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Plastics hoses and hose assemblies — Textile-reinforced types for hydraulic applications — Specification

Tuyaux et flexibles en plastique — Types hydrauliques avec armature textile — Spécifications

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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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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 3949 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This third edition cancels and replaces the second edition (ISO 3949:1991), which has been technically revised.

Plastics hoses and hose assemblies — Textile-reinforced types for hydraulic applications — Specification

1 Scope

This International Standard specifies requirements for two types of textile-reinforced thermoplastics hoses and hose assemblies of nominal bore from 5 to 25. Each type is divided into two classes dependent on electrical-conductivity requirements. They are suitable for use with:

— hydraulic fluids HH, HL, HM, HR and HV (as defined in ISO 6743-4) at temperatures ranging from −40 °C to +100 °C;

— water-based hydraulic fluids HFC, HFAE, HFAS and HFB (as defined in ISO 6743-4) at temperatures ranging from 0 °C to +60 °C.

This International Standard does not include requirements for end fittings. It is limited to the performance of hoses and hose assemblies.

NOTE Operating temperatures in excess of 100 °C may materially reduce the life of the hose.

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 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 6803, *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 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guide to selection, storage, use and maintenance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8830 apply.

4 Classification

Two types of hose are specified, distinguished by their maximum working pressure:

a) type R7: hoses with one or more layers of reinforcement;

b) type R8: hoses with one or more layers of reinforcement, for operation at higher working pressures.

Each type of hose is divided into two classes according to its electrical properties:

1) class 1, no electrical requirements;

2) class 2, “non-conductive” (see 7.8).

5 Materials and construction

5.1 Hoses

Hoses shall consist of a seamless thermoplastics lining resistant to hydraulic fluids, with a suitable textile yarn reinforcement and a thermoplastics cover resistant to hydraulic fluids, water and the weather.

For class 2 hoses, the cover shall not be perforated. It shall be orange (colour code RAL 2004).

5.2 Hose assemblies

Hose assemblies shall only be manufactured with those hose fittings whose functionality conforms to the requirements of 7.1, 7.4, 7.5, 7.6 and, for class 2 only, 7.8.

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

6 Dimensions and tolerances

6.1 Diameters

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

Table 1 — Dimensions of hoses

Nominal bore	Inside diameter mm				Maximum outside diameter mm	
	Type R7		Type R8		Type R7	Type R8
	min.	max.	min.	max.		
5	4,6	5,4	4,6	5,4	11,4	14,6
6,3	6,2	7,0	6,2	7,0	13,7	16,8
8	7,7	8,5	7,7	8,5	15,6	18,6
10	9,3	10,3	9,3	10,3	18,4	20,3
12,5	12,3	13,5	12,3	13,5	22,5	24,6
16	15,6	16,7	15,6	16,7	25,8	29,8
19	18,6	19,8	18,6	19,8	28,6	33,0
25	25,0	26,4	25,0	26,4	34,7	38,6

NOTE Inside diameters are in accordance with ISO 4397.

6.2 Concentricity

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 bore	Maximum variation in wall thickness between inside diameter and outside diameter mm
Up to and including 6,3	0,8
Over 6,3 and including 19	1,0
Over 19	1,3

7 Performance requirements

7.1 Hydrostatic requirements

When determined in accordance with ISO 1402, 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.

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

Nominal bore	Maximum working pressure bar[a]		Proof pressure bar[a]		Minimum burst pressure bar[a]	
	Type R7	Type R8	Type R7	Type R8	Type R7	Type R8
5	210	350	420	700	840	1 400
6,3	192	350	385	700	770	1 400
8	175	—	350	—	700	—
10	158	280	315	560	630	1 120
12,5	140	245	280	490	560	980
16	105	192	210	385	420	770
19	88	158	175	315	350	630
25	70	140	140	280	280	560

[a] 1 bar = 0,1 MPa.

7.2 Change in length

When determined in accordance with ISO 1402, the change in length of the hose at the maximum working pressure shall not exceed ±3 %.

7.3 Minimum bend radius

Use test pieces having a length at least four times the minimum bend radius. Measure the hose outside diameter with vernier 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 4 — Minimum bend radius

Nominal bore	Minimum bend radius mm
5	90
6,3	100
8	115
10	125
12,5	180
16	205
19	240
25	300

7.4 Resistance to impulse

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

7.4.2 For type R7 hoses, when tested at an impulse pressure equal to 125 % of the maximum working pressure, the hose shall withstand a minimum of 150 000 impulse cycles.

For type R8 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.

7.4.3 There shall be no leakage or other malfunction before reaching the specified number of cycles.

7.4.4 This test shall be considered a destructive test and the test pieces shall be destroyed after the test.

7.5 Leakage of hose assemblies

When tested in accordance with ISO 1402, there shall be no leakage or evidence of failure. This test shall be considered a destructive test and the test piece shall be destroyed 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 after regaining ambient temperature.

7.7 Ozone resistance

When tested in accordance with method 1 or 2, depending on the nominal bore of the hose, of ISO 7326:1991, no cracking or deterioration of the cover shall be visible under ×2 magnification.

7.8 Electrical conductivity

This test shall be carried out in accordance with Annex D. It applies to class 2 hoses only (the test shall not be applied to hoses with a perforated cover).

The current measured during the test shall be no greater than 50 μA.

