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HYDROSTATIC TESTING OF RUBBER HOSE

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BRIEF HISTORY

The ISO Recommendation R 1402, *Hydrostatic testing of rubber hose,* was drawn up by Technical Committee ISO/TC 45, *Rubber,* the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1402,which was circulated to all the ISO Member Bodies for enquiry in December 1967. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

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

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council,which decided to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 1402 July 1970

HYDROSTATIC TESTING OF RUBBER HOSE

1. SCOPE

This ISO Recommendation describes 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

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

3.1 General

The hose should 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 should 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 should be measured with a calibrated dial gauge.

NOTES

1. In the interests of accuracy calibrated pressure gauges should 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.

3.2 Pressure increase rate

3.2.1 *Minimum rates* of pressure increase should be

(*a*) 0.075 MN/m^2 per second for test pressures not above 7.0 MN/m^2;

(*b*) 0.15 MN/m^2 per second for test pressures above 7.0 MN/m^2.

If these rates are not obtainable, the manufacturer and user should agree upon a suitable rate in advance. In cases where the minimum rate is somehow not reached, the report should state the rate actually attained.

3.2.2 *Maximum rates* of pressure increase should be

(*a*) 0.175 MN/m^2 per second for test pressures not above 7.0 MN/m^2;

(*b*) 0.35 MN/m^2 per second for test pressures above 7.0 MN/m^2 and not above 42 MN/m^2.

A higher constant rate of pressure increase should be used when the test pressure is above 42 MN/m^2 in order that the final pressure is reached within 2 minutes. The rate of pressure increase should be reported in the test report.

4. TESTS AT PROOF PRESSURE

4.1 Proof pressure hold tests

The pressure should be increased at the rate specified in clause 3.2 until the test pressure has been reached. This pressure should be maintained for a period of 1 minute.

4.2 Measurement of deformation under proof pressure

When tests for change in length, change in outside diameter and twisting are required, the hose should be straightened, laid out horizontally for inspection and a hydrostatic pressure of 0.05 MN/m^2 applied. Three reference marks *a, b* and *c* should then be made 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*, 0.25 m from *b*. Each mark should consist of a segment of a circular arc and a straight line perpendicular to it, the three straight lines being colinear.

The initial pressure of 0.05 MN/m^2 should be maintained steady while the reference marks are measured. The specified hydrostatic proof test pressure should be applied at the rate recommended in clause 3.2, and should be maintained steady for 1 minute before carrying out the test measurements. The measurements should 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, *a* and *c*, should be measured to a precision of ± 1 mm, using a measuring tape.

The change in length should be expressed as a percentage of the original length as follows :

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

where

L_0 is the distance between the two outermost marks under a pressure of 0.05 MN/m^2;

L_1 is the distance between the two outermost marks 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 reference marks *a*, *b* and *c* should be measured. The change in diameter should be expressed as a percentage of the original diameter as follows :

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

where

ΣC_0 is the sum of the three circumferences at the reference marks *a*, *b* and *c*, measured under a pressure of 0.05 MN/m^2 ;

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 should be measured at each of the three reference marks. The change in diameter should be expressed as a percentage of the original diameter as follows :

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

where

ΣD_0 is the sum of the six diameters at the reference marks *a*, *b* and *c*, measured under a pressure of 0.05 MN/m^2 ;

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 *a* until it intersects the circular arc at reference point *c*, at *c'*. The length *d* of the circular arc *cc'* should then be measured to the nearest millimetre using a measuring tape.

The twisting per metre, *T*, expressed in angular degrees, should be calculated as follows :

$$T = \frac{360 \times d}{C_{1c}} \times 2$$

where C_{1c} is the circumference at the reference mark *c*, as measured by the method given in clause 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 should be measured 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 should be reported to the nearest 5 mm.