INTERNATIONAL STANDARD

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Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum

Tuyaux et flexibles en caoutchouc et en plastique — Détermination de la résistance à l'aspiration

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7233 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 7233:1991), which has been technically revised.

Introduction

Vacuum testing is applied to hoses to determine whether they will withstand the differential pressure encountered in service resulting from reduced pressure within the hose.

Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum

1 Scope

This International Standard specifies three methods for determining the resistance to vacuum of hoses and hose assemblies manufactured from plastic or rubber. Applicable dimensions of hoses for each method are as follows:

- method A — for hoses of nominal bore up to and including 80 mm;
- method B — for hoses of nominal bore greater than 80 mm;
- method C — for hoses of all dimensions.

Methods A and B can also be used to check the adhesion of the lining to the reinforcement (delamination) in a length of hard-wall hose or hose assembly.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4671:1999, *Rubber and plastics hoses and hose assemblies — Methods of measurement of dimensions*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Principle

The test methodology for determining the resistance to vacuum of plastic and rubber hoses and hose assemblies consists of reducing the internal pressure in a length of hose by means of a vacuum pump and gauge, whilst examining the hose for any signs of deformation or delamination of reinforcement or lining.

4 Apparatus

4.1 Vacuum pump, provided with a gauge and capable of reducing the internal pressure in the hose within 60 s to the pressure specified in the product standard for the hose under test and maintaining it at that pressure for a minimum of 10 min.

4.2 Smooth, solid ball (for method A), with a diameter equal to 0,9 times the bore of the hose under test, rounded down to the nearest whole millimetre.

4.3 Two transparent airtight plates (for method B), for sealing each end of the hose. One of the plates shall permit attachment of the vacuum pump to the hose, whilst allowing internal visual inspection of the hose during the test.

5 Test pieces

If the complete hose or hose assembly is more than 1 m long, each test piece shall consist of a minimum length of hose, clear of the end fittings, of 1 m. If the complete hose or hose assembly is less than 1 m long, the complete length shall be used.

6 Conditioning of test pieces

No tests shall be carried out within 24 h of manufacture. Test pieces shall be conditioned at the appropriate temperature in accordance with ISO 23529 for at least 3 h before testing.

NOTE This 3 h period may form part of the minimum period of 24 h between manufacture and testing.

7 Test pressure

The internal pressure to which the hose is subjected for the duration of the test shall be that stated in the product specification for the hose under test as being the minimum internal pressure which the hose is required to withstand.

8 Procedure (method A)

Lay out the hose as straight as possible on a flat surface and blank off one end to form an airtight seal. Insert into the hose a smooth, solid ball (4.2) and then connect the open end of the hose to a vacuum pump and gauge. Reduce the pressure in the hose within 60 s to the required test pressure and maintain this pressure for the required period, which shall not be less than 10 min.

While the test pressure is being maintained, examine the hose externally for any signs of indentation or collapse and then tilt the hose to permit the solid ball to traverse the full length of the hose to check for any obstructions caused by internal deformation or delamination.

9 Procedure (method B)

Lay out the hose as straight as possible on a flat surface and fit transparent airtight plates (4.3) to both ends of the hose, one of which shall then be connected to a vacuum pump and gauge. Reduce the pressure in the hose within 60 s to the required test pressure and maintain this pressure for the required period, which shall not be less than 10 min.

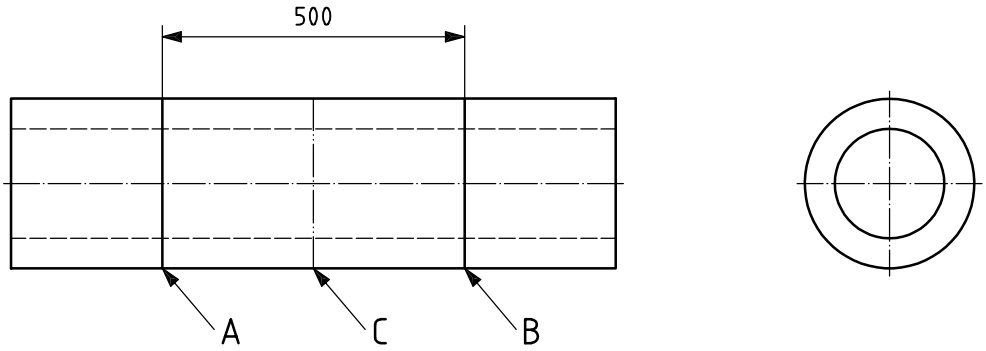
While the test pressure is being maintained, examine the interior of the hose through one of the transparent plates by means of illumination supplied through the transparent plate at the other end of the hose for signs of delamination or blistering of the lining. Also examine the exterior of the hose for signs of indentation or collapse.

10 Procedure (method C)

Lay out the hose as straight as possible on a flat surface, blank off one end to form an airtight seal, and connect the other end to a vacuum pump and gauge.

Before reducing the pressure in the hose, mark two lines (lines A and B), equidistant from the centre and 500 mm apart, round the hose (see Figure 1). Then mark a third line (line C) round the hose at a point between lines A and B. Measure the average outside diameter of the hose round line C in accordance with the method specified in ISO 4671:1999, 4.2.

Dimensions in millimetres



Key

A, B lines marked on test piece for measurement of change in length

C line marked on test piece for measurement of change in outside diameter

Figure 1 — Marking measurement lines on test piece

Reduce the pressure in the hose to the required test pressure and maintain this pressure for the required period, which shall not be less than 10 min. After 10 min, or the required test period (whichever is greater), and before releasing the pressure, measure the distance between lines A and B as well as the average outside diameter round line C, as before.

Release the pressure and, after 10 min, measure, for a third time, the distance between lines A and B and the average outside diameter round line C.

The percentage change in the length of the hose, ΔL, before and after releasing the pressure is given by the equations:

$$\Delta L_t = \left(\frac{L_2 - L_1}{L_1} \right) \times 100$$

$$\Delta L_p = \left(\frac{L_3 - L_1}{L_1} \right) \times 100$$

where

ΔL_t is the temporary length change (before releasing the pressure);

ΔL_p is the permanent length change (after releasing the pressure);

L_1 is the distance between lines A and B before reducing the pressure, in millimetres;

L_2 is the distance between lines A and B before releasing the pressure, in millimetres;

L_3 is the distance between lines A and B after releasing the pressure, in millimetres.