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Rubber and plastics hoses and hose assemblies, wire- or textile-reinforced, for hydraulic power units used in heavy duty hydraulic tool applications — Specification

Tuyaux et flexibles en caoutchouc et en plastique, à armature textile ou métallique, pour des applications de vérin hydraulique — Spécifications

Reference number
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Foreword

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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).

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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.

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

Rubber and plastics hoses and hose assemblies, wire- or textile- reinforced, for hydraulic power units used in heavy duty hydraulic tool applications — Specification

1 Scope

This document specifies the requirements for wire- or textile-reinforced hydraulic hose and hose assemblies used in heavy duty hydraulic tool applications of sizes ranging from 5 to 10. They are suitable for use with hydraulic fluids HH, HL, HM, HR and HV in accordance with ISO 6743-4 at temperature ranging from –20 and +55 °C.

This document does not include requirements for the connection ends. It is limited to the performance of hoses and hose assemblies. The hose assembly maximum working pressure is regulated by the lowest maximum working pressure of the components.

Typical usage of this product includes, but is not limited to, applications where the hose is in close proximity to the operator, such as rescue tools and electrical utilities service tools, using hydraulic power units (electrical, pneumatic, etc.).

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, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 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 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 7326:2016, *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 — Guidelines for selection, storage, use and maintenance*

ISO 10619-1, *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*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

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:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Classification

All hoses are classified on their electrical properties using grades:

a) Grade 1, no electrical requirements.

b) Grade 2, “non-conductive”.

Non-conductive means the current reading shall be no greater than 50 µA when tested in accordance with Annex D.

5 List of significant hazards

5.1 General

This clause contains some of the significant hazards, hazardous situations and events, as far as they are dealt with in this document, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

5.2 Hazards due to bursting or leaking of hoses

Hazards can occur when a hose bursts or leaks. The escaping stream of liquid can cause personal injury or property damage. See Figure 1.

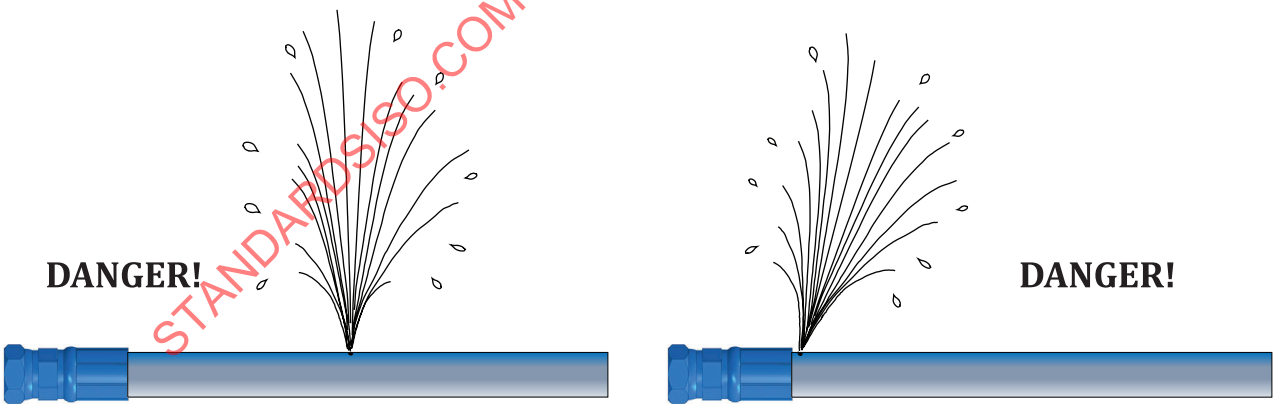


Figure 1 — Hazards due to bursting or leaking of hoses

5.3 Hazards due to failure of connectors

Hazards can occur when a connector fails. The escaping stream of liquid can cause physical damage and also a sudden repositioning of the hose assembly in a dangerous manner (whip). See Figure 2.

