INTERNATIONAL STANDARD

ISO 23297

First edition
2008-12-15

Thermoplastics hoses and hose assemblies — Wire or synthetic yarn reinforced single-pressure types for hydraulic applications — Specification

Tuyaux et flexibles en matière thermoplastique — Types hydrauliques à pression unique, avec armature de fils métalliques ou synthétiques — Spécifications

Reference number
ISO 23297:2008(E)

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

Published in Switzerland

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 23297 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products,* Subcommittee SC 1, *Hoses (rubber and plastics)*.

Introduction

Based on the information received from plastics experts from the Netherlands and the UK, it was decided to exclude, for the time being, the abrasion resistance tests for compounds and hose cover from this International Standard.

However, the manufacturers of this product recognize the need for determining the abrasion resistance of the hose cover, as the users require it. ISO 6945 is being revised to include a special test for this property and an amendment to 7.2, setting standards of acceptability for performance of hoses, is planned.

Thermoplastics hoses and hose assemblies — Wire or synthetic yarn reinforced single-pressure types for hydraulic applications — Specification

1 Scope

This International Standard specifies requirements for eight classes and two types (construction with adhesive bond between layers and construction without adhesive bond between layers) of wire or synthetic yarn reinforced hydraulic hoses and hose assemblies of nominal size from 3,2 to 31,5. Each class has a single maximum working pressure for all sizes. Such hoses 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 for grades A and B and −40 °C to +120 °C for grades C and D.

This International Standard does not include requirements for end fittings. It is limited to the performance of hoses and hose assemblies. The hose assembly maximum working pressure is governed by the lowest maximum working pressure of the components.

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 1746, *Rubber or plastics hoses and tubing — Bending test*

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*

ISO 4892 (all parts), *Plastics — Methods of exposure to laboratory light sources*

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

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

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

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

3 Terms and definitions

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

4 Classification

4.1 Classes

Eight classes of hose are specified, distinguished by their maximum working pressure, as shown in Table 1. Each class may be manufactured in up to 10 nominal sizes.

Table 1 — Classes, nominal size and maximum working pressure

Class	35	70	140	210	280	350	420	560
MWP [a] (bar)	35	70	140	210	280	350	420	560
MWP [a] (MPa)	3,5	7	14	21	28	35	42	56
Nominal size								
3,2	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X
6,3	X	X	X	X	X	X	X	X
8	X	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X	X
12,5	X	X	X	X	X	X	X	X
16	X	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X	X
25	X	X	X	X	X	X	X	X
31,5	X	X	X	X	X	X	X	X

[a] Maximum working pressure.

4.2 Types

Two types are specified according to their construction: type 1 with adhesion between the layers; and type 2 without adhesion between the layers. In type 1 hoses, the lining and cover are adhesively bonded (i.e. only separable by force) to the reinforcement; in type 2 hoses, these layers are not attached to the reinforcement.

4.3 Grades

Hoses are classified according to their resistance to impulse into four grades: A, B, C and D, as shown in Table 2.

Table 2 — Grades

Grade	Resistance to impulse		
	Temperature °C	Impulse pressure (% of MWP [a])	Minimum number of cycles
A	100	133 %	200 000
B	100	133 %	500 000
C	120	133 % (classes 35, 70, 140, 210)	500 000
		120 % (classes 280, 350, 420, 560)	
D	120	133 % (classes 35, 70, 140, 210)	1 000 000
		120 % (classes 280, 350, 420, 560)	

[a] Maximum working pressure.

The maximum working pressure by class is shown in Table 3.

Table 3 — Maximum working pressure

Class	35	70	140	210	280	350	420	560
MWP [a] (bar)	35	70	140	210	280	350	420	560
MWP [a] (MPa)	3,5	7	14	21	28	35	42	56
Grade								
A	X	X	X	X	X	X	X	X
B	X	X	X	X	X	X	X	X
C	X	X	X	X	X	X	X	X
D	X	X	X	X	X	X	X	X
NOTE X = Applicable.								
[a] Maximum working pressure.								

5 Materials and construction

5.1 Hoses

Hoses shall consist of a hydraulic-fluid-resistant thermoplastic lining, one or multiple layers of steel wire or synthetic yarn and an oil- and weather-resistant thermoplastic cover. Other protective materials over the thermoplastic cover are allowed for improved abrasion or other resistance.

5.2 Hose assemblies

Hose assemblies shall only be manufactured with those hose fittings which conform to the requirements of 7.2.1, 7.2.4 and 7.2.5 of this International Standard.

Follow the manufacturer's instructions 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 the hoses shall conform to the values given in Table 4.

