
**Rubber hoses and hose assemblies —
Rubber-covered spiral-wire-reinforced
hydraulic types — Specification —**

Part 1:
Oil-based fluid applications

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

Partie 1: Applications pour fluide à base d'huile



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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 3.

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 part of ISO 3862 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3862-1 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

Together with ISO 3862-2 (in preparation), this part of ISO 3862 cancels and replaces ISO 3862:1991, which has been technically revised.

ISO 3862 consists of the following parts, under the general title *Rubber hoses and hose assemblies — Rubber-covered spiral-wire-reinforced hydraulic types — Specification*:

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

Annex A of this part of ISO 3862 is for information only.

Rubber hoses and hose assemblies — Rubber-covered spiral-wire-reinforced hydraulic types — Specification —

Part 1: Oil-based fluid applications

1 Scope

This part of ISO 3862 specifies requirements for five types of spiral-wire-reinforced hydraulic hoses and hose assemblies of nominal bore from 6,3 to 51. They are suitable for use with hydraulic fluids HH, HL, HM, HR and HV in accordance with ISO 6743-4, at temperatures ranging from $-40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ for types 4SP and 4SH and $-40\text{ }^{\circ}\text{C}$ to $+120\text{ }^{\circ}\text{C}$ for types R12, R13 and R15.

This part of ISO 3862 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 compatibility of the hose with the fluid to be used.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 3862. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 3862 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

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

ISO 4671, *Rubber and plastics hose 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 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

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

- Type 4SP: medium-pressure hose with four plies of steel wire spiral
- Type 4SH: high-pressure hose with four plies of steel wire spiral
- Type R12: heavy-duty high-temperature medium-pressure hose with four plies of steel wire spiral
- Type R13: heavy-duty high-temperature high-pressure hose with multiple-steel-wire spiral
- Type R15: heavy-duty high-temperature extra-high-pressure hose with multiple-steel-wire spiral

NOTE Types R12, R13 and R15 are not subjected to abrasion resistance tests.

4 Materials and construction

4.1 Hoses

Hoses shall consist of a hydraulic-fluid-resistant rubber lining, spiral plies of steel wire wrapped in alternating directions, and an oil- and weather-resistant rubber cover. Each spiral wire ply shall be separated by an insulating layer of rubber.

4.2 Hose assemblies

Hose assemblies shall be manufactured using only those hose fittings whose functionality has been verified in accordance with subclauses 6.1, 6.3, 6.4 and 6.5 of this part of ISO 3862.

The manufacturer's instructions for proper preparation and fabrication of hose assemblies shall be followed.

5 Dimensions

5.1 Diameters and concentricity

When measured in accordance with ISO 4671, the inside diameter of the hoses shall conform to the values given in Table 1.

When measured in accordance with ISO 4671, the diameter over reinforcement and outside diameter of the hoses shall conform to the values given in Table 2.

When measured in accordance with ISO 4671, the concentricity of the hoses shall conform to the values given in Table 3.

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 A.

Table 1 — Dimensions of hoses

Nominal bore	Inside diameter									
	mm									
	Type 4SP		Type 4SH		Type R12		Type R13		Type R15	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
6,3	6,2	7,0	—	—	—	—	—	—	—	—
10	9,3	10,1	—	—	9,3	10,1	—	—	9,3	10,1
12,5	12,3	13,5	—	—	12,3	13,5	—	—	12,3	13,5
16	15,5	16,7	—	—	15,5	16,7	—	—	—	—
19	18,6	19,8	18,6	19,8	18,6	19,8	18,6	19,8	18,6	19,8
25	25,0	26,4	25,0	26,4	25,0	26,4	25,0	26,4	25,0	26,4
31,5	31,4	33,0	31,4	33,0	31,4	33,0	31,4	33,0	31,4	33,0
38	37,7	39,3	37,7	39,3	37,7	39,3	37,7	39,3	37,7	39,3
51	50,4	52,0	50,4	52,0	50,4	52,0	50,4	52,0	—	—

NOTE Nominal bores in this table and in Tables 2 to 5 are in accordance with ISO 4397.

Table 2 — Diameter over reinforcement and outside diameter

Nominal bore	Type 4SP				Type 4SH				Type R12				Type R13				Type R15			
	Diameter over reinforcement		Outside diameter of hose		Diameter over reinforcement		Outside diameter of hose		Diameter over reinforcement		Outside diameter of hose		Diameter over reinforcement		Outside diameter of hose		Diameter over reinforcement		Outside diameter of hose	
	min.	max.	min.	max.																
6,3	14,1	15,3	17,1	18,7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	16,9	18,1	20,6	22,2	16,6	17,8	19,5	21,0	—	—	—	—	—	—	—	—	—	20,3	—	23,3
12,5	19,4	21,0	23,8	25,4	19,9	21,5	23,0	24,6	—	—	—	—	—	—	—	—	—	24,0	—	26,8
16	23,0	24,6	27,4	29,0	—	—	—	—	23,8	25,4	26,6	28,2	—	—	—	—	—	—	—	—
19	27,4	29,0	31,4	33,0	27,6	29,2	31,4	33,0	26,9	28,4	29,9	31,5	28,2	29,8	31,0	33,2	—	—	—	36,1
25	34,5	36,1	38,5	40,9	34,4	36,0	37,5	39,9	34,1	35,7	36,8	39,2	36,4	34,9	37,6	39,8	—	—	—	42,9
31,5	45,0	47,0	49,2	52,4	40,9	42,9	43,9	47,1	42,7	45,1	45,4	48,6	45,6	48,0	48,3	51,3	—	—	—	51,5
38	51,4	53,4	55,6	58,8	47,8	49,8	51,9	55,1	49,2	51,6	51,9	55,0	53,1	55,5	55,8	58,8	—	—	—	59,6
51	64,3	66,3	68,2	71,4	62,2	64,2	66,5	69,7	62,5	64,8	65,1	68,3	66,9	69,3	69,5	72,7	—	—	—	—

