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Rubber and plastics hoses — Assessment of ozone resistance under static conditions

Tuyaux en caoutchouc et en plastique — Évaluation de la résistance à l'ozone dans des conditions statiques

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Contents

Page

Foreword ... iv
Introduction ... v
1 Scope ... 1
2 Normative references ... 1
3 General considerations ... 1
4 Apparatus ... 2
5 Test pieces ... 2
5.1 Type of test piece ... 2
5.2 Number of test pieces ... 3
6 Conditioning of test pieces ... 3
7 Test conditions ... 3
8 Procedure ... 3
8.1 Method 1 ... 3
8.2 Method 2 ... 4
8.3 Method 3 ... 4
8.4 Method 4 ... 5
8.5 Method 5 ... 6
9 Test report ... 7

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 7326 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 7326:1991), which has been technically revised.

Introduction

The methods described in this International Standard provide a means of assessing the resistance of hoses to the deleterious effects of atmospheric ozone under static conditions.

Rubber and plastics hoses — Assessment of ozone resistance under static conditions

1 Scope

This International Standard specifies five methods for determining the ozone resistance of the outer covers of hoses:

— method 1, for bore sizes up to and including 25 mm, carried out on the hose itself;

— method 2, for bore sizes greater than 25 mm, carried out on a test piece from the hose wall;

— method 3, for bore sizes greater than 25 mm, carried out on a test piece from the cover;

— method 4, for all bore sizes, carried out on the hose itself;

— method 5, for all bore sizes, carried out on hoses that are expandable, for example textile-reinforced hoses.

NOTE For hoses with built-in fittings from which it is not possible to take test pieces, the ozone resistance may be assessed on slabs in accordance with ISO 1431-1, using test sheets of the appropriate polymeric compound vulcanized to the same degree.

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 1431-1:2004, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

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

3 General considerations

Methods 1 and 2 are the methods normally used, method 3 being for use only if it is not possible to carry out the test in accordance with method 2. Method 4 is suitable for all bore sizes. Method 5 is specifically for testing expandable hoses in the expanded state.

The results of tests carried out in accordance with method 1 may not be comparable with the results obtained when tests are carried out in accordance with method 2 or 3, even if the cover compounds of the hoses under test are identical in composition and are cured to the same degree. The test method to be used shall be as specified in the product standard.

4 Apparatus

All apparatus placed in the test cabinet shall be fabricated from materials which do not absorb or decompose ozone.

4.1 Ozone cabinet, with apparatus for generating ozone and monitoring and controlling the ozone concentration, as described in ISO 1431-1.

4.2 Test piece holder, as shown in Figure 1 (for method 1).

4.3 Test piece holder, as shown in Figure 2, made, for example, of wood coated with paint or aluminium (for method 2).

4.4 Jig, for elongation of test pieces (for method 3).

Details given in ISO 1431-1:2004, Subclause 5.6, shall be followed.

4.5 Cylinder, as shown in Figure 3, with an outside diameter eight times that of the hose being tested (for method 4).

4.6 Round rod, as shown in Figure 4, with an outside diameter 1,2 times the inside diameter of the hose being tested (for method 5).

5 Test pieces

5.1 Type of test piece

5.1.1 Method 1

The test piece shall consist of a hose sample. The length shall be calculated by the equation

$$L = \pi(r_b + d_{ext}) + 2d_{ext}$$

where

L is the length of the test piece;

r_b is the bend radius of the hose under test, as specified in 8.1.1;

d_{ext} is the outside diameter of the hose under test.

5.1.2 Method 2

The test piece shall consist of a strip cut longitudinally from the hose. The strip shall be 150 mm long and 25 mm wide.

5.1.3 Method 3

The test piece shall consist of a strip of the hose cover, 25 mm in width, removed longitudinally from the hose. Lightly buff the underside of the strip in accordance with ISO 23529 to remove any reinforcement impressions and thus ensure uniformity of strain along the length of the strip.

5.1.4 Method 4

The test piece shall consist of a hose sample long enough to be wound at least once round the cylinder which will be used for the test.

5.1.5 Method 5

The test piece shall consist of a straight length of hose approximately 50 mm long.

5.2 Number of test pieces

Three test pieces shall be tested.

6 Conditioning of test pieces

No test shall be carried out within 24 h of manufacture.

The time interval between manufacture and testing shall be as specified in ISO 23529. For evaluations which are intended to be comparable, the test shall, as far as possible, be carried out after the same time interval after manufacture.

The test pieces, mounted as described for the appropriate procedure, shall be conditioned for 48 h in a substantially ozone-free atmosphere at standard temperature (see ISO 23529), in darkness or subdued light.

7 Test conditions

Unless other conditions are specified in the relevant hose specification, the test pieces shall be exposed in the ozone cabinet to an ozone concentration of (50 ± 5) parts per hundred million (pphm) by volume at (40 ± 2) °C for $\left(72^{\ 0}_{-2}\right)$ h.

NOTE It has been found that differences in atmospheric pressure can influence ozone cracking when test pieces are exposed to constant ozone concentrations expressed in parts per hundred million. This effect may be taken into account by expressing the ozone content in the ozonized air in terms of the partial pressure, i.e. in millipascals, and making comparisons at constant ozone partial pressure. At standard conditions of atmospheric pressure and temperature (101 kPa, 273 K), a concentration of 1 pphm is equivalent to a partial pressure of 1,01 mPa.

8 Procedure

8.1 Method 1

8.1.1 Mount each test piece on a test piece holder (4.2), as shown in Figure 1. The radius, r_b, shall be equal to the specified minimum bend radius for the hose under test or, if not specified, six times the internal diameter.

8.1.2 Seal the ends of the test pieces with caps to prevent absorption of ozone by the inner lining and reinforcement.

8.1.3 After periods of exposure of 2 h, 4 h, 24 h, 48 h and 72 h, examine the test pieces, whilst still in the extended condition, under × 2 magnification, ignoring the area adjacent to the fixing points. If cracks are discovered, record their nature and the time at which they were first observed.