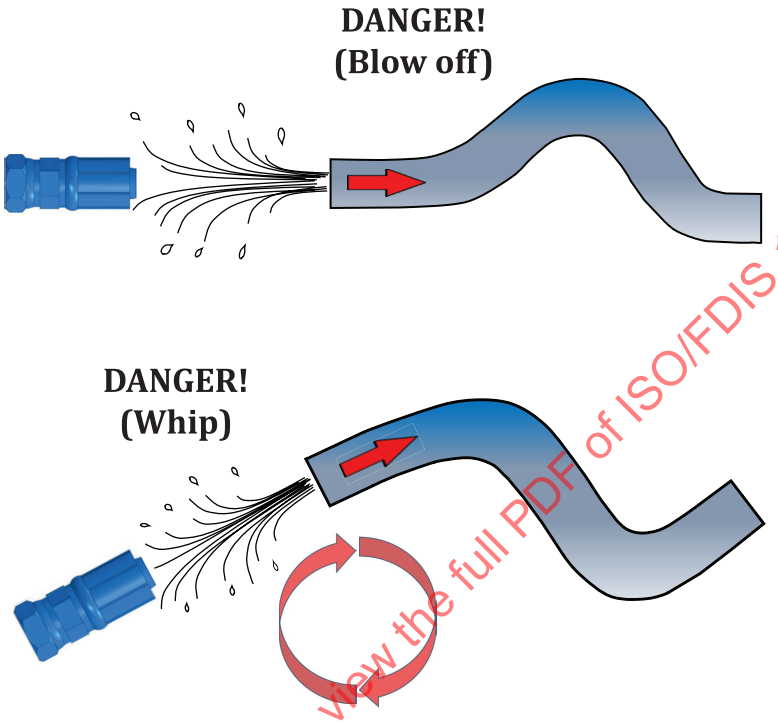


Figure 2 — Hazards due to failure of connectors

5.4 Hazards due to errors by the operator

Hazards can occur if the operator uses incompatible substances or incompatible components. Hazards can also occur if the operator exceeds the limits of use specified by the manufacturer (e.g. too high pressure, too high tensile stress), also pinhole caused by kink might result in a significant injury. See Figure 3.

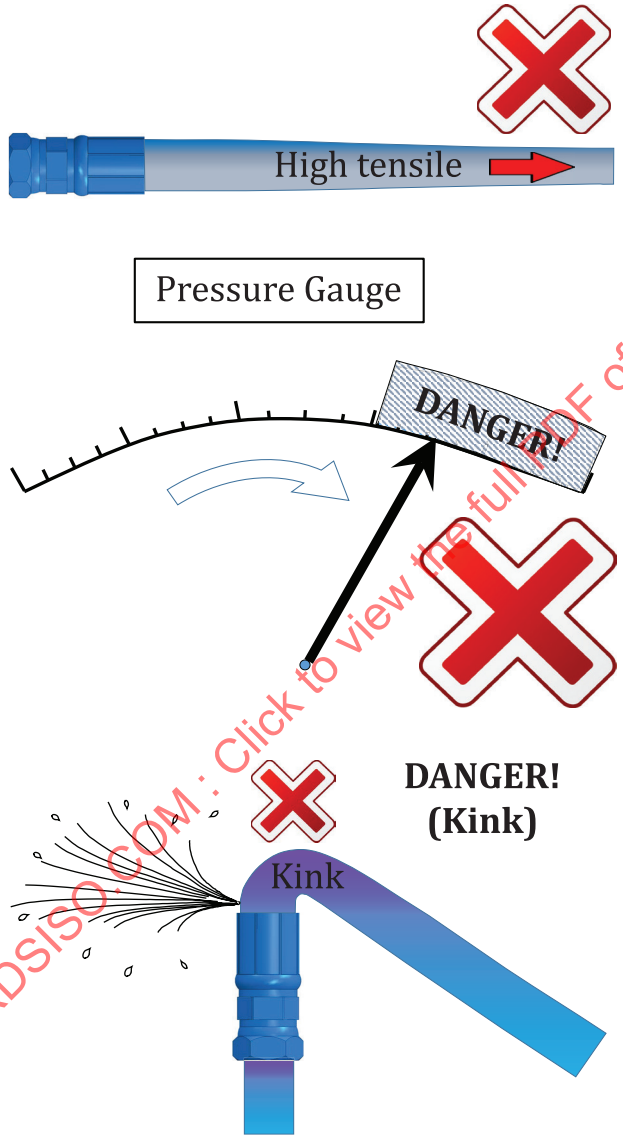


Figure 3 — Hazards due to errors by the operator

5.5 Hazards due to change in length of hose assembly

Hazardous situations occur when there is a sudden change of pressure in the hose assembly causing a change in length resulting in the operators losing their firm hold. See Figure 4.

