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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

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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 document 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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 218, *Rubber and plastics hoses and hose assemblies,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fifth edition cancels and replaces the fourth edition (ISO 6134:2017), which has been technically revised.

The main changes are as follows:

— normative references have been updated;

— methods used for bending have been corrected in accordance with ISO 10619-1;

— methods used for measuring electrical properties have been corrected in accordance with ISO 8031.

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.

Rubber hoses and hose assemblies for saturated steam — Specification

1 Scope

This document specifies requirements for hoses and hose assemblies made of rubber and hose fittings made of metal, which are designed to convey saturated steam and hot water condensate.

This document applies to the following two types of hoses and hose assemblies:

— low pressure, with a maximum working pressure of 0,6 MPa (6 bar);

— high pressure, with a maximum working pressure of 1,8 MPa (18 bar).

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

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 4649:2017, *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 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8031:2020, *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 10619-1:2017, *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:

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

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

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 allows tightening adjustment onto the hose; for example, a clamp type to compensate for creep of the rubber compounds in the hose.

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

CAUTION 2 Vacuum caused by shutting off the hose assembly at both ends can precipitate "popcorning" or separation of the lining.

5 Classification

This document specifies the following two types of hoses and hose assemblies to convey saturated steam and hot water condensate:

— Type 1 is a low-pressure steam hose with a maximum working pressure of 0,6 MPa (6 bar), corresponding to a temperature of 164 °C;

— Type 2 is a high-pressure steam hose with a maximum working pressure of 1,8 MPa (18 bar), corresponding to a temperature of 210 °C.

Each type of hose is further 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.

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

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

Hoses shall be uniform in quality, free of porosity, air holes, foreign inclusions and other defects.

7 Dimensions and tolerances

7.1 Diameters, thickness of lining and cover and bend radii

The diameters, thickness of lining and cover, and the minimum bend radius of the hoses shall be determined in accordance with ISO 4671 and as such shall conform to the values given in Table 1.

Table 1 — Diameters, thickness and minimum bend radius

Dimensions in millimetres

Inside diameter		Outside diameter		Thickness min.		Minimum bend radius
Diameter	Tolerance	Diameter	Tolerance	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 of the sealing surfaces of the couplings from end to end.

The tolerances for the length of hoses and hose assemblies shall be as follows:

— $l \leq 1\,000$ mm: ±10 mm;

— $l > 1\,000$ mm: ±1 %.

7.3 Concentricity

The concentricity of the hose wall shall be determined in accordance with ISO 4671 and as such shall not exceed 1,0 mm for hoses with inside diameters 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.

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 — tensile strength change, max. — elongation at break change, max.	 % %	 50 50	 50 50	ISO 188 (7 days at 125 °C for Type 1 and 150 °C for Type 2, air oven method)
Abrasion resistance — black filled compound, max. — non-black filled compound, max. coloured	 mm^3 mm^3	 — —	 200 400	ISO 4649:2017, 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 10619-1:2017, Method A1 for sizes up to 80 mm I.D. Method B for sizes up to 102 mm I.D.
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 7326:2016; Method 3, relative humidity (55 ± 10) %, ozone concentration (50 ± 5) pphm 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 Ω Ω	≤10^2 /assembly for M-type ≤10^6 /assembly and ≤10^9 resistance between lining and cover for Ω-type	ISO 8031:2020, Method 5. ISO 8031:2020, Method 4
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 ISO 4023:2009, Method B.

The steam pressure for testing shall be:

— 0,6 MPa (6 bar) for Type 1 hoses and hose assemblies;

— 1,8 MPa (18 bar) for Type 2 hoses and hose assemblies.

10.2 Short-term exposure

There shall be seven cycles each of 20 h of steam on and 4 h of steam off, consisting of 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

There shall be 30 cycles each of 20 h of steam on and 4 h of steam off, consisting of 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 "popcorned" and the cover shall not be cracked or blistered.

10.5 Additional tests

On completion of either the short-term or the long-term test, once 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 tests.

11 Electrical resistance

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

This low electrical resistance of hose and hose assemblies may be obtained by either of the following two methods.

a) The first method involves incorporating two low resistance bonding wires into the hose construction.

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

   When attaching fittings to this hose, the bonding wires shall be folded into the hose bore, positioned between the lining and the male part of the fitting and extending by approximately one third of the length of the male part of the fitting into the bore.

