
**Rubber hoses and hose assemblies —
Wire- or textile-reinforced single-pressure
types for hydraulic applications —
Specification**

*Tuyaux et flexibles en caoutchouc — Types hydrauliques avec
armature de fils métalliques tressés — Spécifications*

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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.

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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 18752 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

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Rubber hoses and hose assemblies — Wire- or textile-reinforced single-pressure types for hydraulic applications — Specification

1 Scope

This International Standard specifies requirements for nine classes, four grades and seven types of wire- or textile-reinforced hydraulic hoses and hose assemblies of nominal sizes ranging from 5 to 102. Each class has a single maximum working pressure for all sizes. Such hoses are suitable for use with hydraulic fluids HH, HL, HM, HR and HV as defined in ISO 6743-4 at temperatures ranging from $-40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ for types AS, AC, BS and BC and $-40\text{ }^{\circ}\text{C}$ to $+120\text{ }^{\circ}\text{C}$ for types CS, CC and DC.

This International Standard does not include requirements for the connection ends. It is limited to the performance of hoses and hose assemblies. The hose assembly maximum working pressure is governed by the lowest maximum working pressure of the components.

NOTE It is the responsibility of the user, in consultation with the hose manufacturer, to establish the compatibility of the hose with the fluid to be used.

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

ISO 1746, *Rubber or plastics hoses and tubing — Bending tests*

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

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

ISO 4672:1997, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests*

ISO 6803, *Rubber or plastics hoses and hose assemblies — Hydraulic-pressure impulse test without flexing*

ISO 6945, *Rubber hoses — Determination of abrasion resistance of the outer cover*

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

ISO 7326:1991, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8033:2006, *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*

3 Terms and definitions

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

4 Classification

4.1 Classes

Nine classes of hose are specified, distinguished by their maximum working pressure, as shown in Table 1. Each class may be manufactured in up to 14 nominal sizes.

Table 1 — Classes and nominal sizes

Class	35	70	140	210	250	280	350	420	560
MWP ^a (bar)	35	70	140	210	250	280	350	420	560
MWP ^a (MPa)	3,5	7	14	21	25	28	35	42	56
Nominal size									
5	X	X	X	X	X	X	X	X	N/A
6,3	X	X	X	X	X	X	X	X	N/A
8	X	X	X	X	X	X	X	X	N/A
10	X	X	X	X	X	X	X	X	N/A
12,5	X	X	X	X	X	X	X	X	N/A
16	X	X	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X	X	X
25	X	X	X	X	X	X	X	X	X
31,5	X	X	X	X	X	X	X	X	X
38	X	X	X	X	X	X	X	X	N/A
51	X	X	X	X	X	X	X	X	N/A
63	X	X	X	N/A	N/A	N/A	N/A	N/A	N/A
76	X	X	X	N/A	N/A	N/A	N/A	N/A	N/A
102	X	N/A							
NOTE	X = Applicable; N/A = Not applicable.								
^a	Maximum working pressure.								

4.2 Grades and types

Hoses are classified according to their resistance to impulse into four grades: A, B, C and D. Each grade is classified by outside diameter into standard types (AS, BS and CS) and compact types (AC, BC, CC and DC), as shown in Table 2.

Table 2 — Grades and types

Grade	Type ^a	Resistance to impulse		
		Temperature °C	Impulse pressure (% of MWP ^b)	Minimum number of cycles
A	AS	100	133 %	200 000
	AC			
B	BS	100	133 %	500 000
	BC			
C	CS	120	133 % and 120 % ^c	500 000
	CC			
D	DC	120	133 %	1 000 000

^a Standard or compact, e.g. CS is grade C and standard type.
As shown in Table 4 and Table 8, standard types have larger outside diameters and larger bend radii and compact types have smaller outside diameters and smaller bend radii.

^b Maximum working pressure.

^c 120 % of the MWP shall be used for classes 350, 420 and 560 instead of 133 %.

Each class includes one of each type or both as shown in Table 3.

Table 3 — Type and maximum working pressure

Class		35	70	140	210	250	280	350	420	560
MWP ^a (bar)		35	70	140	210	250	280	350	420	560
MWP ^a (MPa)		3,5	7	14	21	25	28	35	42	56
Grade	Type									
A	AS	X	X	X	X	X	X	X	X	N/A
	AC	X	X	X	X	X	X	X	X	N/A
B	BS	X	X	X	X	X	X	X	X	N/A
	BC	X	X	X	X	X	X	X	X	N/A
C	CS	N/A	N/A	N/A	X	X	X	X	X	N/A
	CC	N/A	N/A	N/A	X	X	X	X	N/A	X
D	DC	N/A	N/A	N/A	X	X	X	X	N/A	N/A

NOTE X = Applicable; N/A = Not applicable.