Table 4 — Diameters of hoses

Nominal size	Inside diameter (all classes) mm		Maximum outside diameter of hose mm							
	min.	max.	Class 35	Class 70	Class 140	Class 210	Class 280	Class 350	Class 420	Class 560
3,2	3,1	4,0	8	8	9	9,5	9,5	9,5	10,5	10,5
5	4,6	5,4	10	10	11	12	12	12	14	15
6,3	6,1	7,0	12	12	14	14	14	14	16	16
8	7,7	8,5	13	13	15,5	15,5 (16,6 [a])	16	16	17	17
10	9,3	10,3	16	16	17,5	18,5	19	19	20	21
12,5	12,3	13,5	20	20	21	23	23	23	24	25
16	15,5	16,8	23	23	25	27 (28 [a])	28	28	28	29
19	18,6	19,8	27	28	29	32	32	33	33	34
25	25,0	26,4	34	36	36	39 (40,4 [a])	39	40,5	40,5	43,5
31,5	31,4	33,0	45	45	46	48	49	50	50	51,5

[a] These dimensions are allowable for textile yarn braided reinforcement only; for metal wire braided reinforcement of other classes and sizes, the standard dimensions apply.

6.2 Outer cover thickness

When measured in accordance with ISO 4671, the outer cover thickness of the hoses shall conform to the values given in Table 5.

Table 5 — Outer cover thickness

Nominal size	Outer cover thickness mm	
	min.	max.
3,2	0,1	1,4
5	0,1	1,4
6,3	0,1	1,4
8	0,1	1,4
10	0,1	1,4
12,5	0,2	1,5
16	0,2	1,5
19	0,2	1,5
25	0,2	1,5
31,5	0,4	1,7

6.3 Concentricity

When measured in accordance with ISO 4671, the concentricity of the hoses shall conform to the values given in Table 6.

Table 6 — Concentricity of hoses

Nominal size	Maximum variation in wall thickness		
	Between internal diameter and outside diameter mm		Between internal diameter and outside diameter of the tubing mm
	Wire	Textile	
3,2, 5 and 6,3	0,5	0,8	0,2
over 6,3 and up to and including 19	0,8	1,0	0,5
25	1,1	1,3	0,6
31,5	1,2	1,3	0,7

7 Physical properties

7.1 Fluid and UV resistance of thermoplastic compounds

7.1.1 Fluid resistance

7.1.1.1 Test pieces

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

7.1.1.2 Oil resistance

For grades A and B, when tested 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, ΔV_{100}, shall be between −10 % and +35 %.

For grades C and D, when tested in accordance with ISO 1817 by immersion in IRM 903 oil for 168 h at a temperature of 120 °C, the percentage change in volume of the lining, ΔV_{100}, shall be between −10 % and +35 %.

For all grades, when tested 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, ΔV_{100}, shall be between −10 % and +35 %.

7.1.2 UV resistance

When tested in accordance with ISO 4892 (e.g. accelerated in a Xenotester capable of generating wave lengths 300 nm to 800 nm and 45 W/m^2, exposure time 400 h), the samples shall show no crack or other defects at visual examination (without magnification) when bent over 180° at the smallest possible radius.

7.2 Performance requirements

7.2.1 Hydrostatic requirements

When tested in accordance with ISO 1402, the maximum working pressure, the proof pressure and the minimum burst pressure of the hoses and hose assemblies shall conform to the values given in Table 7.

Table 7 — Maximum working pressure, proof pressure and minimum burst pressure

Class	Maximum working pressure		Proof pressure		Minimum burst pressure	
	bar	MPa	bar	MPa	bar	MPa
35	35	3,5	70	7,0	140	14,0
70	70	7,0	140	14,0	280	28,0
140	140	14,0	280	28,0	560	56,0
210	210	21,0	420	42,0	840	84,0
280	280	28,0	560	56,0	1 120	112,0
350	350	35,0	700	70,0	1 400	140,0
420	420	42,0	840	84,0	1 680	168,0
560	560	56,0	1 120	112,0	2 240	224,0

7.2.2 Change in length

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

7.2.3 Minimum bend radius

When determined in accordance with ISO 1746, the minimum bend radius shall conform to the values given in Table 8.

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

When bent to the minimum bend radius given in Table 8, measured on the inside of the bend, the flatness shall not exceed 10 % of the original outside diameter.

7.2.4 Resistance to impulse

7.2.4.1 The resistance to impulse shall be determined in accordance with ISO 6803. The test fluid temperature shall be 100 °C for grades A and B and 120 °C for grades C and D.

7.2.4.2 For grade A, when tested at impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 200 000 impulse cycles.

For grade B, when tested at impulse pressure equal to 133 % of the maximum working pressure, the hose shall withstand a minimum of 500 000 impulse cycles.

For grade C, when tested at impulse pressure equal to 133 % of the maximum working pressure (classes 35, 70, 140 and 210) or 120 % of the maximum working pressure (classes 280, 350, 420 and 560), the hose shall withstand a minimum of 500 000 impulse cycles.

For grade D, when tested at impulse pressure equal to 133 % of the maximum working pressure (classes 35, 70, 140 and 210) or 120 % of the maximum working pressure (classes 280, 350, 420 and 560), the hose shall withstand a minimum of 1 000 000 impulse cycles.

After the impulse test, carry out a leakage test at maximum working pressure for 5 min. There shall be no leakage or other malfunction.

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

7.2.4.4 This test shall be considered a destructive test and the test piece shall be destroyed.

7.2.5 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.

