INTERNATIONAL STANDARD 1402

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Rubber hose — Hydrostatic testing

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 45 has reviewed ISO Recommendation R 1402 and found it technically suitable for transformation. International Standard ISO 1402 therefore replaces ISO Recommendation R 1402-1970 to which it is technically identical.

ISO Recommendation R 1402 was approved by the Member Bodies of the following countries :

Austria	India	Poland
Brazil	Iran	Spain
Czechoslovakia	Ireland	Sweden
Egypt, Arab Rep. of	Israel	Switzerland
France	Italy	United Kingdom
Germany	Japan	U.S.A.
Greece	Netherlands	U.S.S.R.
Hungary	New Zealand	Yugoslavia

The Member Body of the following country has subsequently approved this Recommendation :

South Africa, Rep. of

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 1402 into an International Standard.

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Rubber hose — Hydrostatic testing

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the hydrostatic testing of rubber hose by subjecting the test piece or sample hose to the action of internal pressure up to a proof test pressure, checking the dimensional deviations which can occur in actual service, and then up to a minimum bursting pressure.

2 LENGTH OF TEST PIECE

2.1 Hold test under proof pressure

This test will produce strains which in some cases can reduce hose life. Depending on the severity of service conditions, it will be necessary in each case to decide whether the test is to be made on test pieces or on standard delivery lengths.

2.2 Bursting test

For the bursting tests, the free length of the test piece excluding end reinforcements or couplings should be preferably 1 m and in no case less than 0,5 m.

3 APPLICATION OF HYDROSTATIC PRESSURE

3.1 Test media

Unless otherwise specified to meet special requirements, the test medium shall be water. The use of air and other gaseous materials as testing 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 when a liquid is used as the test medium, all air must be 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.

3.2 Procedure

The hose shall be connected to the water supply line and filled with water, all air in the hose being expelled through the valve or stop-cock in the free end. The valve shall then be closed, and hydrostatic pressure applied at a uniform rate of increase by means of a hand- or power-driven hydraulic pump or an accumulator system. The pressure shall be measured with a calibrated dial-gauge.

NOTES

1 In the interests of accuracy, calibrated pressure-gauges shall be checked at frequent intervals, and the fitting of restrictors is recommended to minimize shock damage.

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

3.3 Pressure increase rate

3.3.1 *Minimum rates* of pressure increase shall be

a) 0,075 MPa/s for test pressures not above 7,0 MPa;

b) 0,15 MPa/s for test pressures above 7,0 MPa.

If these rates are not obtainable, the interested parties shall agree upon a suitable rate in advance. In cases where for some reason the minimum rate is not reached, the report shall state the rate actually attained.

3.3.2 *Maximum rates* of pressure increase shall be

a) 0,175 MPa/s for test pressures not above 7,0 MPa;

b) 0,35 MPa/s for test pressures above 7,0 MPa and not above 42 MPa.

A higher constant rate of pressure increase shall be used when the test pressure is above 42 MPa in order that the final pressure is reached within 2 min. The rate of pressure increase shall be reported in the test report.

4 TESTS AT PROOF PRESSURE

4.1 Proof pressure hold tests

The pressure shall be increased at the rate specified in 3.3 until the test pressure has been reached. This pressure shall be maintained for a period of 1 min.

4.2 Measurement of deformation under proof pressure

When tests for change in length, change in outside diameter and twisting are required, the hose shall be straightened, laid out horizontally for inspection and a hydrostatic pressure of 0,05 MPa applied. Three reference marks X, Y and Z shall then be made on the outer surface of the hose, the middle mark Y being made approximately midway along the length of the hose, and the two outer marks, X and Z, 0,25 m from Y. Each mark shall consist of an arc of the circumference of the hose through which is drawn a straight line perpendicular to the arc, the three straight lines being colinear.