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Table 3 — Concentricity of hoses

Nominal bore	Maximum variation in wall thickness	
	Between internal diameter and outside diameter	Between internal diameter and reinforcement diameter
	mm	mm
6,3	0,8	0,5
Over 6,3 but less than or equal to 19	1,0	0,7
Over 19	1,3	0,9

6 Requirements

6.1 Hydrostatic requirements

6.1.1 When tested 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 4.

6.1.2 When tested in accordance with ISO 1402, the change in length of hoses at the maximum working pressure shall be no greater than +2 % and no less than –4 % for types 4SP and 4SH, and no greater than +2 % and no less than –2 % for types R12, R13 and R15.

Table 4 — Maximum working pressure, proof pressure and minimum burst pressure

Nominal bore	Maximum working pressure					Proof pressure					Minimum burst pressure				
	bar					bar					bar				
	Type					Type					Type				
	4SP	4SH	R12	R13	R15	4SP	4SH	R12	R13	R15	4SP	4SH	R12	R13	R15
6,3	450	—	—	—	—	900	—	—	—	—	1 800	—	—	—	—
10	445	—	280	—	420	890	—	560	—	840	1 780	—	1 120	—	1 680
12,5	415	—	280	—	420	830	—	560	—	840	1 660	—	1 120	—	1 680
16	350	—	280	—	420	700	—	560	—	840	1 400	—	1 120	—	1 680
19	350	420	280	350	420	700	840	560	700	840	1 400	1 680	1 120	1 400	1 680
25	280	380	280	350	420	560	760	560	700	840	1 120	152	1 120	1 400	1 680
31,5	210	325	210	350	420	420	650	420	700	840	840	130	840	1 400	1 680
38	185	290	175	350	420	370	580	350	700	840	740	116	700	1 400	1 680
51	165	250	175	350	420	330	500	350	700	840	660	100	700	1 400	1 680

NOTE 1 bar = 0,1 MPa

6.2 Minimum bend radius

Use a test piece having a length at least four times the minimum bend radius.

When bent to the minimum bend radius given in Table 5, measured on the inside of the bend, the hose shall subsequently conform to the impulse and cold-flexibility requirements given in 6.3 and 6.5, respectively.

Table 5 — Minimum bend radius

Nominal bore	Minimum bend radius				
	mm				
	Type 4SP	Type 4SH	Type R12	Type R13	Type R15
6,3	150	—	—	—	—
10	180	—	130	—	150
12,5	230	—	180	—	200
16	250	—	200	—	—
19	300	280	240	240	265
25	340	340	300	300	330
31,5	460	460	420	420	445
38	560	560	500	500	530
51	660	700	630	630	—

6.3 Resistance to impulse

6.3.1 The impulse test shall be in accordance with ISO 6803. The test fluid temperature shall be 100 °C for types 4SP and 4SH and 120 °C for types R12, R13 and R15.

6.3.2 For type 4SP and type 4SH hoses, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 400 000 impulse cycles.

For type R12 hoses, 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 type R13 and type R15 hoses, when tested at an impulse pressure equal to 120 % of the maximum working pressure, the hose shall withstand a minimum of 500 000 impulse cycles.

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

6.3.4 This test shall be considered a destructive test and the test piece shall be discarded afterwards.

6.4 Leakage of hose assemblies

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

6.5 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.

6.6 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 types 4SP and 4SH, and no less than 1,4 kN/m for types R12, R13 and R15.

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.

6.7 Abrasion resistance

For hose types 4SP and 4SH, when tested in accordance with ISO 6945 with a vertical force of $(50 \pm 0,5)$ N, the loss in mass after 2000 cycles shall be no greater than 1 g.

NOTE There is no abrasion resistance requirement for hoses of types R12, R13 and R15.

6.8 Fluid resistance

6.8.1 Test pieces

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

6.8.2 Oil resistance

When determined 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_{100} of the lining of type 4SP and type 4SH hoses shall be between 0 % and + 60 % (i.e. shrinkage is not permissible).

When determined 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 of type 4SP and type 4SH hoses shall be between 0 % and + 100 % (i.e. shrinkage is not permissible).

When determined 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_{100} of type R12, type R13 and type R15 hoses shall be between 0 % and + 100 % for the lining and between 0 % and + 125 % for the cover (i.e. shrinkage is not permissible).

6.9 Ozone resistance

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

7 Designation

Hoses shall be designated in accordance with the following example for a type 4SP hydraulic hose with spiral wire reinforcement and a nominal bore of 10:

EXAMPLE ISO 3862-1/4SP/10

8 Marking

8.1 Hoses

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

- a) the manufacturer's name or identification, e.g. Man;
- b) a reference to this part of ISO 3862, i.e. ISO 3862-1;
- c) the type, e.g. 4SP;
- d) the nominal bore, e.g. 10;
- e) the quarter and the last two digits of the year of manufacture, e.g. 4Q01.

EXAMPLE Man/ISO 3862-1/4SP/10/4Q01

8.2 Hose assemblies

Hose assemblies 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, e.g. 350 bar;¹⁾
- c) the last two digits of the month and year of assembly, e.g. 10/01.

EXAMPLE Man/350 bar/10/01

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1) The maximum working pressure of a hose assembly is equal to the maximum working pressure of that one of its components having the lowest maximum working pressure.