

INTERNATIONAL STANDARD

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

*Tuyaux et flexibles en caoutchouc — Type hydraulique à revêtement de
caoutchouc et armature spiralée de fil métallique — Spécifications*



Reference number
ISO 3862:1991(E)

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.

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.

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

This second edition cancels and replaces the first edition (ISO 3862:1980), of which it constitutes a technical revision.

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

1 Scope

This International Standard specifies requirements for rubber-covered, spiral wire reinforced hydraulic hoses suitable for use with petroleum-based and water-based fluids within a temperature range of $-40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ for types 1 to 5 inclusive and $-40\text{ }^{\circ}\text{C}$ to $+121\text{ }^{\circ}\text{C}$ for types 6 and 7.

The standard does not include requirements for end fittings. It is limited to the performance of hoses and hose assemblies.

NOTE 1 The hoses are not suitable for use with castor oil-based and ester oil-based fluids. Operating temperatures in excess of $93\text{ }^{\circ}\text{C}$ for types 1 to 5 and $121\text{ }^{\circ}\text{C}$ for types 6 and 7 may materially reduce the life of the hose.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1402:1984, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*.

ISO 1817:1985, *Rubber, vulcanized — Determination of the effect of liquids*.

ISO 4671:1984, *Rubber and plastics hose and hose assemblies — Methods of measurement of dimensions*.

ISO 4672:1988, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests*.

ISO 6803:1984, *Rubber or plastics hoses and hose assemblies — Hydraulic pressure impulse test without flexing*.

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

ISO 7751:1991¹⁾, *Rubber and plastics hoses and hose assemblies — Ratios of proof and burst pressure to design working pressure*.

ISO 8033:1985, *Rubber and plastics hose — Determination of adhesion between components*.

3 Types

Hoses shall be one of the following seven types:

Type 1: 4-spiral, light steel wire reinforced, rubber-covered.

Type 2: 4-spiral, medium steel wire reinforced, rubber-covered.

Type 3: 4-spiral, heavy steel wire reinforced, rubber-covered.

Type 4: 6-spiral, heavy steel wire reinforced, rubber-covered.

Type 5: 4-spiral, extra high pressure hose.

Type 6: 4-spiral, heavy-duty, high-temperature hose — medium-pressure rating.

Type 7: multiple-spiral, heavy-duty, high-temperature hose — high-pressure rating.

1) To be published.

4 Materials and construction

4.1 The hose shall consist of an oil- and water-resistant rubber lining, spiral plies of steel wire wrapped in alternating directions, and an oil- and weather-resistant synthetic rubber cover. Each wire layer shall be separated by an insulating layer of synthetic rubber.

4.2 The hose shall be uniformly constructed so that the measurement, in accordance with ISO 4671, of the wall thickness at different points shall not differ by more than the values given in table 1.

Table 1 — Permitted variation in wall thickness measurements

Dimensions in millimetres

Nominal bore	Internal diameter to overall diameter	Internal diameter to reinforcement
Up to and including 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 Dimensions

The bore diameter of the hose shall comply with the requirements of table 2, when measured in accordance with ISO 4671.

NOTE 2 ISO 1307:1983, *Rubber and plastics hoses — Bore diameters and tolerances on length*, has not been followed for nominal bore or permitted range; the dimensions adopted in table 2 are to ensure compatibility with fittings which are in wide use throughout the world.

The diameter over reinforcement and the outside diameter of the hose shall comply with the requirements of table 3, when measured in accordance with ISO 4671.

Table 2 — Nominal bore and tolerances

Dimensions in millimetres

Nominal bore	Bore diameter											
	Type 1		Type 2		Types 3 and 4		Type 5		Type 6		Type 7	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
5	—	—	—	—	4,6	5,4	—	—	—	—	—	—
6,3	—	—	6,2	7,0	6,2	6,9	—	—	—	—	—	—
8	7,7	8,5	—	—	7,7	8,5	—	—	—	—	—	—
10	9,3	10,1	9,3	10,1	9,3	10,1	—	—	9,3	10,1	—	—
12,5	12,3	13,5	12,3	13,5	12,5	13,7	12,3	13,5	12,3	13,5	—	—
16	15,5	16,7	15,5	16,7	15,7	16,9	—	—	—	—	—	—
19	18,6	19,8	18,6	19,8	19,0	20,2	18,6	19,8	18,6	19,8	18,6	19,8
25	25,0	26,4	25,0	26,4	25,4	27	25,0	26,4	25,0	26,4	25,0	26,4
31,5	31,4	33,0	31,4	33,0	31,8	33,4	31,4	33,0	31,4	33,0	31,4	33,0
38	37,7	39,3	37,7	39,3	38,1	39,7	37,7	39,3	37,7	39,3	37,7	39,3
51	50,4	52,0	50,4	52,0	50,8	52,5	50,4	52,0	50,4	52,0	50,4	52,0