^a Maximum working pressure.

5 Materials and construction

5.1 Hoses

Hoses shall consist of a hydraulic-fluid-resistant rubber lining, one or multiple layers of steel wire or textile and an oil-, abrasion- and weather-resistant rubber cover. A layer of other materials on the rubber cover is allowed for improved resistance to abrasion or other.

5.2 Hose assemblies

Hose assemblies shall only be manufactured using hose fittings which conform to the requirements of 7.2.1, 7.2.4 and 7.2.5 of this International Standard.

Follow the manufacturer's instructions for the proper preparation and fabrication of hose assemblies.

6 Dimensions and tolerances

6.1 Diameters

When measured in accordance with ISO 4671, the diameters of hoses shall conform to the values given in Table 4.

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Table 4 — Diameters of hoses

Nom- inal size	Inside diameter (all classes) mm		Maximum outside diameter of hose mm																	
			Class 35		Class 70		Class 140		Class 210		Class 250		Class 280		Class 350		Class 420		Class 560	
			Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact	Stan- dard	Com- pact
5	4,6	5,4	14	11	14	11	14	11	14	17	15	17	15	17	15	17	15	17	15	—
6,3	6,1	7,0	17	14	17	14	17	14	17	19	15	19	15	19	15	19	15	19	15	—
8	7,7	8,5	19	15	19	15	19	15	19	20	16	20	16	20	16	20	16	20	16	—
10	9,3	10,1	21	17	21	17	21	17	21	23	19	23	19	23	19	23	19	23	19	—
12,5	12,3	13,5	24	21	24	22	24	22	26	26	22	26	22	26	23	26	23	26	23	—
16	15,5	16,7	27	25	27	25	29	25	29	29	27	29	27	29	27	29	27	29	27	30
19	18,6	19,8	31	29	31	29	33	29	33	34	31	34	32	34	32	34	32	34	32	36
25	25,0	26,4	40	38	40	38	41	38	41	41	39	41	39	41	39	41	39	41	39	45
31,5	31,4	33,0	53	45	53	45	54	49	56	54	49	54	49	54	49	54	49	54	49	52
38	37,7	39,3	59	56	59	56	59	56	59	59	56	59	56	59	56	59	56	59	56	—
51	50,4	52,0	72	69	72	69	73	70	70	73	70	73	70	73	70	73	70	73	70	—
63	63,1	65,1	84	—	84	—	84	—	—	—	—	—	—	—	—	—	—	—	—	—
76	74,6	77,8	100	—	100	—	100	—	—	—	—	—	—	—	—	—	—	—	—	—
102	100,0	103,2	130	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

6.2 Cover thickness

When measured in accordance with ISO 4671, the outer cover thickness of hoses shall conform to the values given in Table 5. Standard types may be produced with either thick or thin covers, the tolerance limits for thin-cover standard types being the same as the tolerance limits for compact types.

Table 5 — Cover thickness

Nominal size	Cover thickness mm					
	Standard (thick cover)		Standard (thin cover)		Compact	
	min.	max.	min.	max.	min.	max.
5	1,5	3,2	0,8	1,5	0,8	1,5
6,3	1,5	3,2	0,8	1,5	0,8	1,5
8	1,5	3,2	0,8	1,5	0,8	1,5
10	1,5	3,2	0,8	1,5	0,8	1,5
12,5	1,5	3,2	0,8	1,5	0,8	1,5
16	1,5	3,2	0,8	1,5	0,8	1,5
19	1,5	3,2	0,8	1,5	0,8	1,5
25	1,5	4,6	1,0	2,0	1,0	2,0
31,5	1,8	4,6	1,0	2,0	1,0	2,0
38	1,8	4,6	1,3	2,5	1,3	2,5
51	1,8	4,6	1,3	2,5	1,3	2,5
63	1,8	5,0	—	—	—	—
76	1,8	5,0	—	—	—	—
102	1,8	5,0	—	—	—	—

6.3 Concentricity

When measured in accordance with ISO 4671, the concentricity of hoses shall conform to the values given in Table 6.

Table 6 — Concentricity of hoses

Nominal size	Maximum variation in wall thickness	
	between internal diameter and outside diameter	between internal diameter and reinforcement diameter
	mm	mm
5 and 6,3	0,8	0,5
Over 6,3 and up to and including 19	1,0	0,7
Over 19 and up to and including 63	1,3	0,9
Over 63	1,5	1,1

7 Physical properties

7.1 Fluid resistance of rubber compounds

7.1.1 Test pieces

The fluid resistance tests shall be carried out on moulded sheets of lining and cover compound having a minimum thickness 2 mm and a cure state equivalent to that of the hose.

