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# Rubber hoses and hose assemblies for saturated steam — Specification

*Tuyaux et flexibles en caoutchouc pour vapeur saturée — Spécification*



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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.

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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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 fourth edition cancels and replaces the third edition (ISO 6134:2005), which has been technically revised to update Clause 2.

 

# Rubber hoses and hose assemblies for saturated steam — Specification

## 1 Scope

This document specifies requirements for two types of hoses and hose assemblies, low pressure with a maximum working pressure of 6 bar and high pressure with a maximum working pressure of 18 bar, made of rubber and hose fittings made of metal, designed to convey saturated steam and hot water condensate.

Each type is divided into two classes having either an oil resistant or non-oil resistant cover.

NOTE Information on the frequency of testing of hose assemblies in use and storage is given in Annex A and Annex B.

## 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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*



ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 4023:2009, *Rubber hoses and hose assemblies for steam — Test methods*

ISO 4649:2010, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

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

ISO 8031:2009, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

ISO 8033, *Rubber and plastics hoses — Determination of adhesion between components*

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

ISO 10619-1:2011, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

## 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:

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

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

## 4 General requirements

Quick-release coupling shall not be used under any circumstances.

The end fittings used with the hose shall be of a type that provides for tightening-up during service; for example, a clamp type to compensate for creep of the rubber compounds in the hose.

NOTE 1 Where superheated steam conditions occur, the service life of the product can be reduced.

NOTE 2 Vacuum caused by shutting off the hose assembly at both ends can precipitate "pop-corning" or separation of the lining.

## 5 Classification

This document specifies two types of hoses/hose assemblies to convey saturated steam and hot water condensate.

Type 1: low-pressure steam hose, maximum working pressure 6 bar, corresponding to a temperature of 164 °C.

Type 2: high pressure steam hose, maximum working pressure 18 bar, corresponding to a temperature of 210 °C.

NOTE 1 bar = 0,1 MPa.



Each type of hose is divided into either of the following:

— Class A: a non-oil-resistant cover;

— Class B: an oil-resistant cover.



Both types and classes can be either of the following:

a) electrically bonded, marked "M" (see Clause 11);

b) electrically conductive, marked "Ω" (see Clause 11).

## 6 Materials and construction

Hoses shall consist of a lining which is resistant to steam and hot water condensate and shall be uniform in quality, free of porosity, air holes, foreign inclusions and other defects.

The reinforcement shall be textile for Type 1 and steel wire for Type 2, either braided, spiral or cord ply construction.

The cover shall give protection against mechanical damage and be resistant to heat, wear and environmental effects due to weather and short-term chemical exposure. It shall be pricked equally around the periphery and along the whole length of the hose in order to relieve any pressure built-up between the plies and the cover.

## 7 Dimensions and tolerances

### 7.1 Diameters, thickness of lining and cover, and bend radii

When determined in accordance with ISO 4671, the diameters, thickness of lining and cover, and the bend radii of the hoses shall conform to the values given in Table 1.

 

**Table 1 — Diameters, thickness and bend radii**

Dimensions in millimetres

| Internal diameter | | Outside diameter | | Thickness min. | | Bend radius min. |
|---|---|---|---|---|---|---|
| | Deviation limits | | Deviation limits | Lining | Cover | |
| 9,5 | ±0,5 | 21,5 | ±1,0 | 2,0 | 1,5 | 120 |
| 13 | ±0,5 | 25 | ±1,0 | 2,5 | 1,5 | 130 |
| 16 | ±0,5 | 30 | ±1,0 | 2,5 | 1,5 | 160 |
| 19 | ±0,5 | 33 | ±1,0 | 2,5 | 1,5 | 190 |
| 25 | ±0,5 | 40 | ±1,0 | 2,5 | 1,5 | 250 |
| 32 | ±0,5 | 48 | ±1,0 | 2,5 | 1,5 | 320 |
| 38 | ±0,5 | 54 | ±1,2 | 2,5 | 1,5 | 380 |
| 45 | ±0,7 | 61 | ±1,2 | 2,5 | 1,5 | 450 |
| 50 | ±0,7 | 68 | ±1,4 | 2,5 | 1,5 | 500 |
| 51 | ±0,7 | 69 | ±1,4 | 2,5 | 1,5 | 500 |
| 63 | ±0,8 | 81 | ±1,6 | 2,5 | 1,5 | 630 |
| 75 | ±0,8 | 93 | ±1,6 | 2,5 | 1,5 | 750 |
| 76 | ±0,8 | 94 | ±1,6 | 2,5 | 1,5 | 750 |
| 100 | ±0,8 | 120 | ±1,6 | 2,5 | 1,5 | 1 000 |
| 102 | ±0,8 | 122 | ±1,6 | 2,5 | 1,5 | 1 000 |



### 7.2 Length of hoses and hose assemblies and tolerances

The length of the hose assembly is the overall measured distance from the sealing surfaces of the couplings from end to end.



The deviation limits of the hoses and hose assemblies shall be as follows:

— $l \leq 1\,000$ mm: ±10 mm;

— $l > 1\,000$ mm: ±1 %.