The initial pressure of 0,05 MPa shall be maintained steady while the distances between the reference marks are measured. The specified hydrostatic proof test pressure shall be applied at the rate specified in 3.3, and shall be maintained steady for 1 min before the test measurements are carried out. The measurements shall be made as quickly as possible to avoid extending the test for too long a period.

4.2.1 *Change in length*

The length between the two outermost marks, X and Z, shall be measured to a precision of ± 1 mm, using a measuring tape.

The change in length, expressed as a percentage of the original length, is given by the formula :

$$V_L = \frac{L_1 - L_0}{L_0} \times 100$$

where

L_0 is the distance between the two outermost marks, measured under a pressure of 0,05 MPa;

L_1 is the distance between the two outermost marks, measured under the proof test pressure;

V_L is the percentage change in length, which will be positive in the case of an increase in length and negative in the case of a decrease in length.

4.2.2 *Change in outside diameter*

Preferably, the outside diameters should be determined from circumferential measurements made with a precision of ± 1 mm using a measuring tape. The measurements may, however, be made direct using a caliper gauge having a minimum useful tip width of 5 mm.

4.2.2.1 Measurement by change in outside circumference

Using the measuring tape, the circumference at each of the three marks X, Y and Z shall be measured.

The change in diameter is given, as a percentage of the original diameter, by the formula :

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

where

ΣC_0 is the sum of the three circumferences at the reference marks, measured under a pressure of 0,05 MPa;

ΣC_1 is the sum of the three circumferences measured at the proof test pressure;

V_D is the percentage change in diameter, which will be positive in the case of an increase in diameter, and negative in the case of a decrease in diameter.

4.2.2.2 Direct measurement of change in outside diameter

Using a caliper gauge, two perpendicular diameters shall be measured at each of the three reference marks. The change in diameter, expressed as a percentage of the original diameter, is given by the formula :

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

where

ΣD_0 is the sum of the six diameters at the reference marks, measured under a pressure of 0,05 MPa;

ΣD_1 is the sum of the six diameters measured at the proof test pressure;

V_D is the percentage change in diameter, which will be positive in the case of an increase in diameter, and negative in the case of a decrease in diameter.

4.2.3 *Twisting*

If twisting of the hose develops under the proof test pressure, the original lines will take up a helical pattern.

With the hose under the proof test pressure, produce the straight line mark at reference point X until it intersects the circular arc at reference point Z, at Z′. The length d of the circular arc ZZ′ shall then be measured to the nearest millimetre using a measuring tape.

The twisting per metre, T, expressed in angular degrees, is given by the formula :

$$T = \frac{360 \times d}{C_Z} \times 2$$

where C_Z is the circumference at the reference mark Z, as measured by the method given in 4.2.2.

4.2.4 *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. The amount of warping is the maximum deviation of any portion of the hose from a straight line drawn from centre to centre of the fittings. Warping shall be expressed as the distance from this line to the centre line of the hose at the point of maximum deviation. A tightly stretched cord may be used to establish the straight line from centre to centre of the fittings. Results shall be reported to the nearest 5 mm.

5 MINIMUM BURSTING PRESSURE TEST

The pressure shall be increased at the rate recommended in 3.3 until the specified minimum bursting pressure is reached. If failure does not occur, the test shall be discontinued and the sample destroyed.

6 FAILURE DURING TEST

In those cases where failure occurs close to the ends of samples or test pieces, the test shall be considered void and shall be repeated on a fresh sample or test piece. "Close" shall be interpreted to mean the length of penetration of the fitting plus the outside diameter.

Failure due to coupling blow-off or rupture within 25 mm of the fittings shall be interpreted not as a true hose burst, but as a failure of a fitting attachment, and shall be recorded as such in the test report.

7 TEST REPORT

The test report shall include the following particulars :

a) the reference of the method used;

b) the results and the method of expression used;

c) any unusual features noted during the determination;

d) any operation not included in this International Standard, or regarded as optional.