Table 3 — Limits on diameter

Dimensions in millimetres

Nominal bore	Type 1				Type 2				Type 3				Type 4			
	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.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
5	—	—	—	—	—	—	—	—	14,3	15,9	18,3	19,8	17,5	19,1	21,4	23,0
6,3	—	—	—	—	14,1	15,3	17,1	18,7	15,8	17,4	19,8	21,4	19,1	20,6	23,0	24,6
8	13,7	14,8	18,4	20,0	—	—	—	—	17,5	19,0	21,4	23,0	20,6	22,2	24,6	26,2
10	16,9	18,0	20,6	22,2	16,9	18,1	20,6	22,2	19,0	20,6	23,0	24,6	22,2	23,8	26,2	27,8
12,5	19,4	21,0	23,8	25,4	19,4	21,0	23,8	25,4	23,0	24,6	27,0	28,6	26,2	27,8	30,2	31,8
16	22,7	24,3	27,0	28,6	23,0	24,6	27,4	29,0	26,2	27,8	30,2	31,8	29,4	30,9	33,3	34,9
19	26,6	28,2	30,6	32,2	27,4	29,0	31,4	33,0	30,9	32,5	35,7	37,3	34,1	35,7	38,9	40,5
25	34,5	36,1	38,5	40,9	34,5	36,1	38,5	40,9	38,9	40,5	43,3	45,6	41,7	44,0	47,2	49,6
31,5	43,3	45,6	49,2	52,4	45,0	47,0	49,2	52,4	44,8	47,2	49,2	52,4	48,0	50,4	53,2	56,4
38	49,6	52,0	55,6	58,7	51,4	53,4	55,6	58,8	51,2	53,6	55,6	58,7	54,4	56,7	59,5	62,7
51	63,9	66,2	69,9	73,0	64,3	66,3	68,2	71,4	64,7	67,1	69,1	72,2	68,6	71,0	73,8	77,0

Nominal bore	Type 5				Type 6				Type 7			
	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.	min.	max.	min.	max.	min.	max.	min.	max.
5	—	—	—	—	—	—	—	—	—	—	—	—
6,3	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	16,6	17,8	19,5	21,0	—	—	—	—
12,5	21,8	23,4	24,6	26,2	19,9	21,5	23,0	24,6	—	—	—	—
16	—	—	—	—	—	—	—	—	—	—	—	—
19	27,6	29,2	31,4	33,0	26,9	28,4	29,9	31,5	28,2	29,8	31,0	33,2
25	34,4	36,0	37,6	39,8	34,1	35,7	36,8	39,2	34,9	36,4	37,6	39,8
31,5	40,7	43,1	43,9	47,1	42,7	45,1	45,4	48,6	45,6	48,0	48,3	51,3
38	47,6	50,0	51,9	55,1	49,2	51,6	51,9	55,0	53,1	55,5	55,8	58,8
51	62,0	64,4	66,5	69,7	62,5	64,8	65,1	68,3	66,9	69,3	69,5	72,7

Table 4 — Design pressure ratings

Nominal bore mm	Design working pressure													
	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7	
	MPa	bar ¹⁾	MPa	bar ¹⁾	MPa	bar ¹⁾	MPa	bar ¹⁾	MPa	bar ¹⁾	MPa	bar ¹⁾	MPa	bar ¹⁾
5	—	—	—	—	69,0	690	86,0	860	—	—	—	—	—	—
6,3	—	—	42,0	420	60,5	605	77,5	775	—	—	—	—	—	—
8	36,0	360	—	—	56,0	560	71,5	715	—	—	—	—	—	—
10	31,0	310	38,0	380	51,5	515	69,0	690	—	—	27,6	276	—	—
12,5	27,5	275	34,5	345	43,0	430	51,5	515	55,0	550	27,6	276	—	—
16	22,5	225	34,5	345	38,0	380	48,0	480	—	—	—	—	—	—
19	20,5	205	27,5	275	34,5	345	43,0	430	42,0	420	27,6	276	34,5	345
25	20,5	205	27,5	275	27,5	275	34,5	345	38,0	380	27,6	276	34,5	345
31,5	17,0	170	21,0	210	20,5	205	24,0	240	32,5	325	20,7	207	34,5	345
38	14,0	140	18,5	185	17,0	170	20,5	205	29,0	290	17,2	172	34,5	345
51	14,0	140	16,5	165	17,0	170	20,5	205	25,0	250	17,2	172	34,5	345

1) 1 bar = $10^5 \text{ N/m}^2 = 0,1 \text{ MPa}$

6 Hydrostatic requirements

When tested in accordance with ISO 1402, the design working pressure of the hose shall comply with the requirements of table 4. The ratios of proof and minimum burst pressure to design working pressure shall be in accordance with category 3 of ISO 7751, i.e. the proof pressure shall be twice the design working pressure, and the minimum burst pressure four times the design working pressure.

7 Minimum bend radius and change in length at design working pressure

7.1 The hose shall be capable of performing at design working pressure when curved to a radius not less than that in table 5 measured on the inside of the bend.