7.1.2 Oil resistance

For all grades, when tested in accordance with ISO 1817 by immersion in IRM 903 oil for 168 h at a temperature of 100 °C, the percentage change in volume ΔV of the lining shall be between 0 % and + 25 % for braid-construction and textile-reinforced hoses and between 0 % and + 60 % for spiral-wire-reinforced hoses.

For all grades, when tested in accordance with ISO 1817 by immersion in IRM 903 oil for 168 h at a temperature of 70 °C, the percentage change in volume ΔV of the cover shall be between 0 % and + 100 %.

7.2 Performance requirements

7.2.1 Hydrostatic requirements

When determined in accordance with ISO 1402, the maximum working pressure, the proof pressure and the minimum burst pressure of hoses and hose assemblies shall conform to the values given in Table 7.

Table 7 — Maximum working pressure, proof pressure and minimum burst pressure

Class	Maximum working pressure		Proof pressure		Minimum burst pressure	
	bar	MPa	bar	MPa	bar	MPa
35	35	3,5	70	7	140	14
70	70	7	140	14	280	28
140	140	14	280	28	560	56
210	210	21	420	42	840	84
250	250	25	500	50	1 000	100
280	280	28	560	56	1 120	112
350	350	35	700	70	1 400	140
420	420	42	840	84	1 680	168
560	560	56	1 120	112	2 240	224

7.2.2 Change in length

When determined in accordance with ISO 1402, the change in length of hoses at the maximum working pressure shall not exceed + 2 % or – 4 %.

7.2.3 Minimum bend radius

When determined in accordance with ISO 1746, the minimum bend radius shall conform to the values given in Table 8.

When bent to the minimum bend radius given in Table 8, measured on the inside of the bend, the flatness shall not exceed 10 % of the original outside diameter.

Table 8 — Minimum bend radius

Nominal size	Minimum bend radius mm																		
	Class 35		Class 70		Class 140		Class 210		Class 250		Class 280		Class 350		Class 420		Class 560		
	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	
5	90	60	90	60	90	60	90	60	75	90	75	90	75	90	75	90	75	—	—
6,3	100	75	100	75	100	75	100	75	75	100	75	100	75	150	75	150	75	—	—
8	115	85	115	85	115	85	115	85	85	115	85	115	85	165	85	165	—	—	—
10	130	90	130	90	130	90	130	90	90	130	90	130	90	180	150	180	—	—	—
12,5	180	130	180	130	180	130	180	130	130	180	130	180	130	230	180	230	—	—	—
16	200	150	200	150	200	170	200	170	200	200	200	200	200	265	210	265	—	—	250
19	240	180	240	180	240	200	240	200	240	240	240	240	240	330	250	330	—	—	260
25	300	230	300	230	300	250	300	300	300	300	300	300	300	460	300	460	—	—	330
31,5	420	280	420	280	420	420	460	420	460	460	460	460	460	560	460	560	—	—	460
38	500	500	500	500	560	500	560	560	560	560	560	560	560	630	560	630	—	—	—
51	630	630	630	630	660	630	700	700	630	630	630	630	630	700	630	700	—	—	—
63	760	—	760	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
76	840	—	840	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
102	1 000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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7.2.4 Resistance to impulse

7.2.4.1 The resistance to impulse shall be determined in accordance with ISO 6803. The test fluid temperature shall be 100 °C for grades A and B and 120 °C for grades C and D.

7.2.4.2 For grade A, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 200 000 impulse cycles.

For grade B, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 500 000 impulse cycles.

For grade C, when tested at an impulse pressure equal to 133 % of the maximum working pressure (classes 35 to 280) or 120 % of the maximum working pressure (classes 350, 420 and 560), the hose shall withstand a minimum of 500 000 impulse cycles.

For grade D, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 1 000 000 impulse cycles.

7.2.4.3 There shall be no leakage or other malfunction before reaching the specified number of cycles.

7.2.4.4 This test shall be considered a destructive test and the test piece shall be destroyed after the test.

7.2.5 Leakage of hose assemblies

When tested in accordance with ISO 1402, there shall be no leakage or evidence of failure. This test shall be considered a destructive test and the test piece shall be destroyed after the test.

7.2.6 Cold flexibility

When tested in accordance with method B of ISO 4672:1997 at a temperature of – 40 °C, there shall be no cracking of the lining or cover. The test piece shall not leak or crack when subjected to a proof pressure test in accordance with ISO 1402 after regaining ambient temperature.

7.2.7 Adhesion between components

When tested in accordance with ISO 8033, the adhesion between lining and reinforcement, and between cover and reinforcement shall not be less than 2,5 kN/m.

Test pieces shall be type 5 for lining and reinforcement and type 2, 6 or 8 for cover and reinforcement as described in Table 1 of ISO 8033:2006.

