



**International
Standard**

ISO 4641

**Rubber hoses and hose assemblies
for water suction and discharge —
Specification**

*Tuyaux et flexibles en caoutchouc pour aspiration et refoulement
d'eau — Spécifications*

**Sixth edition
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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 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 sixth edition cancels and replaces the fifth edition (ISO 4641:2016), which has been technically revised.

The main changes are as follows:

- publication dates of normative references ISO 7233 and ISO 10619-2 have been updated ([Clause 2](#));
- re-writing the rubber properties limited to [Table 1](#);
- marking of the hose and assembly has been updated ([Clause 10](#));
- test requirements have been updated in [Annexes A](#) and [B](#).

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 water suction and discharge — Specification

1 Scope

This document specifies the minimum requirements for textile-reinforced, smooth-bore rubber water-suction and discharge hoses and hose assemblies.

Three types of hoses and hose assemblies are specified according to their operating duty requirements, i.e. their ambient and water temperature ranges:

- ambient temperatures: $-25\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$;
- water temperatures during operation: $0\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$.

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 1307, *Rubber and plastics hoses — Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses*

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

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

ISO 7233:2021, *Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum*

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

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

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

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

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

ISO 10619-2:2021, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

3 Terms and definitions

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

ISO and IEC maintain terminology 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 Classification

Hoses and hose assemblies for this application are classified into three types according to their operating duty requirements:

- Type 1: light-duty hoses for suction service to $-0,063$ MPa ($-0,63$ bar) and for discharge pressures up to $0,3$ MPa (3 bar);
- Type 2: medium-duty hoses for suction service to $-0,08$ MPa ($-0,8$ bar) and for discharge pressures up to $0,5$ MPa (5 bar);
- Type 3: heavy-duty hoses for suction service to $-0,097$ MPa ($-0,97$ bar) and for discharge pressures up to $1,0$ MPa (10 bar).

5 Coupling and fittings

Hoses shall be fitted with end fittings/couplings to form hose assemblies. [Annex C](#) lists types of coupling and end fitting.

6 Materials and construction

6.1 Lining

The lining shall consist of suitably compounded water-resistant natural or synthetic rubber. Its internal surface shall be smooth and free from imperfections which could impair the expected use.

6.2 Reinforcement

The reinforcement shall consist of a suitable textile material and may contain a helix that can be composed of metallic wire or of another suitable material.

6.3 Cover

The cover shall consist of suitably compounded natural or synthetic rubber. Its external surface may be corrugated or fluted. An external helix is optional and can be either composed of metallic wire or of another suitable material.

7 Dimensions and tolerances

7.1 Inside diameter

The nominal size range is 16 to 315 with inside diameters and tolerances in millimetres as shown in [Table 3](#).

7.2 Enlarged ends

Where enlarged ends are required, the dimensions and tolerances shall be specified by agreement between the purchaser and the manufacturer. The design of the enlarged end shall take into account the hose performance requirements.

7.3 Unit lengths

The unit lengths shall be determined according to the conditions of use as specified by the purchaser. The tolerances of the hose, unless otherwise agreed between the purchaser and the manufacturer, shall be those specified in ISO 1307.

7.4 Lining

When measured in accordance with ISO 4671, the minimum thickness of the lining shall be 1,5 mm. See [Table 4](#).

7.5 Cover

When measured in accordance with ISO 4671, the minimum thickness of the cover shall be 2 mm. If the cover is fluted, the depth of the flutes shall be not greater than 50 % of the cover thickness. See [Table 4](#).

8 Physical properties

8.1 Rubber compounds

When determined by the methods listed in [Table 1](#), the physical properties of the compounds used for the lining and cover shall conform to the values specified in [Table 1](#).

Tests shall be carried out either on samples taken from the hose or from separately vulcanized sheets, 2 mm in thickness and vulcanized to the same cure state as the production hoses.

Table 1 — Physical properties of rubber compounds

Property	Unit	Requirements		Method of test
		Lining	Cover	
Tensile strength, min.	MPa	7	7	ISO 37 (dumb-bell test piece)
Elongation at break, min.	%	200	200	ISO 37 (dumb-bell test piece)
Resistance to ageing				ISO 188 (3 days at 100 °C ± 1 °C) air-over method; ISO 37 (dumb-bell test piece)
Change in tensile strength from original value (max.)	%	±25	±25	
Change in elongation at break from original value (max.)	%	±50	±50	

8.2 Performance requirements for hoses and hose assemblies

8.2.1 Hydrostatic-pressure requirements (proof pressure test)

The proof pressure test shall be carried out on full lengths of finished hose and on hose assemblies. When tested in accordance with ISO 1402, the hose (and the hose assembly) shall meet the requirements of [Table 2](#). The maximum variation in length and outside diameter at maximum working pressure shall be ±7 %, and the hose/hose assembly shall not burst or fail by showing signs of leakage, cracking, abrupt distortion indicating irregularities in material or manufacture or other signs of failure. See [Table 4](#).