NOTE 3 Should any portion of the hose be curved to a radius less than the specified minimum bend radius, the performance capability of the hose will be reduced.

7.2 The change in length of the hose at the design working pressure shall not exceed + 2 % and – 4 % for types 1 to 5 and + 2 % and – 2 % for types 6 and 7.

8 Tolerance on hose length

8.1 Hoses shall be supplied in lengths as specified by the purchaser, subject to a tolerance on the specified lengths of $\pm 1 \%$ or $\pm 3 \text{ mm}$, whichever is the greater.

8.2 When no specific hose lengths have been ordered, the percentages of different lengths in any given delivery shall be as follows:

- over 13 m: not less than 65 % of total length;
- 7,5 m to 13 m: not more than 35 % of total length;
- 1 m to 7,5 m: not more than 10 % of total length.

No length shall be less than 1 m.

9 Impulse test requirements

9.1 Four unaged samples of hose with end fittings shall be tested in accordance with the method specified in ISO 6803.

9.2 Type 1 hoses, when tested at 133 % of the design working pressure with circulating test fluid at a temperature of 93 °C, shall withstand a minimum of 200 000 impulse cycles for hoses of nominal bores 8 mm, 10 mm and 12,5 mm, and 300 000 impulse cycles for all other nominal bores.

Type 2 and type 3 hoses with a nominal bore of 12,5 mm and larger, and type 4 hoses with a nominal bore of 19 mm and larger, when tested at 133 % of the design working pressure with circulating test fluid at a temperature of 93 °C, shall withstand a minimum of 400 000 impulse cycles.

NOTE 4 Hose sizes 5 mm, 6,3 mm, 8 mm and 10 mm of types 2 and 3, and 5 mm, 6,3 mm, 8 mm, 10 mm, 12,5 mm and 16 mm of type 4 are not usually submitted

Table 5 — Minimum bend radius

Dimensions in millimetres

Nominal bore	Minimum bend radius					
	Type 1	Type 2	Types 3 and 4	Type 5	Type 6	Type 7
5	—	—	100	—	—	—
6,3	—	150	125	—	—	—
8	115	—	140	—	—	—
10	130	180	150	—	125	—
12,5	180	230	205	200	180	—
16	205	250	235	—	—	—
19	240	300	280	280	240	240
25	305	340	360	340	300	305
31,5	420	460	460	460	420	420
38	510	560	560	560	510	510
51	660	660	710	700	640	640

to the impulse test as these sizes are not recommended for systems with conventional hydraulic surges.

Type 5 hoses, when tested at 133 % of the design working pressure with circulating test fluid at a temperature of 93 °C, shall withstand a minimum of 400 000 impulse cycles.

Type 6 hoses when tested at 133 % of the design working pressure with circulating test fluid at a temperature of 121 °C shall withstand a minimum of 500 000 impulse cycles.

Type 7 hoses, when tested at 120 % of the design working pressure with circulating test fluid at a temperature of 121 °C, shall withstand a minimum of 500 000 cycles.

Leakage at the end-fitting, fitting blow-off or rupture of the hose adjacent to the fitting shall be considered as failures in the performance of the assembly. Such failures do not necessarily demonstrate an inability of the hose to meet the specified requirements with an alternative fitting.

The mode and position of any failures shall be recorded.

If an impulse test is unavoidably stopped for a period of more than 24 h before completion of the minimum number of cycles, slight seepage of test fluid may occur at the hose/fitting junction upon re-starting the test. If such a seepage seals itself within 30 min of the re-start, this shall not constitute a failure.

10 Leakage

Unaged hose assemblies on which the end fittings have been attached for not over 30 days shall be subjected to a hydrostatic pressure equal to 70 % of the specified minimum burst pressure for a period of 5 min to 5,5 min and then reduced to zero, after which the 70 % of the minimum burst pressure shall

be re-applied for another 5 min. There shall be no leakage or evidence of failure. This test is to be considered a destructive test and the sample shall be destroyed. Two samples shall be tested.

11 Cold flexibility requirements

When tested in accordance with method B of ISO 4672 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 (see clause 6) after regaining ambient temperature.

12 Oil resistance

The lining and cover, when tested by the method specified in ISO 1817, immersed in oil No. 3 for 72 h at a temperature of 100 °C, shall show no shrinkage and shall not show volume swelling greater than 100 %. The volume swell of the lining shall be less than that of the cover.

13 Ozone resistance

When tested in accordance with ISO 7326, no cracking or deterioration of the cover shall be visible at a magnification of $\times 2$.

14 Adhesion between components

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

15 Marking

Hoses and hose assemblies complying with this International Standard shall be marked with at least the following information:

- a) the number and year of publication of this International Standard (ISO 3862:1991);
- b) the hose type;
- c) the nominal bore;
- d) the manufacturer's name or trademark;

- e) the date of manufacture, i.e. quarter and last two digits of year of manufacture.

EXAMPLE: ISO 3862:1991/type 2/16/XXXX/4.91

Other information as agreed between the purchaser and the manufacturer may be included if requested.

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