
**Rubber hoses and hose assemblies —
Wire-braid-reinforced hydraulic types —
Specification —**

**Part 2:
Water-based fluid applications**

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

Partie 2: Applications pour fluide à base d'eau



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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 1436-2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

Together with Part 1 (see below), this part of ISO 1436 cancels and replaces ISO 1436:1991, which has been technically revised.

ISO 1436 consists of the following parts, under the general title *Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types — Specification*:

- *Part 1: Oil-based fluid applications*
- *Part 2: Water-based fluid applications*

Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types — Specification —

Part 2: Water-based fluid applications

1 Scope

This part of ISO 1436 specifies requirements for six types of wire-braid-reinforced hose and hose assembly of nominal size from 5 to 51. They are suitable for use with water-based hydraulic fluids HFC, HFAE, HFAS and HFB as defined in ISO 6743-4 at temperatures ranging from $-40\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$.

This part of ISO 1436 does not include requirements for end fittings. It is limited to requirements for the performance of hoses and hose assemblies.

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 1436-1, *Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types — Specification — Part 1: Oil-based fluid applications*

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 6605, *Hydraulic fluid power — Hoses and hose assemblies — Test methods*

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 suction resistance*

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

ISO 8033:1991, *Rubber and plastics hose — Determination of adhesion between components*

3 Classification

Six types of hose are specified, distinguished by their construction, working pressure and oil resistance:

- Type 1ST: hoses with a single braid of wire reinforcement and having a thick cover.
- Type 2ST: hoses with two braids of wire reinforcement and having a thick cover.
- Types 1SN and R1AT: hoses with a single braid of wire reinforcement and having a thin cover.
- Types 2SN and R2AT: hoses with two braids of wire reinforcement and having a thin cover.

NOTE Types 1SN and R1AT and types 2SN and R2AT have the same reinforcement dimensions as type 1ST and type 2ST, respectively, except that they have thinner covers designed to assemble with fittings without removal of the cover or a portion of the cover.

4 Materials and construction

4.1 Hoses

Hoses shall consist of a rubber lining resistant to water-based hydraulic fluids, one or two layers of high-tensile steel wire and a weather- and oil-resistant rubber cover.

4.2 Hose assemblies

Hose assemblies shall be manufactured using hoses conforming to the requirements of this part of ISO 1436.

Hose assemblies shall be manufactured only with those hose fittings whose correct functioning has been verified in accordance with Subclauses 6.2, 6.4, 6.5 and 6.6 of this part of ISO 1436. The manufacturer's instructions shall be followed for the preparation and fabrication of hose assemblies.

5 Dimensions

5.1 Hose diameters, cover thickness and hose concentricity

When measured in accordance with ISO 4671, the hose diameters and the cover thickness (where appropriate) shall conform to the values given in Table 1.

When measured in accordance with ISO 4671, the concentricity of hoses shall conform to the values given in Table 2.

Table 1 — Dimensions of hoses

Nominal size	All types		Types R1AT, 1SN, 1ST		Type 1ST		Types 1SN, R1AT		Types R2AT, 2SN, 2ST		Type 2ST		Types 2SN, R2AT	
	Inside diameter		Diameter over reinforcement		Outside diameter of hose		Outside diameter of hose		Diameter over reinforcement		Outside diameter of hose		Outside diameter of hose	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
5	4,6	5,4	8,9	10,1	11,9	13,5	12,5	14,1	10,6	11,7	15,1	16,7	0,8	1,5
6,3	6,1	7,0	10,6	11,7	15,1	16,7	14,1	15,7	12,1	13,3	16,7	18,3	0,8	1,5
8	7,7	8,5	12,1	13,3	16,7	18,3	15,7	17,3	13,7	14,9	18,3	19,9	0,8	1,5
10	9,3	10,1	14,5	15,7	19,0	20,6	18,1	19,7	16,1	17,3	20,6	22,2	0,8	1,5
12,5	12,3	13,5	17,5	19,1	22,2	23,8	21,5	23,1	19,0	20,6	23,8	25,4	0,8	1,5
16	15,5	16,7	20,6	22,2	25,4	27,0	24,7	26,3	22,2	23,8	27,0	28,6	0,8	1,5
19	18,6	19,8	24,6	26,2	29,4	31,0	28,6	30,2	26,2	27,8	31,0	32,6	0,8	1,5
25	25,0	26,4	32,5	34,1	36,9	39,3	36,6	38,2	34,1	35,7	38,5	40,9	0,8	1,5
31,5	31,4	33,0	39,3	41,7	44,4	47,6	44,8	46,4	43,2	45,7	49,2	52,4	1,0	2,0
38	37,7	39,3	45,6	48,0	50,8	54,0	52,1	54,7	49,6	52,0	55,6	58,8	1,3	2,5
51	50,4	52,0	58,7	61,9	65,1	68,3	65,9	68,5	62,3	64,7	68,2	71,4	1,3	2,5

NOTE Nominal sizes correspond to the inside diameters in ISO 4397.