Table 2 — Hydrostatic-pressure requirements

Hose type	Maximum working pressure		Proof pressure		Minimum burst pressure	
	MPa	Bar	MPa	Bar	MPa	Bar
1	0,3	3	0,5	5	1,0	10
2	0,5	5	0,8	8	1,6	16
3	1,0	10	1,5	15	3,0	30

8.2.2 Burst test

When tested by the method specified in ISO 1402, hoses shall meet the requirements of [Table 2](#).

8.2.3 Resistance to bending (minimum bend radius as a function of nominal size)

When subjected to the minimum bend radii given in [Table 3](#), in accordance with one of the methods specified in ISO 10619-1 (the method chosen to be the most appropriate one for the size of hose), hoses shall show no kinking, breaking or peeling under visual examination. The value of T/D shall not be lower than 0,95.

Table 3 — Nominal sizes, tolerances and minimum bend radii

Nominal size	Inside diameter mm		Minimum bend radius mm
	min.	max.	
16	15,4	16,6	50
19	18,5	19,7	55
20	19,4	20,6	60
25	24,2	26,2	75
31,5	30,5	33,0	95
38	37,1	39,1	115
40	39,0	41,0	120
50	48,8	51,2	150
51	49,6	52,0	155
63	61,8	64,7	250
76	74,8	77,6	305
80	78,6	81,4	320
90	88,6	91,4	450
100	98,4	103,2	500
125	123,4	126,6	750
150	148,0	152,0	960
160	158,0	162,0	980
200	197,5	202,5	1 200
250	247,0	253,0	1 500
305	301,8	307,8	1 840
315	312,0	318,0	1 900

8.2.4 Resistance to suction flattening

The test shall be carried out in accordance with ISO 7233. The test conditions shall be as follows:

- −0,063 MPa (−0,63 bar) for type 1;
- −0,08 MPa (−0,80 bar) for type 2;

— -0,097 MPa (-0,97 bar) for type 3.

Duration of test: 10 min.

For hoses of nominal inside diameter greater than 80 mm (ISO 7233:2021, Method C), the measured collapse shall not exceed 5 % of the nominal inside diameter.

8.2.5 Low-temperature flexibility

When tested at -25 °C in accordance with ISO 10619-2:2021, Method B for nominal sizes up to and including 100 mm and Method C for nominal sizes over 100 mm, with the exception of measuring the stiffness, all types of hose shall be free of cracks and shall pass the proof pressure test as specified in [8.2.1](#).

8.2.6 Adhesion

When determined in accordance with ISO 8033, the adhesion between the various components (except the helix, when included in the construction of the hose wall) shall not be <2 kN/m. See [Table 4](#).

8.2.7 Ozone resistance of the cover

When tested in accordance with ISO 7326:2016, Method 2, all types of hose shall be free of cracks. See [Table 4](#).

Table 4 — Performance requirements for finished hoses and hose assemblies

Property	Unit	Requirement	Method of test
Hose dimensions			
Inside diameter	mm	See Table 3	ISO 4671
Cover thickness	mm	Minimum 2	ISO 4671
Lining thickness	mm	Minimum 1,5	ISO 4671
Length tolerance	%	See ISO 1307:2006, Table 2	ISO 4671
Hose/hose assembly tests			
Proof pressure	MPa (bar)	See 8.2.1 and Table 2	ISO 1402
Variation in length at max. working pressure	%	-7 to +7	ISO 1402
Variation in outside diameter at max. working pressure	%	-7 to +7	ISO 4671
Burst pressure (min.)	MPa (bar)	See 8.2.2 and Table 2	ISO 1402
Vacuum test	MPa (bar)	See 8.2.4	ISO 7233
Resistance to bending	—	See 8.2.3 and Table 3	ISO 10619-1
Low-temperature flexibility	—	See 8.2.5	ISO 10619-2:2021, Method B
Adhesion between components	kN/m	Minimum 2	ISO 8033
Ozone resistance (cover)	—	No cracking observed at 0 magnification	ISO 7326:2016, Method 2

9 Frequency of testing

Type and routine testing shall be as specified in [Annex A](#).

Type testing is carried out in order to confirm that all the material, construction and test requirements specified in this document have been met by the method of manufacture and the hose design. Type testing shall be repeated at intervals of, at the most, five years or whenever a change in the method of manufacture or the materials occurs and shall be performed on the largest-diameter hose of each design in the manufacturer's range for each type.