   The resistance along the bonding wires in the case of hose or the resistance between fittings in the case of hose assemblies, shall be determined in accordance with ISO 8031 and shall not exceed 1×10^2 Ω per length.

   When obtaining electrical continuity by this method, the hose shall be marked with the symbol "M".

b) The second method involves incorporating electrically conducting elastomers.

   When attaching fittings to this hose, a connection between the end fittings and the conductive compound shall be obtained.

   The resistance along the conductive non-metallic material in the case of hoses or the resistance between the fittings in the case of hose assemblies shall be determined in accordance with ISO 8031 and shall be equal to or less than 1×10^6 Ω per length and the resistance between lining and cover shall not exceed 1×10^9 Ω.

   When obtaining electrical resistance by this method, the hose shall be marked with the symbol "Ω".

12 Type testing

Type testing shall be performed in order to confirm that all the material construction and the requirements of this document have been met by the method of manufacture and hose design. Type tests shall be carried out every five years at a minimum, or whenever a change of manufacture, design or material occurs. Type tests shall be conducted on the largest size of each design in the manufacturer's range.

13 Marking

13.1 Hoses

All hoses shall be continuously marked by relief embossing or branding, which is clearly legible and permanent in medium spaced bold lettering, with a letter height of at least 5 mm.

Unless otherwise agreed, the length of the identification shall not exceed 500 mm.

At least the following information shall be marked:

a) the manufacturer's name or identification;

b) designation of this document, i.e. ISO 6134;

c) type and class;

d) steam;

e) maximum working pressure, in MPa and in bar with the unit indicated, and max. temperature in °C, e.g. 1,8 MPa (18 bar) to 210 °C;

f) inside diameter (i.e. 19);

g) symbol to identify electrical conductivity (Ω or M);

h) at least the quarter and year of manufacture (i.e. 3Q-23).

EXAMPLE XXXX – ISO 6134 – 2A – steam – 1,8 MPa (18 bar) – 210 °C – 19 – Ω – 3Q-23.

Regarding 13.1 b), the hose manufacturer shall use the latest publication of this document, otherwise the year of the publication of the standard used shall be included in the marking.

13.2 Hose couplings

The couplings shall be permanently marked with the following information:

a) name or identification of the manufacturer or assembler;

b) inside diameter;

c) wall thickness or outside diameter;

d) maximum working pressure.

13.3 Identification of hose assemblies

Before using for the first time, hose assemblies shall have two stainless steel identification bands in addition to the marking specified in 13.1 and 13.2. These bands shall be fixed onto the hose assembly close to the end fitting so that they remain captive.

Identification details shall be marked legibly and durably by, for example, engraving. The identification bands are generally affixed by the operator.

Band 1 shall remain permanently in position on the hose assembly.

Once routine tests have been carried out on hose assemblies in use, Band 2 shall be removed and replaced by a new band bearing the identification details stated for Band 2.

Band 1

Band 1 shall be marked with the following information:

a) operator's registration number (in order to identify the hose assembly and operator's no., i.e. building no.);

b) admissible working pressure, in MPa and in bar, with the unit indicated, i.e. 1,8 MPa (18 bar);

c) admissible working temperature, i.e. 210 °C;

d) symbol Ω or M (to identify electrical resistance of hose);

e) steam.

EXAMPLE No. XXXX – 1,8 MPa (18 bar) – 210 °C – Ω – steam.

Band 2

Band 2 shall be marked with the following information:

a) test laboratory (or, if this is not able to be ascertained, then with a document's registration number);

b) date of assembling or date of testing;

c) date of follow-up testing (month and year, i.e. 05-03).

EXAMPLE XXXX – tested on 30-11-99 – Follow-up testing 05–03.

14 Frequency of testing

The requirements regarding type and routine tests specified in Annex B shall apply.

Type tests shall be carried out in order to confirm that the product meets all requirements of this document.

Routine tests shall be carried out on all hose assemblies prior to dispatch.

See also Annex A.

15 Storage and admissible storage time

The requirements for storing hoses and hose assemblies can be found in ISO 8331.

Once hoses and hose assemblies have been stored for three years with effect from the date of manufacture or from the last test, they should be subjected to further routine tests in accordance with Clause 14 before use.