7.9 Resistance to fluids

7.9.1 Test pieces

The fluid resistance tests specified in 7.9.2 to 7.9.4 shall be carried out on moulded sheets of lining and cover material having a minimum thickness of 2 mm.

7.9.2 Oil resistance

When determined in accordance with ISO 1817 by immersion in IRM 903 oil for 72^{0}_{-2} h at a temperature of 100 °C ± 3 °C, the percentage change in volume of the lining and cover shall be between 0 % and +35 %.

7.9.3 Water based fluid resistance

When determined in accordance with ISO 1817 by immersion in a test liquid made up of equal volumes of 1,2-ethanediol and distilled water for 168^{0}_{-2} h at a temperature of 70 °C ± 1 °C, the percentage change in volume of the lining and cover shall be between 0 % and 25 %.

7.9.4 Water resistance

When determined in accordance with ISO 1817 by immersion in distilled water for 168^{0}_{-2} h at a temperature of 70 °C ± 1 °C, the percentage change in volume of the lining and cover shall not be greater than 25 %.

8 Frequency of testing

The frequency of type approval and routine testing shall be as specified in Annex A.

Type approval tests are those tests required to confirm that a particular hose design, manufactured by a particular method, meets all the requirements of this International Standard. The tests shall be repeated at a maximum of five-year intervals, or whenever a change in the method of manufacture or materials used occurs. They shall be performed on the largest-diameter hose of each design and each type in the manufacturer's range.

Routine tests are those tests required to be carried out on each length of finished hose prior to dispatch.

Production acceptance tests are those tests, specified in Annex B, which should preferably be carried out to control the quality of manufacture. The frequencies specified in Annex B are given as a guide only.

9 Designation

Hoses shall be designated as in the following example for a type R7 textile-reinforced thermoplastics hydraulic hose of class 1 with a nominal bore of 10.

EXAMPLE ISO 3949/R7-1/10.

10 Marking

10.1 Hoses

Hoses 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) the number of this International Standard, i.e. ISO 3949;

c) the type and class, e.g. R7-1;

d) for class 2 hoses, the words “NON-CONDUCTIVE”;

e) the nominal bore, e.g. 16;

f) the quarter and last two digits of the year of manufacture, e.g. 3Q04.

EXAMPLE 1 Man/ISO 3949/R7-1/16/3Q04.

EXAMPLE 2 Man/ISO 3949/R7-2 NON-CONDUCTIVE/16/3Q04.

10.2 Hose assemblies

Hose assemblies shall be marked with at least the following information:

a) the manufacturer's name or identification, e.g. Man;

b) the maximum working pressure[1)] of the assembly, in bars[2)], e.g. 70;

c) the last two digits of the month and year of assembly, e.g. 09/04.

EXAMPLE Man/70/09/04.

11 Recommendations for packaging and storage

These are given in ISO 8331.

12 Test report

When requested by the purchaser, the manufacturer or supplier shall provide a test report with each length or batch of hoses supplied to the purchaser.

1) The maximum working pressure of an assembly is the lowest maximum working pressure of any of its components.

2) 10 bar = 1 MPa.

Annex A
(normative)

Frequency of testing for type approval and routine tests

Table A.1 gives the frequency of testing for type approval and routine tests (see Clause 8 for a definition of these tests).

Table A.1

Property	Type approval tests	Routine tests
Hoses/hose assemblies (as appropriate)		
Visual examination (inside and outside)	X	X
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of concentricity	X	X
Proof test	X	X
Burst test	X	X
Change-in-length test	X	X
Minimum bend radius	X	N.A.
Impulse test	X	N.A.
Leakage test	X	X
Cold flexibility test	X	N.A.
Ozone resistance test	X	N.A.
Electrical conductivity (class 2 only)	X	N.A.
Resistance to fluids		
Oil resistance test on cover	X	N.A.
Oil resistance test on lining	X	N.A.
Water based fluid resistance test on cover	X	N.A.
Water based fluid resistance test on lining	X	N.A.
Water resistance test on cover	X	N.A.
Water resistance test on lining	X	N.A.
N.A. = not applicable; X = test to be carried out.		

Annex B
(informative)

Recommended frequency of testing for production acceptance tests

Table B.1 gives the suggested frequency for production acceptance tests (see Clause 8), which may be carried out either per batch or per 10 batches as indicated in the table. A batch is defined as 500 m of hose.

Table B.1 — Recommended frequency of production acceptance tests

Property	Per batch	Per 10 batches
Hoses/hose assemblies (as appropriate)		
Visual examination (inside and outside)	X	X
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of concentricity	X	X
Proof test	X	X
Burst test	X	X
Change-in-length test	X	X
Minimum bend radius	X	X
Impulse test	N.A.	N.A.
Leakage test	X	X
Cold flexibility test	N.A.	N.A.
Ozone resistance test	N.A.	N.A.
Electrical conductivity (class 2 only)	N.A.	N.A.
Resistance to fluids		
Oil resistance test on cover	N.A.	N.A.
Oil resistance test on lining	N.A.	N.A.
Water based fluid resistance test on cover	N.A.	N.A.
Water based fluid resistance test on lining	N.A.	N.A.
Water resistance test on cover	N.A.	N.A.
Water resistance test on lining	N.A.	N.A.
N.A. = not applicable; X = test to be carried out.		