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**Rubber hoses and hose assemblies —  
Wire-braid-reinforced hydraulic types  
for oil-based or water-based fluids —  
Specification**

*Tuyaux et flexibles en caoutchouc — Types hydrauliques avec  
armature de fils métalliques tressés pour fluides à base d'huile ou à  
base d'eau-- 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

This fifth edition cancels and replaces the fourth edition (ISO 1436:2009), which has been technically revised. It also incorporates the Technical Corrigendum ISO 1436:2009/Cor. 1:2010.

The main changes compared to the previous edition are as follows:

- [Clause 1](#) has been updated to be more precise;
- [Clause 2](#) has been updated; ISO 4672 has been deleted and replaced by ISO 10619-2, and ISO 10619-1 has been added;
- [8.1](#) has been revised; year of publication of a standard shall be included in the marking if previous edition is used.

# Rubber hoses and hose assemblies — Wire-braid-reinforced hydraulic types for oil-based or water-based fluids — Specification

## 1 Scope

This document specifies requirements for six types of wire-braid-reinforced hose and hose assembly of nominal size from 5 to 51 plus, for one of the five types (type R2ATS), nominal size 63.

They are suitable for use with:

- oil-based hydraulic fluids HH, HL, HM, HR and HV as defined in ISO 6743-4 at temperatures ranging from  $-40\text{ °C}$  to  $+100\text{ °C}$ ;
- water-based fluids HFC, HFAC, HFAS and HFB as defined in ISO 6743-4 at temperatures ranging from  $0\text{ °C}$  to  $+60\text{ °C}$ ;
- water at temperatures ranging from  $0\text{ °C}$  to  $+60\text{ °C}$ .

This document does not include requirements for end fittings. It is limited to requirements for 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1307, *Rubber and plastics hoses — Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses*

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

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

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

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

ISO 6743-4, *Lubricants, industrial oils and related products (class L) — Classification — Part 4: Family H (Hydraulic systems)*

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

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

ISO 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8033:2016, *Rubber and plastics hoses — Determination of adhesion between components*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 10619-1:2011, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

ISO 10619-2:2011, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

### **3 Terms and definitions**

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### **4 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 R1ATS: hoses with a single braid of wire reinforcement and having a thin cover.
- Types 2SN and R2ATS: hoses with two braids of wire reinforcement and having a thin cover.

**NOTE** Types 1SN and R1ATS and types 2SN and R2ATS 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. SAE J 517 defines a type S as having the same dimensions and construction as the type R1AT and type R2AT, which were specified in ISO 1436-1:2001 and ISO 1436-2:2005, but with a higher maximum working pressure. This document uses type R1ATS and type R2ATS to represent these hose types.

### **5 Materials and construction**

#### **5.1 Hoses**

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

#### **5.2 Hose assemblies**

Hose assemblies shall be manufactured using hoses conforming to the requirements of this document.

Hose assemblies shall be manufactured only with those hose fittings whose correct functioning has been verified in accordance with [7.2](#), [7.4](#), [7.5](#) and [7.6](#). The manufacturer's instructions shall be followed for the preparation and fabrication of hose assemblies.

Table 1 — Dimensions of hoses

Nominal size <sup>a</sup>	All types		Types R1ATS, 1SN, 1ST		Type 1ST		Types 1SN, R1ATS		Types R2ATS, 2SN, 2ST		Type 2ST		Types 2SN, R2ATS	
	min.	max.	min.	max.	min.	max.	Outside diameter of hose	Cover thickness	min.	max.	min.	max.	min.	max.
5	4,6	5,4	8,9	10,1	11,9	13,5	12,5	0,8	1,5	10,6	11,7	15,1	16,7	14,1
6,3	6,1	7,0	10,6	11,7	15,1	16,7	14,1	0,8	1,5	12,1	13,3	16,7	18,3	15,7
8	7,7	8,5	12,1	13,3	16,7	18,3	15,7	0,8	1,5	13,7	14,9	18,3	19,9	17,3
10	9,3	10,1	14,5	15,7	19,0	20,6	18,1	0,8	1,5	16,1	17,3	20,6	22,2	19,7
12,5	12,3	13,5	17,5	19,1	22,2	23,8	21,5	0,8	1,5	19,0	20,6	23,8	25,4	23,1
16	15,5	16,7	20,6	22,2	25,4	27,0	24,7	0,8	1,5	22,2	23,8	27,0	28,6	26,3
19	18,6	19,8	24,6	26,2	29,4	31,0	28,6	0,8	1,5	26,2	27,8	31,0	32,6	30,2
25	25,0	26,4	32,5	34,1	36,9	39,3	36,6	0,8	1,5	34,1	35,7	38,5	40,9	38,9
31,5	31,4	33,0	39,3	41,7	44,4	47,6	44,8	1,0	2,0	43,2	45,7	49,2	52,4	49,6
38	37,7	39,3	45,6	48,0	50,8	54,0	52,1	1,3	2,5	49,6	52,0	55,6	58,8	56,0
51	50,4	52,0	58,7	61,9	65,1	68,3	65,9	1,3	2,5	62,3	64,7	68,2	71,4	68,6
63 <sup>b</sup>	63,1	65,1								74,6	77,8			81,8

<sup>a</sup> The nominal sizes correspond to those given in ISO 1307.

