INTERNATIONAL STANDARD

ISO 4079-2

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Rubber hoses and hose assemblies — Textile-reinforced hydraulic types — Specification —

Part 2: Water-based fluid applications

Tuyaux et flexibles en caoutchouc — Types hydrauliques avec armature de textile — Spécifications —

Partie 2: Applications pour fluide à base d'eau

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Contents

Page

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 4079-2 was prepared by Technical Committee ISO/TC 45, *Ruber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

Together with Part 1 (see below), it cancels and replaces ISO 4079:1991, which has been technically revised.

ISO 4079 consists of the following parts, under the general title *Rubber hoses and hose assemblies — Textile-reinforced hydraulic types — Specification*:

— *Part 1: Oil-based fluid applications*

— *Part 2: Water-based fluid applications*

Rubber hoses and hose assemblies — Textile-reinforced hydraulic types — Specification —

Part 2: Water-based fluid applications

1 Scope

This part of ISO 4079 specifies requirements for five types of textile-reinforced hydraulic hoses and hose assemblies of nominal size from 5 to 100. They are suitable for use with hydraulic fluids HFC, HFAE, HFAS and HFB as defined in ISO 6743-4 at temperatures ranging from − 40 °C to + 60 °C.

This part of ISO 4079 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 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 4079-1, *Rubber hoses and hose assemblies — Textile-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 minimum bend radius:

— Type 1TE: hoses with a single braid of textile reinforcement

— Type 2TE: hoses with one or more braid(s) of textile reinforcement

— Type 3TE: hoses with one or more braid(s) of textile reinforcement (higher working pressure)

— Type R3: hoses with two braids of textile reinforcement

— Type R6: hoses with a single braid of textile reinforcement

NOTE Type 1TE is not subjected to the impulse or vacuum resistance tests. Type R3 is not subjected to the vacuum resistance or abrasion resistance tests. Type R6 is not subjected to the impulse, vacuum resistance or abrasion resistance tests.

4 Materials and construction

4.1 Hoses

Hoses shall consist of a rubber lining resistant to water-based hydraulic fluids, one or more layers of suitable textile yarn, and an oil- and weather-resistant rubber cover.

Hoses shall be designed to enable end fittings to be assembled without removal of the cover.

4.2 Hose assemblies

Hose assemblies shall be manufactured with only those hose fittings whose functionality has been verified in accordance with Subclauses 6.2, 6.4, 6.5 and 6.6 of this part of ISO 4079.

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

5 Dimensions

5.1 Hose diameters and hose concentricity

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

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

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.

Table 1 — Dimensions of hoses

Nominal size	Inside diameter mm				Outside diameter mm									
	Types 1TE, 2TE, 3TE [a]		Types R6, R3		Type 1TE		Type 2TE		Type 3TE		Type R6		Type R3	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
5	4,4	5,2	4,5	5,4	10,0	11,6	11,0	12,6	12,0	13,6	10,3	11,9	11,9	13,5
6,3	5,9	6,9	6,1	7,0	11,6	13,2	12,6	14,2	13,6	15,2	11,9	13,5	13,5	15,1
8	7,4	8,4	7,6	8,5	13,1	14,7	14,1	15,7	16,1	17,7	13,5	15,1	16,7	18,3
10	9,0	10,0	9,2	10,1	14,7	16,3	15,7	17,3	17,7	19,3	15,1	16,7	18,3	19,8
12,5	12,1	13,3	12,4	13,5	17,7	19,7	18,7	20,7	20,7	22,7	19,0	20,6	23,0	24,6
16	15,3	16,5	15,6	16,7	21,9	23,9	22,9	24,9	24,9	26,9	22,2	23,8	26,2	27,8
19	18,2	19,8	18,7	19,8	—	—	26,0	28,0	28,0	30,0	25,4	27,8	31,0	32,5
25	24,6	26,2	25,1	26,2	—	—	32,9	35,9	34,4	37,4	—	—	36,9	39,3
31,5	30,8	32,8	31,4	32,9	—	—	—	—	40,8	43,8	—	—	42,9	46,0
38	37,1	39,1	—	—	—	—	—	—	47,6	51,6	—	—	—	—
51	49,8	51,8	—	—	—	—	—	—	60,3	64,3	—	—	—	—
60	58,8	61,2	—	—	—	—	—	—	70,0	74,0	—	—	—	—
80	78,8	81,2	—	—	—	—	—	—	91,5	96,5	—	—	—	—
100	98,6	101,4	—	—	—	—	—	—	113,5	118,5	—	—	—	—

NOTE Nominal sizes in this table and in Tables 2 to 6 correspond to the inside diameters given in ISO 4397.

[a] Inside dimensions apply to type 3TE only for nominal sizes larger than 25.

Table 2 — Concentricity of hoses

Nominal size	Maximum variation in wall thickness between internal diameter and outside diameter mm
Up to and including 6,3	0,8
Over 6,3 but less than or equal to 19	1,0
Over 19	1,3

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

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 3.

When determined in accordance with ISO 1402 or ISO 6605, the change in length of hoses at the maximum working pressure shall be no greater than + 2 % and no less than − 4 % for hoses up to and including nominal size 31,5, and no greater than + 5 % and no less than 0 % for hoses above nominal size 31,5.

6.3 Minimum bend radius

Use a test piece having a length at least four times the minimum bend radius. Measure the hose outside diameter with a pair of callipers in the straight-lay position before bending the hose. Bend the hose through 180° to the minimum bend radius and measure the flatness with the callipers.