Table 8 — Minimum bend radius

Nominal size	Minimum bend radius mm							
	Class 35	Class 70	Class 140	Class 210	Class 280	Class 350	Class 420	Class 560
3,2	25	25	25	25	30	45	45	50
5	35	35	35	35	35	60	60	70
6,3	45	45	45	45	50	70	70	80
8	50	50	50	50	50	80	80	110
10	60	60	75	75	75	110	110	150
12,5	75	75	90	90	90	150	150	175
16	110	110	125	125	125	175	175	225
19	170	170	185	185	185	200	225	250
25	230	230	250	250	250	260	275	310
31,5	280	300	320	320	320	340	375	440

7.2.6 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.

7.2.7 Adhesion between components (applicable to type 1 hoses only)

The requirement for adhesion between components depends on the hose construction (material of reinforcement) and the application of the hose (there are applications where adhesion between components is not necessary and reinforcement materials where achieving adhesion between lining and reinforcement is not possible). The service conditions determine which type of construction: type 1 (bonded) or type 2 (non-bonded) is chosen for the application of the hose assembly.

When tested in accordance with ISO 8033, the adhesion between lining and reinforcement shall not be less than 0,8 N/mm (for hoses of type 1 construction, e.g. when vacuum in the bore may occur during service) and the adhesion between cover and reinforcement shall also be not less than 0,8 N/mm.

7.2.8 Vacuum resistance

When tested in accordance with ISO 7233, hoses and hose assemblies shall conform to the values given in Table 9. This requirement is applied to all classes and bore diameters of type 1 hoses only.

Table 9 — Degree of vacuum

Nominal size	Negative gauge pressure (classes 35 to 520 inclusive) bar [a]
3,2 to 31,5 inclusive	−0,8
[a] 0,1 bar = 10 kPa.	

7.2.9 Ozone resistance

When tested in accordance with method 1 or 2 of ISO 7326:2006, no cracking or deterioration of the cover shall be visible under × 2 magnification.

8 Frequency of testing

Type testing and routine testing shall be as specified in Annex A.

Type tests are those tests required to confirm that a particular hose meets all the requirements of this International Standard. Type testing shall be repeated at a minimum every five years or whenever a change in the method of manufacture or materials occurs. Type testing shall be performed on all sizes, classes, types and grades of each design in manufacture'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 for guidance only.

9 Marking

9.1 Hoses

Hoses shall be marked with at least the following information, and the marking shall be repeated every 760 mm or less:

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

b) the number of this International Standard, i.e. ISO 23297;

c) the type and grade, e.g. 1A;

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

e) maximum working pressure in bar, e.g. 280 bar;

f) the quarter and last two digits of year of manufacture, e.g. 1Q08.

EXAMPLE XXX/ISO 23297/1A/16/280bar/1Q08

9.2 Hose assemblies

The hose assemblies shall be permanently marked, preferably on the hose fittings or on a metal ring adjacent to the fitting, with at least the following information:

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

b) the part number or identification number (when required by national legislation only), e.g. YYY;

c) the maximum working pressure [1)] of the assemblies, in bar, e.g. 16;

---

1) The maximum working pressure (MWP) of the assembly is the lowest maximum working pressure of any of its components. The MWP of a hose assembly comprising ISO hose and ISO hose fittings shall not exceed the lower of the respective ISO maximum working pressure values.

d) last two digits of month and year of assembly, e.g. 02/08.

EXAMPLE XXX/YYY/16/02/08

10 Recommendations for packaging and storage

These are given in ISO 8331.

11 Test report

When requested by the purchaser, the manufacturer or supplier shall provide a test report with each length or batch (specify size of batch) of hoses or hose assemblies supplied to the purchaser, identifying each hose length or assembly positively, including identification as marked on the hose, the lot number and the client's order number (serial numbers when applicable).

Annex A
(normative)

Type tests and routine tests

Table A.1 gives the tests to be carried out for type testing and routine testing as defined in Clause 8.

Table A.1 — Frequency of testing

Property	Type testing	Routine testing
Compound tests		
Oil resistance test for cover compound material	X	N/A
Oil resistance test for lining compound/material	X	N/A
UV resistance test for cover compound/material	X	N/A
Hose tests		
Visual examination (inside and outside)	X	X
Measurement of inside diameter	X	X
Measurement of outside diameter	X	X
Measurement of outer cover thickness	X	X[b]
Measurement of concentricity	X	X[b]
Minimum bend radius test	X	X[b]
Proof test	X	X
Burst test[a]	X	X[b]
Change in length test	X	X[b]
Impulse test	X	N/A
Leakage test[a]	X	X[b]
Cold bend test	X	N/A
Adhesion	X	X[b]
Vacuum test (type 1 only)	X	N/A
Ozone resistance test of cover	X	N/A
UV resistance test for cover	X	N/A
UV resistance test of hose sample	X	N/A

NOTE X = Test to be carried out; N/A = Not applicable

[a] Burst test and leakage test can be performed on a suitable length of sample fixed in a test rig.

[b] Routine tests to be carried out on a sample of every 3 000 m produced or less (in case of shorter production runs).