INTERNATIONAL STANDARD

ISO 3862-2

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

Part 2: Water-based fluid applications

Tuyaux et flexibles en caoutchouc — Types hydrauliques avec armature hélicoïdale de fils métalliques — 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 3862-2 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 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*

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

Part 2: Water-based fluid applications

1 Scope

This part of ISO 3862 specifies requirements for five types of spiral-wire-reinforced hydraulic hose and hose assembly of nominal size from 6,3 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 °C to +60 °C.

NOTE 1 This temperature rating is related to the water-based hydraulic fluids defined in ISO 6743-4.

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 2 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 1817, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 3862-1, *Rubber hoses and hose assemblies — Rubber-covered spiral-wire-reinforced hydraulic types — Specification — Part 1: Oil-based fluid applications*

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

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

— Type 4SP: medium-pressure hoses with four plies of steel wire spiral.

— Type 4SH: high-pressure hoses with four plies of steel wire spiral.

— Type R12: heavy-duty high-temperature hose with a medium-pressure rating having four plies of steel wire spiral.

— Type R13: heavy-duty high-temperature hoses with a high-pressure rating having a multiple-steel-wire spiral.

— Type R15: heavy-duty high-temperature hoses with an extra-high-pressure rating having a 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 rubber lining resistant to water-based hydraulic fluids, 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.

4.2 Hose assemblies

Hose assemblies shall be manufactured using hoses conforming to the requirements of this part of ISO 3862.

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 3862. The manufacturer's instructions shall be followed for the preparation and fabrication of hose assemblies.

5 Dimensions

5.1 Hose diameters and hose concentricity

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

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

Table 1 — Inside diameters of hoses

Nominal size	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	—	—

Table 2 — Diameter over reinforcement and outside diameter

Nominal size	Type 4SP				Type 4SH				Type R12				Type R13				Type R15			
	Diameter over reinforcement mm		Outside diameter of hose mm		Diameter over reinforcement mm		Outside diameter of hose mm		Diameter over reinforcement mm		Outside diameter of hose mm		Diameter over reinforcement mm		Outside diameter of hose mm		Diameter over reinforcement mm		Outside diameter of hose mm	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	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	28,7	29,9	31,7	28,2	29,8	31,0	33,2	—	32,9	—	36,1
25	34,5	36,1	38,5	40,9	34,4	36,0	37,5	39,9	34,1	36,0	36,8	39,4	34,9	36,4	37,6	39,8	—	38,9	—	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	—	48,4	—	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	—	56,3	—	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	—	—	—	—

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

Table 3 — Concentricity of hoses

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

6.2.1 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 4.

6.2.2 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 % for types 4SP and 4SH, or +2 % or −2 % for types R12, R13 and R15.

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

Nominal size	Maximum working pressure bar					Proof pressure bar					Minimum burst pressure 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	1 520	1 120	1 400	1 680
31,5	210	325	210	350	420	420	650	420	700	840	840	1 300	840	1 400	1 680
38	185	290	175	350	420	370	580	350	700	840	740	1 160	700	1 400	1 680
51	165	250	175	350	—	330	500	350	700	—	660	1 000	700	1 400	—
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.

When bent to the minimum bend radius given in Table 5, measured on the inside of the bend, the hose shall conform, in the bent state, to the impulse and cold flexibility requirements of 6.4 and 6.6.

Table 5 — Minimum bend radius

Nominal size	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	—

6.4 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 3862-1.

For type 4SP and 4SH hoses, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the assemblies 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 assemblies shall withstand a minimum of 500 000 impulse cycles.

For type R13 and R15 hoses, when tested at an impulse pressure equal to 120 % of the maximum working pressure, the assemblies shall withstand a minimum of 500 000 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 4SP and 4SH hoses and no less than 1,4 kN/m for type R12, R13 and R15 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 Abrasion resistance

For hose types 4SP and 4SH, when tested in accordance with ISO 6945 with a vertical force of (50 ± 0,5) N, the loss in mass after 2 000 cycles shall be no greater than 1 g.

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

6.9 Fluid resistance

6.9.1 Test pieces

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.

6.9.2 Fluid resistance

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 %.

6.10 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 ×2 magnification.

7 Marking

7.1 Hoses

Hoses meeting the requirements of this part of ISO 3862 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 3862, i.e. ISO 3862-2;

c) the type, e.g. 4SP;

d) the nominal size, e.g. 10;

e) the quarter and the last two digits of the year of manufacture, e.g. 3Q05.

EXAMPLE MAN/ISO 3862-2/4SP/10/3Q05

7.2 Hose assemblies

Hose assemblies meeting the requirements of this part of ISO 3862 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. 350 bar[1)];

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/350 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 intial 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