISO 7751:1991, *Rubber and plastics hoses and hose assemblies — Ratios of proof and burst pressure to design working pressure.*

3 General

Unless otherwise specified, all tests shall be carried out at standard temperature (see ISO 471).

4 Apparatus

4.1 Pressure source, capable of applying pressure at the rate specified in 6.2.2, up to the required test pressure.

4.2 Calibrated pressure gauge or **pressure transducers with digital readouts**, chosen for each test so that the test pressure is between 15 % and 85 % of the full-scale reading.

In the interest of accuracy, calibrated pressure gauges or pressure transducers with digital readouts shall be checked at frequent intervals and the fitting of restrictors is recommended to minimize shock damage.

4.3 Sliding vernier callipers or **micrometer,** and **measuring tape**.

5 Test pieces

5.1 Hose assemblies

When hose assemblies are to be tested, the manufactured assembly length shall be used for the test.

5.2 Hoses

The hydrostatic pressure and burst tests shall be carried out on a hose test piece with a minimum free length, excluding end fittings and end reinforcements, of 600 mm when deformation is to be measured and 300 mm when it is not.

1) To be published. (Combination and revision of ISO 471:1983 and ISO 1826:1981)

5.3 Number of test pieces

At least two test pieces shall be tested.

6 Application of hydrostatic pressure

6.1 General

Water or another liquid suitable for the hose under test shall be used as the test medium.

WARNING — Hoses and hose assemblies pressurized by liquids can fail in a potentially dangerous manner. For this reason, the test shall be performed in a suitable enclosure. Also the use of air and other gases as test media shall be avoided because of the risk to operators. In special cases, where such media are required for the tests, strict safety measures are imperative. Furthermore, it is stressed that, even when a liquid is used as the test medium, it is essential that all air is expelled from the test piece because of the risk of injury to the operator due to the sudden expansion of trapped air released when the hose bursts.

6.2 Procedure

6.2.1 Fill the test piece with test liquid, expelling all air, and connect to the test equipment. Close the valve and apply the hydrostatic pressure at a uniform rate of increase. Measure the pressure using a calibrated pressure gauge or pressure transducer with digital readout (4.2).

NOTE 1 It is important to allow unrestricted movement of the free or plugged end of the test piece during the test.

6.2.2 The rate of pressure increase shall be constant and chosen to reach the final pressure after between 30 s and 60 s for hoses with nominal inside diameters up to 50 mm. For hoses with nominal inside diameters greater than 50 mm and less than or equal to 250 mm, the time needed to reach the final pressure shall be between 60 s and 240 s. For hoses with nominal inside diameters larger than 250 mm, the time needed to reach the final pressure shall be decided between the manufacturer and user.

7 Hydrostatic pressure tests

7.1 Proof pressure hold test

When proof pressure tests are used to determine leakage of hoses or hose assemblies, apply the specified proof pressure in accordance with 6.2.2 and hold it for not less than 30 s or more than 60 s, unless otherwise specified in the product standard, examining the test pieces during this period for evidence of leakage, cracking, abrupt distortions indicating irregularity in material or manufacture, or other signs of failure.

Unless otherwise specified for the hose, the proof pressure shall be related to the design working pressure by the ratio given in ISO 7751.

NOTE 2 The test is not applicable to curved hose.

7.2 Measurement of deformation under pressure

7.2.1 General procedure

When tests for determining change in length, change in internal diameter and twisting are required, straighten the hose, lay it out horizontally for inspection and apply a hydrostatic pressure of 0,07 MPa when this is necessary to stabilize the hose. Make three reference marks (A, B and C) on the outer surface of the hose, the middle mark (B) being made approximately midway along the length of the hose, and the two outer marks (A and C) being 250 mm from B. Each mark shall consist of an arc on the circumference of the hose through which is drawn a straight line perpendicular to the arc, the three straight lines being colinear (see figure 1).

Maintain the initial pressure of 0,07 MPa (if applied) and make the appropriate measurements (see 7.2.2, 7.2.3 and 7.2.4) at the reference marks.

Apply the specified test pressure at the rate specified in 6.2.2 and maintain it for 1 min before making the test measurements, which shall then be made as quickly as possible to avoid prolonging the test period.

NOTE 3 The test pressure will be specified in the appropriate hose product specification and could be the design working pressure, the proof pressure or any other pressure below the proof pressure at which the hose deformation characteristics are to be measured.

7.2.2 Change in length

Measure the length between the two outermost reference marks (A and C) with an accuracy of ± 1 mm, using the measuring tape (4.3), at the initial pressure (0 or 0,07 MPa) and at the specified test pressure.

Calculate the change in length, Δl, expressed as a percentage of the original length, from the equation

$$\Delta l = \frac{l_1 - l_0}{l_0} \times 100$$

where

l_0 is the distance between the two outermost reference marks (A and C) measured at the initial pressure;

l_1 is the distance between the same two reference marks measured at the specified test pressure.