<sup>b</sup> This nominal size is for type R2ATS only.

## 6 Dimensions

### 6.1 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 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 R1ATS	Types 2ST, 2SN and R2ATS
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

### 6.2 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](#).

## 7 Performance requirements

### 7.1 General

The requirements for type and routine testing are given in [Annex A](#) and recommendations for production acceptance testing in [Annex B](#).

### 7.2 Hydrostatic requirements

When determined in accordance with ISO 1402 or ISO 6605, 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		Proof pressure		Minimum burst pressure	
	Types 1ST, 1SN and R1ATS	Types 2ST, 2SN and R2ATS	Types 1ST, 1SN and R1ATS	Types 2ST, 2SN and R2ATS	Types 1ST, 1SN and R1ATS	Types 2ST, 2SN and R2ATS
	MPa (bar)					
5	25,0 (250)	41,5 (415)	50,0 (500)	83,0 (830)	100,0 (1 000)	166,0 (1 660)
6,3	22,5 (225)	40,0 (400)	45,0 (450)	80,0 (800)	90,0 (900)	160,0 (1 600)
8	21,5 (215)	35,0 (350)	43,0 (430)	70,0 (700)	86,0 (860)	140,0 (1 400)
10	18,0 (180)	33,0 (330)	36,0 (360)	66,0 (660)	72,0 (720)	132,0 (1 320)
12,5	16,0 (160)	27,5 (275)	32,0 (320)	55,0 (550)	64,0 (640)	110,0 (1 100)
16	13,0 (130)	25,0 (250)	26,0 (260)	50,0 (500)	52,0 (520)	100,0 (1 000)
19	10,5 (105)	21,5 (215)	21,0 (210)	43,0 (430)	42,0 (420)	86,0 (860)
25	8,7 (87)	16,5 (165)	18,0 (180)	33,0 (330)	36,0 (360)	66,0 (660)
31,5	6,2 (62)	12,5 (125)	13,0 (130)	25,0 (250)	26,0 (260)	50,0 (500)
38	5,0 (50)	9,0 (90)	10,0 (100)	18,0 (180)	20,0 (200)	36,0 (360)
51	4,0 (40)	8,0 (80)	8,0 (80)	16,0 (160)	16,0 (160)	32,0 (320)
63 <sup>a</sup>	—	7,0 (70)	—	14,0 (140)	—	28,0 (280)

<sup>a</sup> This nominal size is for type R2ATS only.

### 7.3 Minimum bend radius

Use a test piece having a length at least four times the minimum bend radius. Measure the hose outside diameter with callipers 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 callipers.

When the hose is bent to the minimum bend radius given in [Table 4](#), measured in accordance with method A1 of ISO 10619-1:2011, 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
63	760

## 7.4 Resistance to impulse

### 7.4.1 Oil-based fluid impulse test

The impulse test shall be in accordance with ISO 6803 or ISO 6605. The test fluid temperature shall be 100 °C.

For type 1ST and type 1SN and R1ATS hoses, 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 hoses of nominal size 31,5 and above, the hose shall withstand a minimum of 150 000 impulse cycles.

For type 2ST and type 2SN and R2ATS hoses, 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.

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

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

### 7.4.2 Water-based fluid 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.

For type 1ST and type 1SN and R1ATS hoses, 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 hoses shall withstand a minimum of 150 000 impulse cycles.

For type 2ST and type 2SN and R2ATS hoses, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hoses shall withstand a minimum of 200 000 impulse cycles.

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

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

### 7.4.3 Optional impulse test

The following test may be used to maximize test efficiency:

- a) oven-age assemblies filled with one of the water-based fluids specified in 7.4.2 for 120 h at 60 °C;
- b) impulse-test the aged assemblies using an oil-based hydraulic fluid at a temperature of 100 °C.

For type 1ST and type 1SN and R1ATS hoses, 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 hoses shall withstand a minimum of 150 000 impulse cycles.

For type 2ST and type 2SN and R2ATS hoses, when tested at an impulse pressure equal to 133 % of the maximum working pressure, the hoses shall withstand a minimum of 200 000 impulse cycles.

