
**Rubber and plastics hoses — Methods of
exposure to laboratory light sources —
Determination of changes in colour,
appearance and other physical properties**

*Tuyaux en caoutchouc et en plastique — Méthodes d'exposition à des
sources lumineuses de laboratoire — Détermination du changement de
coloration, d'aspect et d'autres propriétés physiques*

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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

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 30013 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

It cancels and replaces ISO 8580:1987 and ISO 11758:1995, which have been combined and technically revised. It also cancels and replaces the Technical Corrigendum ISO 11758:1995/Cor.1:1998.

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Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies methods for the exposure of rubber and plastics hoses to three types of laboratory light source (xenon-arc, fluorescent UV and open-flame carbon-arc lamps).

These methods are designed to simulate the exposure of hoses used in an outdoor environment (exposure to xenon-arc lamps by method A, exposure to fluorescent UV lamps by method A and exposure to open-flame carbon-arc lamps with type 1 filters) or in an indoor environment (exposure to xenon-arc lamps by method B, exposure to fluorescent UV lamps by method B and exposure to open-flame carbon-arc lamps with type 2 filters).

Four types of test piece (two strained and two unstrained upon exposure) are specified. Results from the three light sources and the different sets of exposure conditions specified are not comparable.

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 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 4582, *Plastics — Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or laboratory light sources*

ISO 4665, *Rubber, vulcanized or thermoplastic — Resistance to weathering*

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 4892-2:—¹⁾, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 4892-3:2006, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

1) To be published (revision of ISO 4892-2:2006).

ISO 4892-4:2004, *Plastics — Methods of exposure to laboratory light sources — Part 4: Open-flame carbon-arc lamps*

ISO 7326:2006, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 7724-3²⁾, *Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences*

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 4665, ISO 4892-1 and ISO 8330 apply.

4 Principle

Test pieces are exposed to artificial laboratory light sources, and the resulting changes in colour, appearance and selected physical properties are determined for a simulated outdoor or indoor environment.

5 Test pieces

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5.1 Types of test piece

5.1.1 General

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Four types of test piece are detailed in Table 1. The type used shall be as specified in the product standard.

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Results obtained with the various types of test piece are not comparable, even for the same property.

Table 1 — Types of test piece

	Type 1	Type 2	Type 3	Type 4
Bore size, mm	≤25	>25	>25	Any size
Test piece	Sample of hose	Strip cut longitudinally from hose	Strip cut longitudinally from hose cover or hose	Sample of hose
Test piece size, ^a mm	$L = \pi(r_b + d/2) + 2d$	$L = 150, W = 25$	$L = 100, W = 25$	$L \approx 150$
Test piece mounting method	Mandrel (see Figure 1)	Holder (see Figure 2)	Holder (see Figure 3)	Holder (see Figure 4)
Test piece condition during exposure	Strained	Strained	Not strained	Not strained
Elongation	Bent for minimum bend radius	Required elongation of hose cover	Not elongated	Not elongated

NOTE Types 1 and 2 are tested under strain, types 3 and 4 are tested without strain.

^a W = width, L = length, r_b = minimum bend radius, d = hose outside diameter.

2) Users should note that ISO 7724-3 will be withdrawn at some time in the future. It will be replaced by ISO 11664-4.

5.1.2 Type 1

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

$$L = \pi \left(r_b + \frac{d}{2} \right) + 2d$$

where

L is the length, in mm, of the test piece;

r_b is the minimum bend radius, in mm, of the hose under test;

d is the outside diameter, in mm, of the hose under test.

Mount the test piece in a test piece holder 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 this is not specified, six times the inside diameter.

5.1.3 Type 2

The test piece shall consist of a strip cut longitudinally from a hose. The strip shall be 150 mm in length and 25 mm in width.

Mount the test piece in a test piece holder as shown in Figure 2, in such a way that the convex side will be exposed to the light during the exposure.

For details of the mounting of the test piece, see method 2 in ISO 7326:2006.

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5.1.4 Type 3

The test piece shall normally consist of a strip of hose cover, cut longitudinally from the hose.

The strip shall be 100 mm in length and 25 mm in width.

If a hose cover test piece cannot easily be cut from the hose, the test piece shall consist of a strip cut longitudinally from the complete hose with its cover in place. The strip shall be 100 mm in length and 25 mm in width.

