BRITISH STANDARD

BS ISO 1436:2009

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

ICS 23.100.40; 83.140.40

BSI British Standards

National foreword

This British Standard is the UK implementation of ISO 1436:2009. It supersedes BS ISO 1436-2:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/66/-/3, Hydraulic applications.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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INTERNATIONAL STANDARD

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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.

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

This fourth edition of ISO 1436 cancels and replaces ISO 1436-1:2001 and ISO 1436-2:2005, which have been technically revised and combined in a single document. The main changes are as follows:

— pressures are now given in megapascals as the preferred unit;

— the requirement for an abrasion test has been deleted;

— ISO 4397 has been replaced by ISO 1307.

INTERNATIONAL STANDARD **ISO 1436:2009(E)**

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

1 Scope

This International Standard 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 water-based hydraulic fluids HFC, HFAE, HFAS and HFB as defined in ISO 6743-4 at temperatures ranging from to −40 °C to +60 °C or oil-based hydraulic fluids HH, HL, HM, HR and HV as defined in ISO 6743-4 at temperatures ranging from −40 °C to +100 °C.

This International Standard 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 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 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 — 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 4672:1997, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests*[1)]

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*

1) Under revision as ISO 10619-2.

ISO 7326:2006, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8033:2006, *Rubber and plastics hoses — Determination of adhesion between components*

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

3 Terms and definitions

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

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, *Hydraulic Hose*, 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 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 International Standard.

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

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 1 — Dimensions of hoses

Nominal size[a]	All types		Types R1ATS, 1SN, 1ST		Type 1ST		Types 1SN, R1ATS			Types R2ATS, 2SN, 2ST		Type 2ST		Types 2SN, R2ATS		
	Inside diameter		Diameter over reinforcement		Outside diameter of hose		Outside diameter of hose	Cover thickness		Diameter over reinforcement		Outside diameter of hose		Outside diameter of hose	Cover thickness	
	mm		mm		mm		mm	mm		mm		mm		mm	mm	
	min.	max.	min.	max.	min.	max.	max.	min.	max.	min.	max.	min.	max.	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	0,8	1,5
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	0,8	1,5
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	0,8	1,5
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	0,8	1,5
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	0,8	1,5
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	0,8	1,5
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	0,8	1,5
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	0,8	1,5
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	1,0	2,0
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	1,3	2,5
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	1,3	2,5
63[b]	63,1	65,1								74,6	77,8			81,8	1,3	2,5

[a] The nominal sizes correspond to those given in ISO 1307.

[b] This nominal size is for type R2ATS only.

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)	MPa (bar)	MPa (bar)	MPa (bar)	MPa (bar)	MPa (bar)
5	25,0 (250)	41,5 (415)	50,0 (500)	83,0 (830)	100,0 (1 000)	166,0 (1 660)
6	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[a]	—	7,0 (70)	—	14,0 (140)	—	28,0 (280)

[a] 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 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
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 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 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 Subclauses 5.1 and 5.3 of ISO 8033:2006.

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	Types 2ST and 2SN
	MPa (bar)	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 IRM 903 oil for 168 h at a temperature of 100 °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 IRM 903 oil 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 7326:2006, depending on the nominal bore of the hose, no cracking or other deterioration of the cover shall be visible under × 2 magnification.

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 International Standard 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 International Standard, i.e. ISO 1436:2009;

c) the type, e.g. 2ST;

d) the nominal size, e.g. 16;

e) the maximum working pressure, in megapascals, with the unit indicated, e.g. 25 MPa;

f) the quarter and the last two digits of the year of manufacture, e.g. 2Q09 (other date-coding methods indicating, for instance, the month or day of manufacture are allowed as long as they are clear to the user).

EXAMPLE MAN/ISO 1436:2009/2ST/16/25 MPa/2Q09

8.2 Hose assemblies

Hose assemblies meeting the requirements of this International Standard 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 megapascals, with the unit indicated, e.g. 25 MPa[2)];

c) two digits indicating the month of assembly followed by a slash and the last two digits of the year of assembly, e.g. 04/09 (monthly, daily and other code dating methods are allowed as long as they are clear to the user).

EXAMPLE MAN/25 MPa/04/09

2) 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
Dimensions		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness (if applicable — see Table 1)	X	N/A
Measurement of concentricity	X	N/A
Hose tests		
Proof test	X	X
Burst test	X	N/A
Minimum bend radius test	X	N/A
Change in length test (see 6.2)	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 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
Dimensions		
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness (if applicable — see Table 1)	X	X
Measurement of concentricity	X	X
Hose tests		
Proof test	X	X
Burst test	X	X
Minimum bend radius test	N/A	X
Change in length test (see 6.2)	X	X
Impulse test	N/A	X
Leakage test (hose assemblies)	N/A	X
Cold flexibility test	N/A	X
Adhesion (cover)	N/A	X
Adhesion (lining)	N/A	X
Vacuum resistance test	N/A	X
Fluid resistance test for cover	N/A	X
Fluid resistance test for lining	N/A	X
Ozone resistance test	N/A	X
Visual examination	X	X
X Test shall be carried out.		
N/A Test not applicable.		

Annex C
(informative)

Recommendations for lengths of supplied hoses and tolerances on lengths of hose assemblies

C.1 Hoses

The lengths of hoses in the manufacturer's standard pack, with the lengths marked, should preferably be within ± 2 % of the lengths indicated.

When no specific hose lengths have been ordered, the percentages of different lengths in any given delivery or pack of at least 500 m should preferably be as indicated in Table C.1.

Table C.1 — Hose lengths in delivery when no lengths specified

Length of hose	Percentage of total length
Greater than or equal to 1 m but less than or equal to 10 m	5 % max.
Greater than 10 m but less than or equal to 15 m	25 % max.
Greater than 15 m	75 % min.

C.2 Hose assemblies

The tolerances on the lengths of hose assemblies should preferably conform to the values given in Table C.2.

Table C.2 — Tolerances on lengths of hose assemblies

<table>
<tr><th rowspan="2">Length of hose assembly
mm</th><th colspan="3">Nominal size</th></tr>
<tr><th>Up to and including 25</th><th>Over 25 and up to and including 50</th><th>Over 50</th></tr>
<tr><td>Up to and including 630</td><td>$^{+7}_{-3}$ mm</td><td>$^{+12}_{-4}$ mm</td><td rowspan="2">$^{+25}_{-6}$ mm</td></tr>
<tr><td>Over 630 and up to and including 1 250</td><td>$^{+12}_{-4}$ mm</td><td>$^{+20}_{-6}$ mm</td></tr>
<tr><td>Over 1 250 and up to and including 2 500</td><td>$^{+20}_{-6}$ mm</td><td colspan="2">$^{+25}_{-6}$ mm</td></tr>
<tr><td>Over 2 500 and up to and including 8 000</td><td colspan="3">$^{+1,5}_{-0,5}$ %</td></tr>
<tr><td>Over 8 000</td><td colspan="3">$^{+3}_{-1}$ %</td></tr>
</table>

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