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

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

## 7.5 Leakage of hose assemblies

When tested in accordance with ISO 1402 or ISO 6605, 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 after the test.

## 7.6 Cold flexibility

When tested in accordance with method B of ISO 10619-2:2011 at a temperature of  $-40\text{ }^{\circ}\text{C}$ , 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 or ISO 6605 after regaining ambient temperature.

## 7.7 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 R1ATS and R2ATS hoses.

Test pieces shall be type 5 for lining and reinforcement and type 2 or type 6 for cover and reinforcement as described in ISO 8033:2016, 6.1 and 6.3.

## 7.8 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	
	Types 1ST and 1SN MPa (bar)	Types 2ST and 2SN MPa (bar)
5	0,080 (0,80)	0,095 (0,95)
6,3	0,080 (0,80)	0,095 (0,95)
8	0,080 (0,80)	0,095 (0,95)
10	0,080 (0,80)	0,095 (0,95)
12,5	0,080 (0,80)	0,095 (0,95)
16	0,080 (0,80)	0,095 (0,95)
19	0,080 (0,80)	0,080 (0,80)
25	0,080 (0,80)	0,080 (0,80)
31,5	0,060 (0,60)	0,080 (0,80)
38	0,060 (0,60)	0,080 (0,80)
51	0,060 (0,60)	0,080 (0,80)

NOTE There is no vacuum resistance requirement for hoses of types R1ATS and R2ATS.

## 7.9 Fluid resistance

### 7.9.1 General

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

### 7.9.2 Oil resistance

When determined in accordance with ISO 1817 by immersion in oil No. 3 for 168 h at a temperature of  $100\text{ }^{\circ}\text{C}$ , the percentage change in volume of the lining shall be between 0 % and +25 % for type 1SN, 1ST, 2SN and 2ST hoses and between 0 % and +100 % for type R1ATS and R2ATS hoses (i.e. shrinkage is not permissible).

When determined in accordance with ISO 1817 by immersion in oil No. 3 for 168 h at a temperature of 70 °C, the percentage change in volume of the cover shall be between 0 % and +100 % (i.e. shrinkage is not permissible).

### **7.9.3 Water resistance**

For all types of hose, when determined in accordance with ISO 1817 by immersion in distilled water for 168 h at a temperature of 60 °C, the percentage change in volume of the lining shall be between 0 % and +30 % (i.e. shrinkage is not permissible).

### **7.10 Ozone resistance**

When tested in accordance with method 1 or 2 of ISO 7326:2016, depending on the nominal bore of the hose, no cracking or other deterioration of the cover shall be visible under ×2 magnifications.

### **7.11 Visual examination**

Hoses shall be examined for visible defects in the outer cover and to verify that the hose identification is correct and has been properly marked. Hose assemblies shall, in addition, be inspected to verify that the correct fittings are fitted.

## **8 Marking**

### **8.1 Hoses**

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

- a) the manufacturer's name or identification, e.g. XXX;
- b) a reference to this document, i.e. ISO 1436;
- c) the type, e.g. 2ST;
- d) the nominal size, e.g. 16;
- e) the maximum working pressure, in megapascals and in bars, or in either, with the unit indicated, e.g. 25 MPa (250 bar);
- f) the quarter and last two digits of the year of manufacture, e.g. 2Q16 (other date-coding methods indicating, for instance, the day or month and year of manufacture are allowed as long as they are clear to the user).

EXAMPLE     XXX/ISO 1436/2ST/16/25 MPa (250 bar)/2Q16.

For item b), the hose manufacturer shall use the latest publication of this document; otherwise, the year of publication shall be included in the marking.

### **8.2 Hose assemblies**

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

- a) the manufacturer's name or identification, e.g. XXX;
- b) the maximum working pressure of the assembly, in megapascals and in bars, or in either, with the units indicated, e.g. 25 MPa (250 bar);

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

- c) two digits indicating the month of assembly followed by a slash and the last two digits of the year of assembly, e.g. 05/16 (monthly, daily and other date-coding methods are allowed as long as they are clear to the user).

EXAMPLE XXX/25 MPa (250 bar)/05/16.

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## 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
<b>Dimensions</b>		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness (if applicable — see <a href="#">Table 1</a> )	X	N/A
Measurement of concentricity	X	N/A
<b>Hose tests</b>		
Proof test	X	X
Burst test	X	N/A
Minimum bend radius test	X	N/A
Change in length test (see <a href="#">6.2</a> )	X	X
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
Fluid resistance test for cover	X	N/A
Fluid resistance test for lining	X	N/A
Ozone resistance test	X	N/A
Visual examination	X	X
X = Test required. N/A = Test not applicable.		