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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

ISO/CEN PARALLEL PROCESSING

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

This fifth edition cancels and replaces the fourth edition (ISO 7233:2016), which has been technically revised. The main changes compared to the previous edition are as follows:

— hose assembly has been added in the text;

— a statement regarding change in length, as mentioned in Method C, has been added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

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

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

1 Scope

This document 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 size up to and including 80;

— method B for hoses of nominal size greater than 80;

— method C for hoses of all dimensions.

If not otherwise specified in the product standard, method C can be used as an alternative to methods A and B.

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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 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, while examining the hose for any signs of deformation or delamination of reinforcement or lining.

5 Apparatus

5.1 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 (or, if no product standard is applicable, the

pressure agreed between the parties) for the hose under test and maintaining it at that pressure for a minimum of 10 min.

5.2 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.

5.3 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, while allowing internal visual inspection of the hose during the test.

6 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.

7 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.

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

8 Test pressure

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

9 Procedures

9.1 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 (5.2) before assembling the hose and then connect the open end of the hose or hose assembly to a vacuum pump and gauge. Reduce the pressure in the hose or hose assembly 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 resulting irregularities, flaws or collapse and then tilt the hose to permit the solid ball to traverse the full length of the hose or hose assembly to check for any obstructions caused by internal deformation or delamination.

9.2 Method B

Lay out the hose or hose assembly as straight as possible on a flat surface and fit transparent airtight plates (5.3) to both ends of the hose or hose assembly, one of which shall then be connected to a vacuum pump and gauge. Reduce the pressure in the hose or hose assembly within 60 s to the required test pressure and maintain this pressure for the required period, which shall not be less than 10 min.

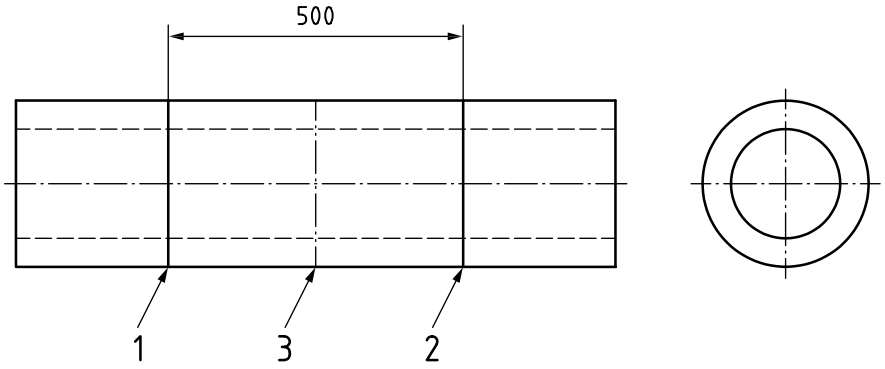
While the test pressure is being maintained, examine the interior of the hose or hose assembly through one of the transparent plates by means of illumination supplied through the transparent plate at the other end of the hose for signs of delamination or blistering of the lining. Also examine the exterior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

9.3 Method C

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

Before reducing the pressure in the hose or hose assembly, mark in accordance with ISO 1402.

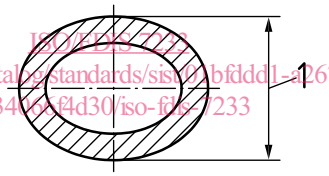
Dimensions in millimetres



Key

1 line A marked on test piece for measurement of change in length
2 line B marked on test piece for measurement of change in length
3 line C marked on test piece for measurement of change in outside diameter

Figure 1 — Marking measurement lines on test piece



Key

1 minor axis (D_2, D_3)

Figure 2 — Minor axis of a deformed test piece

Reduce the pressure in the hose or hose assembly 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 (see Figure 1), as well as the minor axis, D_2, (see Figure 2) 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 minor axis, D_3, round line C.

After releasing the pressure, examine the interior of the hose or hose assembly for signs of delamination or blistering of the lining. Also, examine the exterior of the hose or hose assembly for signs of resulting irregularities, flaws, or collapse.

The percentage change in the length of the hose or hose assembly, ΔL, before and after releasing the pressure is given by Formula (1) and Formula (2):

$$\Delta L_t = \left(\frac{L_2 - L_1}{L_1} \right) [\times 100\%] \quad (1)$$