Mount the test piece in a test piece holder as shown in Figure 3, in such a way that the convex side will be exposed to the light during the exposure.

5.1.5 Type 4

The test piece shall consist of a sample of hose approximately 150 mm in length. If possible, test pieces shall be cut from different sections of the hose (e.g. from each end and from the middle).

Mount each test piece in a test piece holder as shown in Figure 4, ensuring that it is not subject to any stress but curves naturally in such a way that the convex side will be exposed to the light during the exposure.

5.2 Conditioning

Prior to testing, condition the test pieces, mounted as described in 7.2, under the applicable standard conditions as specified in ISO 23529 or ISO 291, as appropriate, in darkness or subdued light.

5.3 Number of test pieces

At least three test pieces shall be exposed to laboratory light sources, and at least one piece shall be kept in darkness as a control in order to permit the evaluation of the change in colour, appearance and physical properties. The total number of test pieces will therefore be at least four.

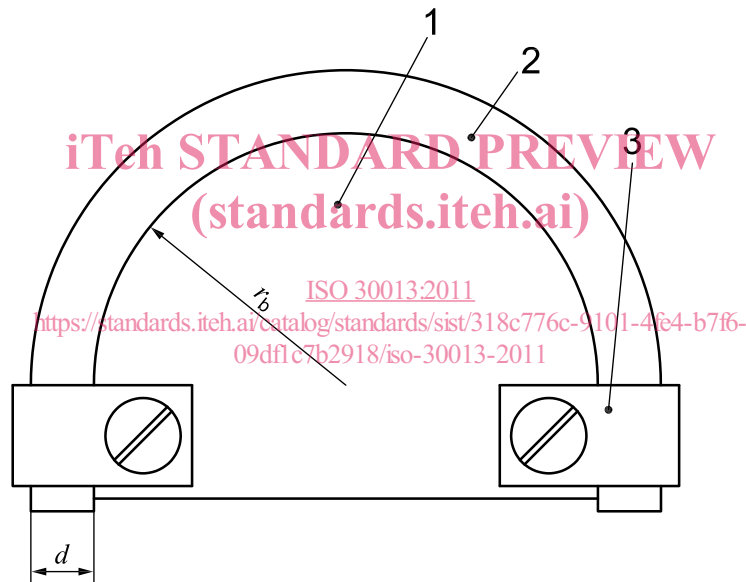
5.4 Test piece holders

The test piece holders may be used in each type of test piece. The holder shall be constructed with inert materials that do not affect the results, e.g. aluminium or stainless steel. They are also designed to support the back of the test piece. Brass, steel and copper shall not be used near to the test piece.

5.5 Radiation direction and radiation surface

Test pieces shall be attached to the appropriate holder shown in Figure 1 to Figure 4. Place the holder with the test piece in the exposure area using holder or mounting hardware appropriate to the type and model of exposure device being used (see Figure 6).

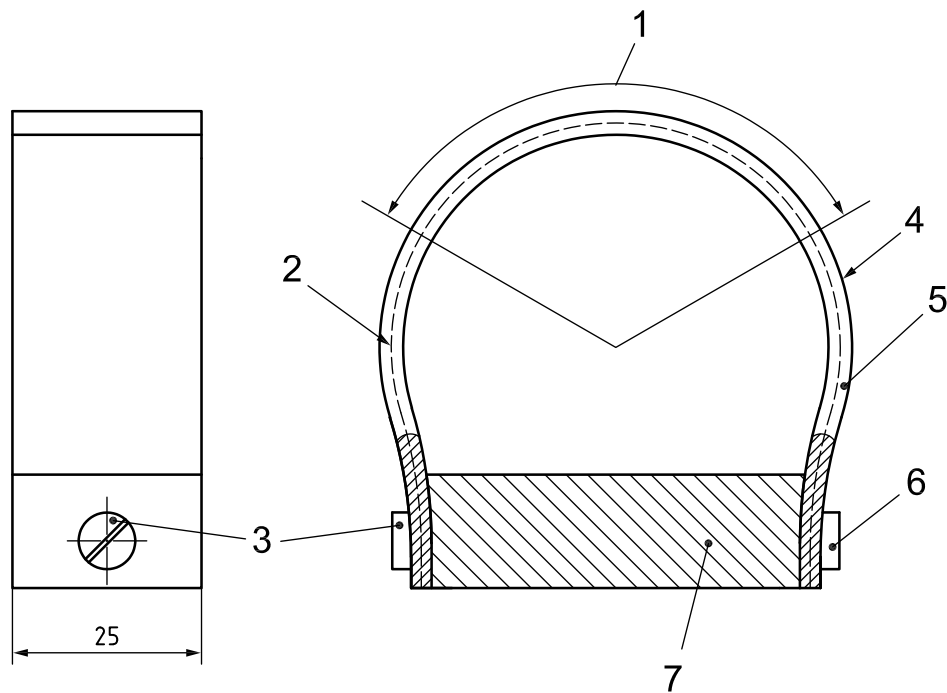
The direction of the radiation and the surface of the test piece which is irradiated are shown in Figure 5.