7.2.3 Change in external diameter

7.2.3.1 General

The external diameter should preferably be determined from measurements of circumference made with an accuracy of 1 mm using the measuring tape (see ISO 4671). The measurements may, however, be made directly, using sliding vernier callipers having a minimum useful tip width of 5 mm.

7.2.3.2 Determination by measuring the change in external circumference

Using the measuring tape (4.3), measure the circumference at each of the three reference marks (A, B and C) at the intial pressure (0 or 0,07 MPa) and at the specified test pressure.

Calculate the change in diameter ΔD, expressed as a percentage of the original diameter, from the equation

$$\Delta D = \frac{\Sigma C_1 - \Sigma C_0}{\Sigma C_0} \times 100$$

where

ΣC_0 is the sum of the circumferences at the three reference marks measured at the initial pressure;

ΣC_1 is the sum of the circumferences at the three reference marks measured at the specified test pressure.

7.2.3.3 Direct measurement of change in external diameter

Using the sliding vernier callipers (4.3), measure two perpendicular diameters at each of the three reference marks at the initial pressure (0 or 0,07 MPa) and at the specified test pressure.

Calculate the change in diameter ΔD, expressed as a percentage of the original diameter, from the equation

$$\Delta D = \frac{\Sigma D_1 - \Sigma D_0}{\Sigma D_0} \times 100$$

where

ΣD_0 is the sum of the six diameters measured at the reference marks at the initial pressure;

ΣD_1 is the sum of the six diameters measured at the reference marks at the specified test pressure.

7.2.4 Twisting

If twisting of the hose develops under pressure, the original lines forming the reference marks will take up a helical pattern (see figure 2).

With the hose at the specified test pressure, project a straight line along the length of the hose from reference mark A until it intersects, at C′, the circular arc at reference point C.

Then measure the length s of the circular arc CC′ to the nearest millimetre, using the measuring tape (4.3).

Calculate the amount of twisting per metre, T, expressed in degrees, from the equation

$$T = \frac{s \times 360}{C_c \times l_0}$$

where

C_c is the circumference at reference mark C, measured as described in 7.2.3.1;

l_0 is the distance between A and C as measured in 7.2.2.

7.2.5 Warping

Warping in hose tests is the deviation from a straight line drawn from fitting to fitting in a plane parallel to the surface on which the hose rests at the initial pressure (0 or 0,07 MPa). A tightly stretched cord may be used to establish the straight line from centre to centre of the fittings. The amount of warping at the specified test pressure is the maximum deviation of any portion of the hose from the straight line drawn from centre to centre of the fittings at the initial pressure. Express warping as the distance from this line to the centreline of the hose at the point of maximum deviation. Report the result to the nearest 5 mm.

7.3 Burst pressure test

Increase the pressure at a rate in accordance with 6.2.2 until the hose or hose assembly fails. The pos-

ition and mode of failure shall be recorded in the test report.

Any failure caused by blowing off of fittings, leakage or bursts within 25 mm of a fitting or within a distance equal to the external diameter of the hose, whichever is greater, shall not be interpreted as a true hose burst.

7.4 Leakage test

7.4.1 Test pieces

The test pieces for the leakage test shall comprise unaged hose assemblies on which the end fittings have been attached for not more than 30 days and not less than 1 day.

7.4.2 Procedure

Subject the test assemblies to a specified hydrostatic pressure equal to 70 % of the specified minimum burst pressure. Maintain this specified test pressure for 5 min ± 0,5 min and then reduce it to zero. Re-apply the specified test pressure and maintain it for a further period of 5 min ± 0,5 min. This is considered to be a destructive test and the test assemblies shall be destroyed after test.

7.4.3 Criteria for failure

There shall be no leakage or evidence of failure.

Leakage at the end fitting, fitting blow-off or rupture of the hose adjacent to the fitting shall be considered as failures in the performance of the assembly.

NOTE 4 Such failures do not necessarily demonstrate an inability of the hose to meet the specified requirements with an alternative fitting.

8 Test report

The test report shall include the following particulars for each test undertaken:

a) a full description of the hose and, where applicable, hose assembly tested;

b) a reference to this International Standard, i.e. ISO 1402;

c) the method used;

d) the number of test pieces tested and the length of each test piece;

e) the test pressure and rate of pressure increase;

f) the test medium (if other than water);

g) the results obtained for each test piece;

h) if the test piece fails, the position and mode of failure;

i) any unusual features noted during the test;

j) the date of the test.