When 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 3 — Maximum working pressure, proof pressure and minimum burst pressure

Nominal size	Maximum working pressure bar					Proof pressure bar					Minimum burst pressure bar				
	Type 1TE	Type 2TE	Type 3TE	Type R6	Type R3	Type 1TE	Type 2TE	Type 3TE	Type R6	Type R3	Type 1TE	Type 2TE	Type 3TE	Type R6	Type R3
5	25	80	160	35	105	50	160	320	70	210	100	320	640	140	420
6,3	25	75	145	28	87	50	150	290	56	174	100	300	580	112	348
8	20	68	130	28	83	40	136	260	56	166	80	272	520	112	332
10	20	63	110	28	78	40	126	220	56	156	80	252	440	112	312
12,5	16	58	93	28	70	32	116	186	56	140	64	232	372	112	280
16	16	50	80	24	61	32	100	160	48	122	64	200	320	96	245
19	—	45	70	21	52	—	90	140	42	104	—	180	280	84	208
25	—	40	55	—	39	—	80	110	—	78	—	160	220	—	156
31,5	—	—	45	—	26	—	—	90	—	52	—	—	180	—	104
38	—	—	40	—	—	—	—	80	—	—	—	—	160	—	—
51	—	—	33	—	—	—	—	66	—	—	—	—	132	—	—
60	—	—	25	—	—	—	—	50	—	—	—	—	100	—	—
80	—	—	18	—	—	—	—	36	—	—	—	—	72	—	—
100	—	—	10	—	—	—	—	20	—	—	—	—	40	—	—

NOTE 1 bar = 0,1 MPa

Table 4 — Minimum bend radius

Nominal size	Minimum bend radius mm				
	Type 1TE	Type 2TE	Type 3TE	Type R6	Type R3
5	35	25	40	50	75
6,3	45	40	45	65	75
8	65	50	55	75	100
10	75	60	70	75	100
12,5	90	70	85	100	125
16	115	90	105	125	140
19	—	110	130	150	150
25	—	150	150	—	205
31,5	—	—	190	—	250
38	—	—	240	—	—
51	—	—	300	—	—
60	—	—	400	—	—
80	—	—	500	—	—
100	—	—	600	—	—

6.4 Impulse test requirements

6.4.1 Standard impulse test

The impulse test shall be performed on hose types 2TE, 3TE and R3 in accordance with ISO 6803 or ISO 6605. The test fluid temperature shall be 60 °C. The test fluid shall be selected from HFC, HFAE, HFAS and 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 4079-1.

For type 2TE hoses, when tested at an impulse pressure equal to 125 % of the maximum working pressure, the hose shall withstand a minimum of 100 000 impulse cycles.

For type 3TE and R3 hoses, when tested at an impulse pressure equal to 133 % of the maximum working pressure for hoses of nominal size up to and including 25 and at 100 % of the maximum working pressure for hoses of nominal size greater than 25, the hose shall withstand a minimum of 200 000 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.

NOTE The impulse test is not required for types 1TE and R6.

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 or ISO 6605 after regaining ambient temperature.

6.7 Adhesion between components

When determined in accordance with ISO 8033, the adhesion for hose types 1TE, 2TE and 3TE shall be in accordance with Table 5. For hose types R3 and R6, the adhesion between lining and reinforcement, and between cover and reinforcement, shall not be less than 1,4 kN/m.

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.

Table 5 — Minimum adhesion between components

Nominal size	Between lining and reinforcement kN/m	Between cover and reinforcement kN/m
Up to and including 8	1,5	2,0
Greater than 8	2,5	2,5

6.8 Vacuum resistance

When tested in accordance with ISO 7233, hoses and hose assemblies shall conform to the values given in Table 6.

Table 6 — Degree of vacuum

<table>
<tr><th rowspan="2">Nominal size</th><th colspan="2">Negative gauge pressure (max.)
bar</th></tr>
<tr><th>Type 2TE</th><th>Type 3TE</th></tr>
<tr><td>5
6,3
8
10
12,5</td><td rowspan="2">– 0,60</td><td rowspan="2">– 0,80</td></tr>
<tr><td>16
19
25
31,5
38
51
60
80
100</td><td rowspan="2">– 0,60</td></tr>
<tr><td colspan="3">NOTE There is no vacuum resistance requirement for hoses of types 1TE, R3 and R6.</td></tr>
</table>

6.9 Abrasion resistance

When determined in accordance with ISO 6945 with a vertical force of $(25 \pm 0{,}5)$ 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 1TE, R3 and R6.

6.10 Fluid resistance

6.10.1 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.

6.10.2 Fluid resistance

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 ΔV_{100} of the lining shall be between 0 % and + 30 %.

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 shall be between 0 % and + 100 % (i.e. shrinkage is not permissible).

6.11 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 4079 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 4079, i.e. ISO 4079-2;

c) the type, e.g. 1TE;

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

e) the quarter and the last two digits of the year of manufacture, e.g. 3Q05 (monthly, daily and other code dating methods are allowed as long as they are clear to the user).

EXAMPLE Man/ISO 4079-2/1TE/16/3Q05

7.2 Hose assemblies

Hose assemblies meeting the requirements of this part of ISO 4079 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. 250 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 (monthly, daily and other code dating methods are allowed as long as they are clear to the user).

EXAMPLE Man/250 bar/09/05

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

Annex A
(normative)

Type and routine testing of production hoses

Property	Type tests Frequency (for each hose size and type): 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
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	N/A	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
Abrasion 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

X test shall be carried out.

N/A test not applicable.