- Key**
- d hose outside diameter
 - r_b bend radius
 - 1 mandrel
 - 2 test piece
 - 3 retaining clamp

Figure 1 — Arrangement for mounting a type 1 test piece on a mandrel

Dimensions in millimetres

**Key**

- 1 measurement distance (20 mm)
- 2 hose reinforcement
- 3 retaining bolt
- 4 outside surface of hose
- 5 test piece
- 6 grip
- 7 holder, made of stainless steel or aluminium

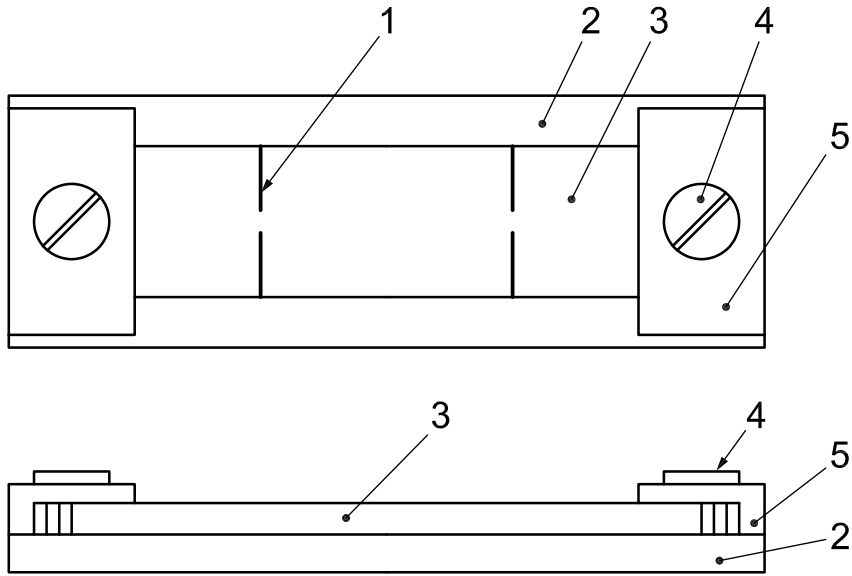
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NOTE End-to-end length of test piece is 150 mm.