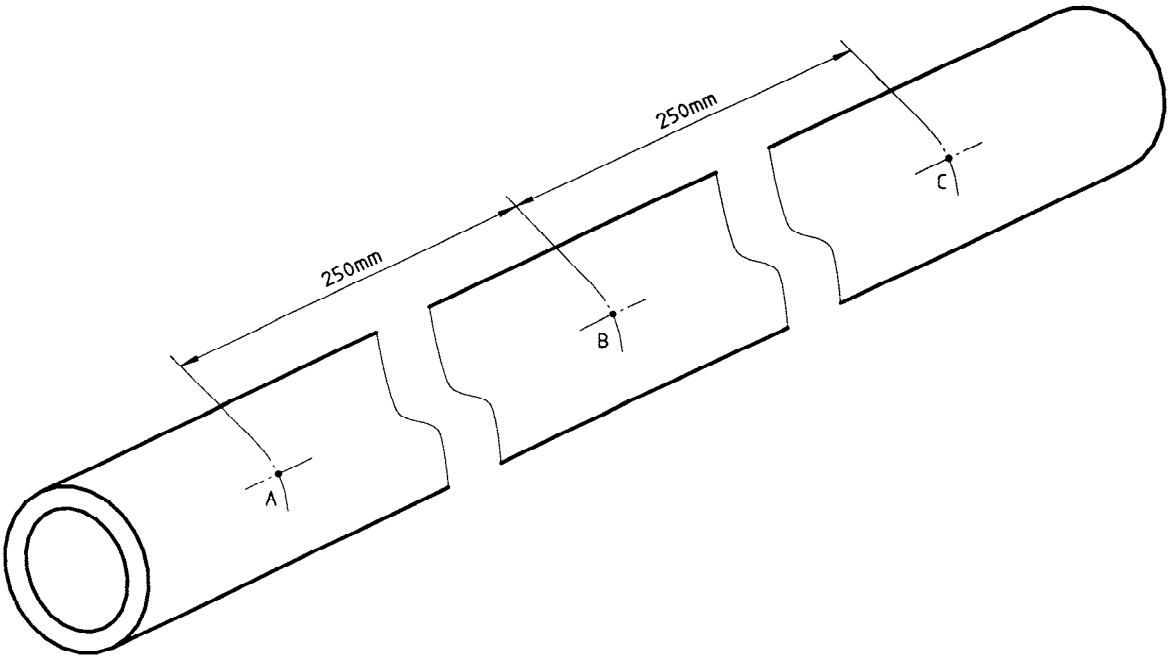

Figure 1 — Measurement of dimensional stability

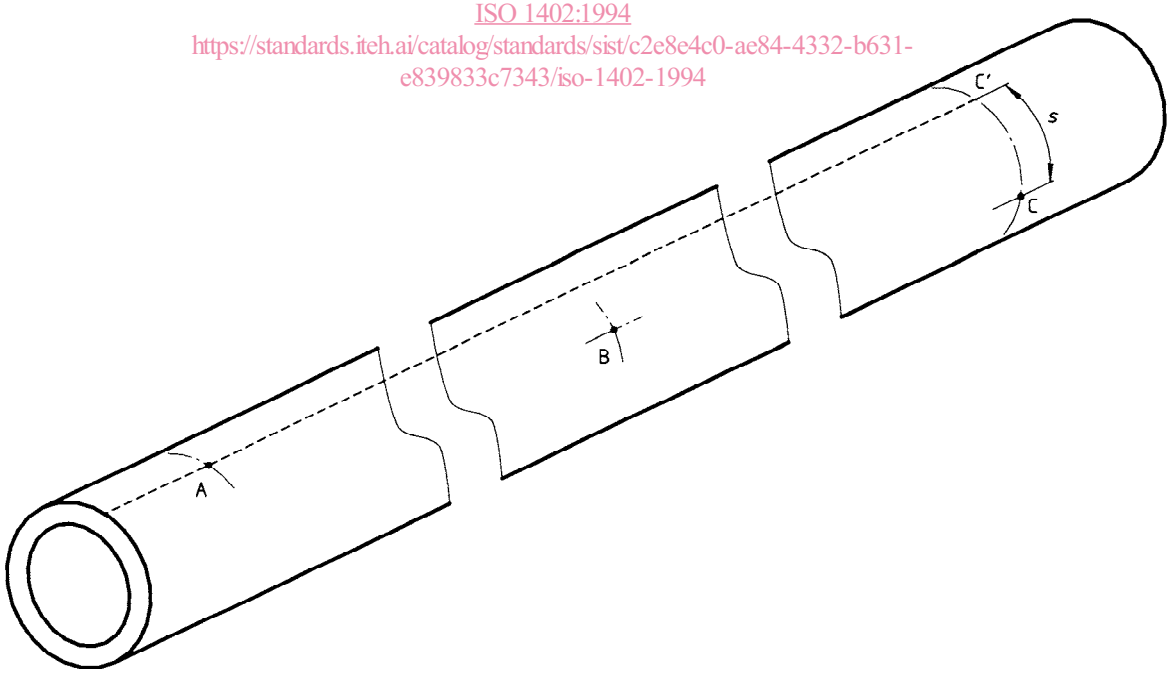

Figure 2 — Measurement of amount of twisting

ICS 23.040.70

Descriptors: rubber products, plastics products, hoses, rubber hoses, plastics hoses, tests, hydrostatic tests, determination, dimensional stability.

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