Routine tests are those tests carried out on each length of finished hose or hose assembly.

Production acceptance tests are those tests carried out per batch or per 10 batches, by the manufacturer to monitor the quality of his production (see the schedule given in [Annex B](#), which is for guidance only).

10 Marking

10.1 Hoses

The hose shall be indelibly and legibly marked, at intervals of not more than 1 m on the outer cover, with at least the following information:

- a) the manufacturer's name or identification (e.g. XXX);
- b) the number of this document, i.e. ISO 4641;
- c) the hose classification, i.e. the type;
- d) the nominal size (e.g. 250);
- e) the maximum working pressure, in MPa and in bars, or in either with the units indicated, e.g. 1 MPa (10 bar);
- f) the quarter and year of manufacture (e.g. 4Q22).

EXAMPLE XXX/ISO 4641/Type 3/250/1 MPa (10 bar)/4Q22

For [10.1 b\)](#), the hose manufacturer shall use the latest publication of this document, otherwise the year of publication shall be included in the marking.

10.2 Hose assemblies

The couplings/end fittings shall be permanently marked with the following minimum information:

- a) the name or identification of the producer/assembler of the hose assembly;
- b) the maximum working pressure of the assembly, in MPa and in bars, or in either with the units indicated, e.g. 1 MPa (10 bar);
- c) two digits indicating the month of assembly followed by a slash and the last two digits of the year of assembly (e.g. 12/16);
- d) the name or logo of the coupling manufacturer.

Optionally, the identification of the coupling/end fitting material (if required by the purchaser) can also be included in the marking.

EXAMPLE MAN/1 MPa (10 bar)/12/16 + coupling manufacturer's logo and identification of material.

11 Test report/certificate

When requested by the purchaser, the manufacturer or supplier shall provide a test report or test certificate with each length of hose or batch of hoses supplied to the purchaser.

12 Packaging and storage

Packaging and storage shall be in accordance with ISO 8331.

Annex A

(normative)

Type tests and routine tests

Table A.1 gives the tests to be carried out for type and routine testing as defined in [Clause 9](#).

Table A.1 — Required type test and routine test

Property	Type test	Routine tests
Compound tests		
Tensile strength and elongation at break of lining and cover: 8.1	X	N.A.
Resistance to ageing, lining and cover: 8.1	X	N.A.
Hose tests		
Inside diameter: 7.1	X	X
Minimum thickness of lining: 7.4	X	N.A.
Minimum thickness of cover: 7.5	X	N.A.
Adhesion between the various components: 8.2.6	X	N.A.
Ozone resistance (cover): 8.2.7	X	N.A.
Resistance to bending: 8.2.3	X	N.A.
Low-temperature flexibility: 8.2.5	X	N.A.
Resistance to suction: 8.2.4	X	N.A.
Min burst pressure: 8.2.2	X	N.A.
Hose assembly tests		
Length of assembly: 7.3	X	X
Resistance to suction: 8.2.4	X	N.A.
Hydrostatic test: 8.2.1	X	X
Variation in length at maximum working pressure 8.2.1	X	N.A.
Variation in outside diameter at maximum working pressure 8.2.1	X	N.A.
Min burst pressure: 8.2.2	X	N.A.
Key		
X	test shall be carried out	
N.A.	test not applicable	

Annex B

(informative)

Production acceptance tests

[Table B.1](#) gives the suggested frequency of production tests (see [Clause 9](#)), to be carried out per batch or every 10 batches as indicated in the table.

A batch is defined as either 500 m of hose or 10 000 kg of lining and/or cover compound.

Table B.1 — Recommended frequency for production acceptance tests

Property	Production testing	
	Per batch	Every 10 batches
Compound tests		
Tensile strength and elongation at break of lining and cover: 8.1	X	N.A.
Resistance to ageing, lining and cover: 8.1	N.A.	X
Hose tests		
Inside diameter	X	N.A.
Thickness of lining	X ^a	N.A.
Thickness of cover	X ^a	N.A.
Adhesion between the various components: 8.2.6	X	N.A.
Ozone resistance (cover)	N.A.	X
Resistance to bending	X	N.A.
Low-temperature flexibility	N.A.	X
Length of hose	N.A.	N.A.
Resistance to suction	X	N.A.
Minimum burst pressure	N.A.	N.A.
Hose assembly tests		
Length of assembly	N.A.	N.A.
Resistance to proof pressure	X	N.A.
Variation in length at max. working pressure	X ^a	N.A.
Variation in outside diameter at max. working pressure	X ^a	N.A.
Key X test should be carried out N.A. test not applicable ^a One check per hose production batch.		