### 7.3 Concentricity

When determined in accordance with ISO 4671, the concentricity of the hose wall shall not exceed 1,0 mm for internal diameter hoses up to and including 51 mm and 1,5 mm for sizes above.

## 8 Physical properties of compounds

Tests shall be carried out on test sheets of 2,0 mm minimum thickness of equivalent cure to that of the hoses.

The physical properties of compounds shall conform to the values given in Table 2.

The recommended frequency of testing is illustrated in Table D.1.

**Table 2 — Physical properties of compounds**

| Property | Unit | Requirements | | Method of test |
|---|---|---|---|---|
| | | Lining | Cover | |
| Tensile strength, min. | MPa | 8 | 8 | ISO 37 (dumb-bell test piece) |
| Elongation at break, min. | % | 200 | 200 | ISO 37 (dumb-bell test piece) |
| Ageing<br>— tensile strength change, max.<br>— elongation at break change, max. | <br>%<br>% | <br>50<br>50 | <br>50<br>50 | ISO 188 (7 days at 125 °C for Type 1 and 150 °C for Type 2, air oven method) |
| Abrasion resistance<br>— black filled compound, max.<br>— non-black filled compound, max. coloured | <br>$mm^3$<br>$mm^3$ | <br>—<br>— | <br>200<br>400 | ISO 4649:2010, method A |
| Change in volume, max. (class B only) | % | — | 100 | ISO 1817, oil No. 3, 72 h at 100 °C |

## 9 Physical properties of finished hoses and hose assemblies

The physical properties of finished hoses and hose assemblies shall conform to the values given in Table 3.

The minimum frequency of testing shall be in accordance with Clause 14.



**Table 3 — Physical properties of finished hoses and hose assemblies**

| Property | Unit | Requirements | Method of test |
|---|---|---|---|
| **Hoses** | | | |
| Burst pressure, min. | | 10× the max. working pressure | ISO 1402 |
| Proof test pressure | — | No leakage or distortion at 5× the max. working pressure | ISO 1402 |
| Adhesion between components, min. | kN/m | 2,4 | ISO 8033 |
| Bending test, (under no pressure), min. | T/D | 0,8 | ISO 10619-1:2011, method C1 |
| Change in length, at proof test pressure | % | −3 to +8 | ISO 1402 |
| Change in twist, max. at proof test pressure | °/m | 10 | ISO 1402 |
| Ozone resistance of the cover | — | No cracking observed under ×2 magnification | ISO 7326:2006; method 3, relative humidity (55 ± 10) %, ozone concentration (50 ± 5) × $10^{-9}$, elongation 20 %, temperature 40 °C |
| **Hose assemblies** | | | |
| Proof test pressure | — | No leakage or distortion at 5 × the max. working pressure | ISO 1402 |
| Electrical resistance | Ω<br>Ω<br>Ω | ≤ $10^2$ /assembly for M-type<br>≤$10^6$ /assembly and<br>≤$10^9$ resistance between lining and cover for Ω-type | ISO 8031:2009, method 4<br>ISO 8031:2009, method 3.4, 3.5 or 3.6 |
| Short-term steam test | — | Clause 10 | Clause 10 |
| Long term steam test | — | Clause 10 | Clause 10 |

# 10 Resistance to steam

## 10.1 Principle

Expose a hose assembly to a flow of saturated steam in accordance with the method described in ISO 4023:2009, method B.

The steam pressure for testing Type 1 hose/hoses assembly shall be 6 bar and shall be 18 bar for Type 2 hose/hoses assembly.

## 10.2 Short-term exposure

The number of cycles of 20 h steam on and 4 h steam off shall be seven, i.e. a period of 168 h.

After this exposure, the change in any physical properties shall not exceed the values given in Table 4.

**Table 4 — Permissible changes in properties after the short-term test**

| Property | Type 1 | Type 2 |
|---|---|---|
| Maximum reduction in actual burst pressure, in % | 25 | 10 |
| Maximum reduction in lining elongation at break, in % | 50 | 50 |
| Minimum elongation at break of lining, in % | 150 | 150 |
| Maximum lining hardness increase, in IRHD | 10 | 10 |



## 10.3 Long term test

The number of cycles of 20 h steam on and 4 h steam off shall be 30, i.e. a period of 720 h.



## 10.4 Observations

During either exposure, there shall be no leakage of steam through the hose wall. Following the test the lining shall not be cracked, blistered or pop-corned and the cover shall not be cracked or blistered.

## 10.5 Additional tests

On completion of either the short-term test or the long term test at room temperature, bend the test piece through 180° for sizes up to and including 32 mm and 90° for sizes over 32 mm, four times over a mandrel of the appropriate radius given in Table 1.

Rotate the test piece through 90° between each bending operation.

After completion of the test, there shall be no cracks in the bent position.

Measure the electrical resistance which shall not be greater than the values given in Table 3.

For safety requirements, the electrical properties shall be measured after the bending procedure in both the 168 h and 720 h steam test.

# 11 Electrical resistance

The resistance between the hose couplings shall not exceed the value of $1 \times 10^6$ Ω.

This low electrical resistance of hose and hose assemblies can be obtained by two methods.

a) Incorporating two low resistance bonding wires into the hose construction.

   These shall be spirally applied and shall be positioned in such a way to cross uniformly.