7.2.8 Vacuum resistance

When tested in accordance with ISO 7233, hoses and hose assemblies shall conform to the values given in Table 9. This requirement is only applicable to classes 35, 70, 140 and 210.

Table 9 — Degree of vacuum

Nominal size	Negative gauge pressure (classes 35, 70, 140 and 210 only)
	bar ^a max.
5 to 25	– 0,8
31,5 and over	– 0,6
^a 0,1 bar = 10 kPa	

7.2.9 Abrasion resistance

When hoses are tested in accordance with ISO 6945, with a vertical force of $(50 \pm 0,5)$ N, the loss in mass of the hose cover after 2 000 cycles shall not be greater than 1 g for the thick-cover variant of types AS, BS and CS.

When hoses are tested in accordance with ISO 6945, with a vertical force of $(25 \pm 0,5)$ N, the loss of mass of the hose cover after 2 000 cycles shall not be greater than 0,5 g for types AC, BC, CC and DC and the thin-cover variant of types AS, BS and CS.

7.2.10 Ozone resistance

When tested in accordance with method 1 or 2 of ISO 7326:1991, no cracking or deterioration of the cover shall be visible under $\times 2$ magnification.

8 Frequency of testing

Type testing and routine testing shall be as specified in Annex A.

Type tests are those tests required to confirm that a particular hose design, manufactured by a particular method, meets all the requirements of this International Standard. The tests shall be repeated at a maximum of five-year intervals, or whenever a change in the method of manufacture or materials used occurs. They shall be performed on all sizes, and on all classes and types except those of the same size and construction.

Routine tests are those tests required to be carried out on each length of finished hose prior to dispatch.

Production acceptance tests are those tests, specified in Annex B, which should preferably be carried out to control the quality of manufacture. The frequencies specified in Annex B are given as a guide only.

9 Marking

9.1 Hoses

Hoses shall be marked with at least the following information, and the marking shall be repeated every 760 mm or less:

- a) the manufacturer's name or identification, e.g. MAN;
- b) the number of this International Standard, i.e. ISO 18752;
- c) the type, e.g. AS¹⁾;
- d) the nominal size, e.g. 16;
- e) the maximum working pressure, in bars, e.g. 280 bar;
- f) the quarter and last two digits of the year of manufacture, e.g. 3Q06.

EXAMPLE MAN/ISO 18752/AS/16/280 bar/3Q06

1) If the thin-cover variant is concerned, add "T", e.g. AST.

9.2 Hose assemblies

Hose assemblies shall be marked, preferably at the coupling, with at least the following information:

- a) the manufacturer's name or identification, e.g. MAN;
- b) the maximum working pressure²⁾ of the assembly, in bars, e.g. 280;
- c) two digits indicating the month of assembly followed by a slash and the last two digits of the year of assembly, e.g. 12/05.

EXAMPLE MAN/280/07/06

10 Recommendations for packaging and storage

These are given in ISO 8331.

11 Test report

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

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2) The maximum working pressure of the assembly is the lowest maximum working pressure of any of its components.

Annex A (normative)

Type tests and routine tests

Table A.1 gives the tests to be carried out for type testing and routine testing as defined in Clause 8.

Table A.1

Property	Type testing	Routine testing
Compound tests		
Oil resistance test for cover	X	N/A
Oil resistance test for lining	X	N/A
Hose tests		
Visual examination (inside and outside)	X	X
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness	X	X
Measurement of concentricity	X	X
Minimum bend radius test	X	N/A
Proof test	X	X
Burst test	X	N/A
Change in length test	X	N/A
Impulse test	X	N/A
Leakage test	X	N/A
Cold bend test	X	N/A
Adhesion test	X	N/A
Vacuum test	X	N/A
Abrasion test	X	N/A
Ozone resistance test	X	N/A
NOTE X = Test to be carried out; N/A = Not applicable.		

Annex B (informative)

Production acceptance tests

Table B.1 gives the suggested frequency for production tests (see Clause 8), to be carried out per batch or per 10 batches as indicated in the table. A batch is defined as 3 000 m of hose.

Table B.1 — Recommended test frequency

Property	Production test	
	Per batch	Per 10 batches
Compound tests		
Oil resistance test for cover	N/A	N/A
Oil resistance test for lining	N/A	X
Hose tests		
Visual examination (inside and outside)	X	X
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness	X	X
Measurement of concentricity	X	X
Minimum bend radius test	N/A	N/A
Proof test	X	X
Burst test	X	X
Change in length test	X	X
Impulse test	N/A	N/A
Leakage test	X	X
Cold bend test	N/A	N/A
Adhesion	X	X
Vacuum test	N/A	N/A
Abrasion test	N/A	N/A
Ozone resistance test	N/A	N/A
NOTE	X = Test to be carried out; N/A = Not applicable.	