Table 2 — Concentricity of hoses

Nominal size	Maximum variation in wall thickness		
	mm		
	Between inside diameter and outside diameter	Between inside diameter and reinforcement diameter	
	All types	Types 1ST, 1SN and R1AT	Types 2ST, 2SN and R2AT
Up to and including 6,3	0,8	0,4	0,5
Greater than 6,3 and up to and including 19	1,0	0,6	0,7
Greater than 19	1,3	0,8	0,9

5.2 Length

The length of supplied hoses and hose assemblies shall be the subject of agreement between the manufacturer and the purchaser.

NOTE Recommendations for supplied lengths of hoses and hose assemblies are given in Annex C.

6 Performance requirements

6.1 General

The requirements for type and routine testing are given in Annex A and recommendations for production acceptance testing in Annex B.

6.2 Hydrostatic requirements

When determined in accordance with ISO 1402 or ISO 6605, 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 3.

When determined in accordance with ISO 1402 or ISO 6605, the change in length of hoses at the maximum working pressure shall not exceed +2 % or –4 %.

Table 3 — Maximum working pressure, proof pressure and minimum burst pressure

Nominal size	Maximum working pressure bar		Proof pressure bar		Minimum burst pressure bar	
	Types 1ST, 1SN and R1AT	Types 2ST, 2SN and R2AT	Types 1ST, 1SN and R1AT	Types 2ST, 2SN and R2AT	Types 1ST, 1SN and R1AT	Types 2ST, 2SN and R2AT
5	250	415	500	830	1 000	1 660
6,3	225	400	450	800	900	1 600
8	215	350	430	700	860	1 400
10	180	330	360	660	720	1 320
12,5	160	275	320	550	640	1 100
16	130	250	260	500	520	1 000
19	105	215	210	430	420	860
25	87	165	180	330	360	660
31,5	62	125	130	250	260	500
38	50	90	100	180	200	360
51	40	80	80	160	160	320
NOTE 1 bar = 0,1 MPa						

6.3 Minimum bend radius

Use a test piece having a length at least four times the minimum bend radius. Measure the hose outside diameter with a calliper in the straight lay position before bending the hose. Bend the hose through 180° to the minimum bend radius (see Table 4) and measure the flatness with the calliper.

When bent to the minimum bend radius given in Table 4, measured on the inside of the bend, the flatness shall not exceed 10 % of the original outside diameter.

Table 4 — Minimum bend radius

Nominal size	Minimum bend radius mm
5	90
6,3	100
8	115
10	130
12,5	180
16	200
19	240
25	300
31,5	420
38	500
51	630

6.4 Resistance to impulse

6.4.1 Standard impulse test

The impulse test shall be in accordance with ISO 6803 or ISO 6605. The test fluid temperature shall be 60 °C. The test fluid used shall be HFC, HFAE, HFAS or HFB as defined in ISO 6743-4.

6.4.2 Optional impulse test

The following test may be used to maximize efficiency:

- a) oven-age assemblies filled with one of the above water-based fluids for 120 h at 60 °C;
- b) impulse-test the aged assemblies using an oil-based hydraulic fluid as required in ISO 1436-1.

For type 1ST and type 1SN and R1AT hose assemblies, when tested at an impulse pressure equal to 125 % of the maximum working pressure for hoses of nominal size 25 and smaller and at 100 % of the maximum working pressure for nominal size 31,5 and above, the assemblies shall withstand a minimum of 150 000 impulse cycles.

For type 2ST and type 2SN and R2AT hose assemblies, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hose assemblies shall withstand a minimum of 200 000 impulse cycles.

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

This test shall be considered a destructive test and the test piece shall be made unusable and discarded after the test.

6.5 Leakage of hose assemblies

When tested in accordance with ISO 1402 or ISO 6605, there shall be no leakage or evidence of failure. This test shall be considered a destructive test and the test piece shall be made unusable and discarded after the test.

6.6 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.