Figure 2 — Holder for type 2 test piece

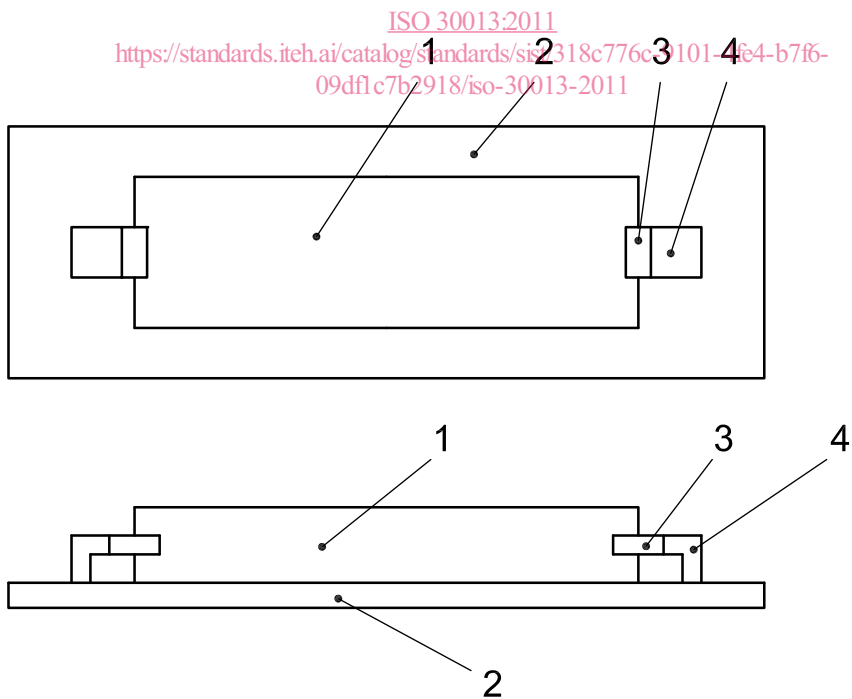


Key

- 1 mark for extension measurement
- 2 holder, made of stainless steel or aluminium
- 3 test piece
- 4 retaining bolt
- 5 clamp

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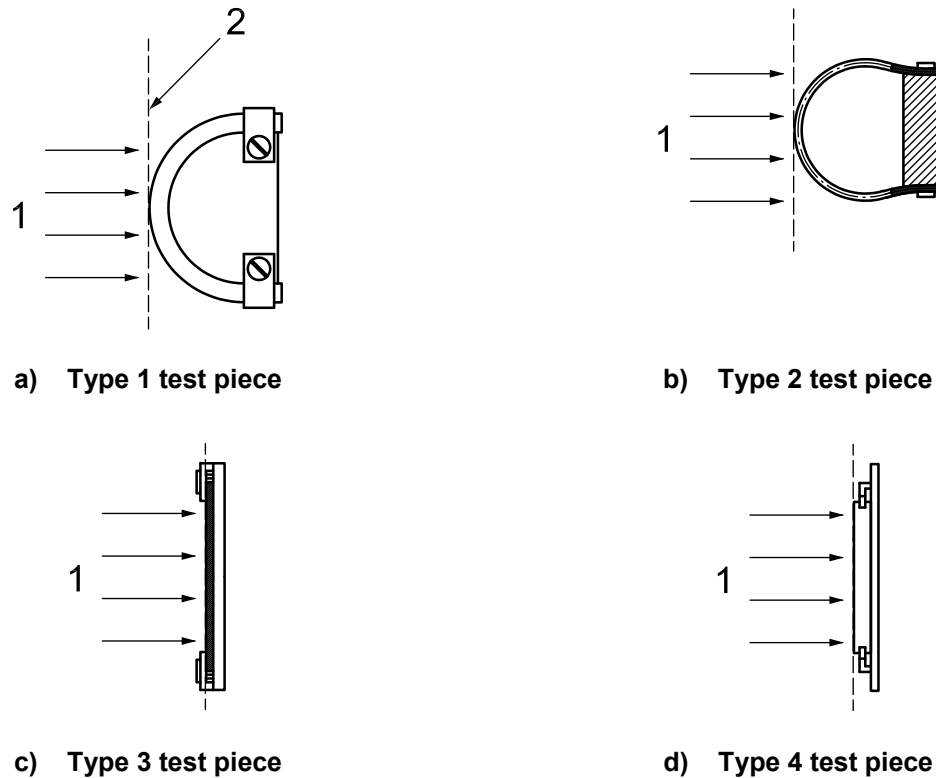
Figure 3 — Holder for type 3 test piece



Key

- 1 test piece
- 2 holder, made of stainless steel or aluminium
- 3 clip
- 4 clamp

Figure 4 — Holder for type 4 test piece

**Key**

- 1 light source
2 exposed surface closest to light source

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Figure 5 — Radiation direction and exposed surface closest to the light source
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6 Light sources and exposure cycles**6.1 General**

The test piece shall be exposed to the light source (see 6.2, 6.3 and 6.4) specified in the product standard, using the method and cycle No. specified in the product standard.

6.2 Xenon-arc lamps**6.2.1 Apparatus**

The apparatus used shall be in accordance with Clause 4 of ISO 4892-2:—.

6.2.2 Exposure conditions (exposure cycles)**6.2.2.1 General**

The exposure conditions (exposure cycles) available are listed in Table 2 for the case when a black-standard thermometer (BST) is used and Table 3 for the case when a black-panel thermometer (BPT) is used. The cycle used shall be as stated in the product standard. If no exposure cycle is stated, use cycle 1 or 2 with a BST and cycle 5 or 6 with a BPT (i.e. method A).

If other exposure cycles are required, refer to Tables 3, 4, B.1 and B.2 in ISO 4892-2:—.