6.7 Adhesion between components

When determined in accordance with ISO 8033, the adhesion between lining and reinforcement, and between cover and reinforcement, shall be no less than 2,5 kN/m for type 1ST, 2ST, 1SN and 2SN hoses and no less than 1,8 kN/m for type R1AT and R2AT hoses.

Test pieces shall be type 5 for lining and reinforcement and type 2 or type 6 for cover and reinforcement as described in Table 1 of ISO 8033:1991.

6.8 Vacuum resistance

When tested in accordance with ISO 7233, hoses and hose assemblies shall conform to the values given in Table 5.

Table 5 — Degree of vacuum

Nominal size	Negative gauge pressure	
	bar	
	Types 1ST and 1SN	Types 2ST and 2SN
5	-0,80	-0,95
6,3		
8		
10		
12,5		
16		
19	-0,60	-0,80
25		
31,5		
38		
51		

NOTE There is no vacuum resistance requirement for hoses of types R1AT and R2AT.

6.9 Abrasion resistance

For hose types 1ST and 2ST, when tested in accordance with ISO 6945 with a vertical force of $(50 \pm 0,5)$ N, the loss in mass after 2 000 cycles shall be no greater than 1 g.

For hose types 1SN and 2SN, when tested in accordance with ISO 6945 with a vertical force of $(25 \pm 0,5)$ N, the loss in mass after 2 000 cycles shall be no greater than 0,5 g.

NOTE There is no abrasion resistance requirement for hoses of types R1AT and R2AT.

6.10 Fluid resistance

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

When tested in accordance with ISO 1817 by immersion in distilled water for 168 h at a temperature of 60 °C, the percentage change in volume ΔV_{100} of the lining shall be between 0 % and +30 %.

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_{100} of the cover shall be between 0 % and +100 %.

6.11 Ozone resistance

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

7 Marking

7.1 Hoses

Hoses meeting the requirements of this part of ISO 1436 shall be marked at least once every 760 mm with at least the following information:

- a) the manufacturer's name or identification, e.g. MAN;
- b) a reference to this part of ISO 1436, i.e. ISO 1436-2;
- c) the type, e.g. 2ST;
- d) the nominal size, e.g. 16;
- e) the quarter and the last two digits of the year of manufacture, e.g. 3Q05.

EXAMPLE MAN/ISO 1436-2/2ST/16/3Q05

7.2 Hose assemblies

Hose assemblies meeting the requirements of this part of ISO 1436 shall be marked with at least the following information:

- a) the manufacturer's name or identification, e.g. MAN;
- b) the maximum working pressure of the assembly, in bars, with the units indicated, e.g. 250 bar¹⁾;
- c) two digits indicating the month of assembly followed by a slash and the last two digits of the year of assembly, e.g. 09/05.

EXAMPLE MAN/250 bar/09/05

1) The maximum working pressure of a hose assembly is equal to the maximum working pressure of the component having the lowest maximum working pressure.

Annex A (normative)

Type and routine testing of production hoses

Property	Type tests Frequency (for each hose type and size): at initial product qualification, in the event of product changes after initial qualification and after 5 years	Routine tests Performed on each length of finished hose prior to warehousing or sale
Visual examination	X	X
Dimensions		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness	X	N/A
Measurement of concentricity	X	N/A
Hose tests		
Proof test	X	X
Burst test	X	N/A
Change in length test (see 6.2)	X	X
Minimum bend radius test	X	N/A
Impulse test	X	N/A
Leakage test (hose assemblies)	X	N/A
Cold flexibility test	X	N/A
Adhesion (cover)	X	N/A
Adhesion (lining)	X	N/A
Vacuum resistance test	X	N/A
Abrasion resistance test	X	N/A
Fluid resistance test for cover	X	N/A
Fluid resistance test for lining	X	N/A
Ozone resistance test	X	N/A
X test shall be carried out. N/A test not applicable.		

Annex B (informative)

Production acceptance testing

Property	Production tests	
	Frequency: every 3 000 m produced of each hose type and size	Frequency: every 12 months of production for each hose type and size
Visual examination	X	X
Dimensions		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness	X	X
Measurement of concentricity	X	X
Hose tests		
Proof test	X	X
Burst test	X	X
Change in length test (see 6.2)	X	X
Minimum bend radius test		X
Impulse test		X
Leakage test (hose assemblies)		X
Cold flexibility test		X
Adhesion (cover)		X
Adhesion (lining)		X
Vacuum resistance test		X
Abrasion resistance test		X
Fluid resistance test for cover		X
Fluid resistance test for lining		X
Ozone resistance test		X