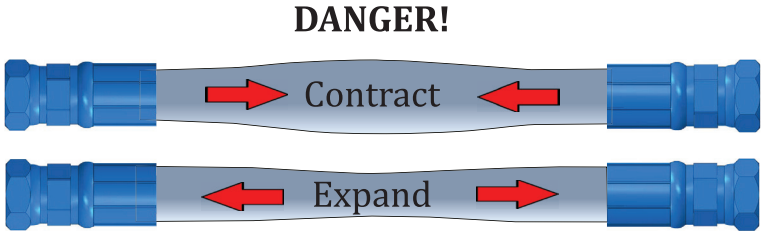


Figure 4 — Hazards due to change in length of hose assembly

6 Safety requirements and/or protective measures

6.1 General

Hoses, hose assemblies and their connectors shall comply with the safety requirements and/or protective measures of this clause. In addition, they shall be designed according to the principles of ISO 12100 for relevant, but not significant hazards, which are not dealt with in this document.

Hoses, hose assemblies and connectors shall feature a certain structure in order to guarantee safe operation when used properly. They shall not bear any risks for the operator or for the workplace and its environment.

The design of any connector safety devices shall provide safe operational performance to eliminate any risk or hazard for the operators or their environment. However, improper use of a hose assembly or the connectors may result in hazardous situations and shall be avoided.

Correct assembly of hose assemblies requires specific knowledge and skills and also specific equipment.

6.2 Requirements for compatibility of components

The hoses and connectors combined into hose assemblies shall match each other in terms of structure, composition and design.

NOTE Hoses of one manufacturer do not necessarily match connectors of another manufacturer.

7 Materials and construction

7.1 Hoses

Hoses shall consist of a hydraulic fluid resistant rubber or plastic lining, one or multiple layers of steel wire or textile and an oil, abrasion and weather resistant rubber or plastic cover. A layer of other materials on the cover are allowed for improved abrasion resistance or other resistance.

7.2 Hose assemblies

Hose assemblies shall only be manufactured with those hose fittings whose functionality conforms to the requirements of this document.

Hose assemblies shall be provided with an anti-kink protection at each end, e.g. spring guards.

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

8 Dimensions and tolerances

8.1 Diameters

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

Table 1 — Diameters of hoses

Nominal size	Inside diameter mm		Maximum outside diameter mm
	Min.	Max.	
5	4,6	5,4	17
6,3	6,1	7,0	20
8	7,7	8,5	22
10	9,3	10,1	24

8.2 Cover thickness

When measured in accordance with ISO 4671, the outer cover thickness of the hoses shall be between 0,5 mm and 1,5 mm.

8.3 Concentricity

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

Table 2 — Concentricity of hoses

Nominal size	Maximum variation in wall thickness	
	Between inside diameter and outside diameter mm	Between inside diameter and reinforcement diameter mm
5 and 6,3	0,8	0,5
over 6,3 and including 10	1,2	0,7

9 Physical properties

9.1 Fluid resistance

9.1.1 Test pieces

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

9.1.2 Oil resistance

When tested in accordance with ISO 1817, by immersion in oil No. 3 for 168 h at a temperature of 55 °C, the percentage change in volume of the lining ΔV shall be between –10 % and +60 %.

When tested in accordance with ISO 1817, by immersion in oil No. 3 for 168 h at a temperature of 55 °C, the percentage change in volume of the cover ΔV shall be between –10 % and +100 %.

9.2 Performance requirements

9.2.1 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 3.

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

Nominal size	Maximum working pressure		Proof pressure		Minimum burst pressure	
	MPa	bar	MPa	bar	MPa	bar
5	70	700	140	1 400	280	2 800
6,3	70	700	140	1 400	280	2 800
8	70	700	140	1 400	280	2 800
10	70	700	140	1 400	280	2 800

All hose assemblies shall be subjected to the proof pressure test with a pressure hold time of 1 min. Any deviations to this requirement shall be agreed between hose assembly manufacturer and purchaser.

9.2.2 Change in length

When tested in accordance with ISO 1402, the change in length of hose at the maximum working pressure shall not exceed +2 % to –2 % for rubber and plastic hoses.

9.2.3 Minimum bend radius

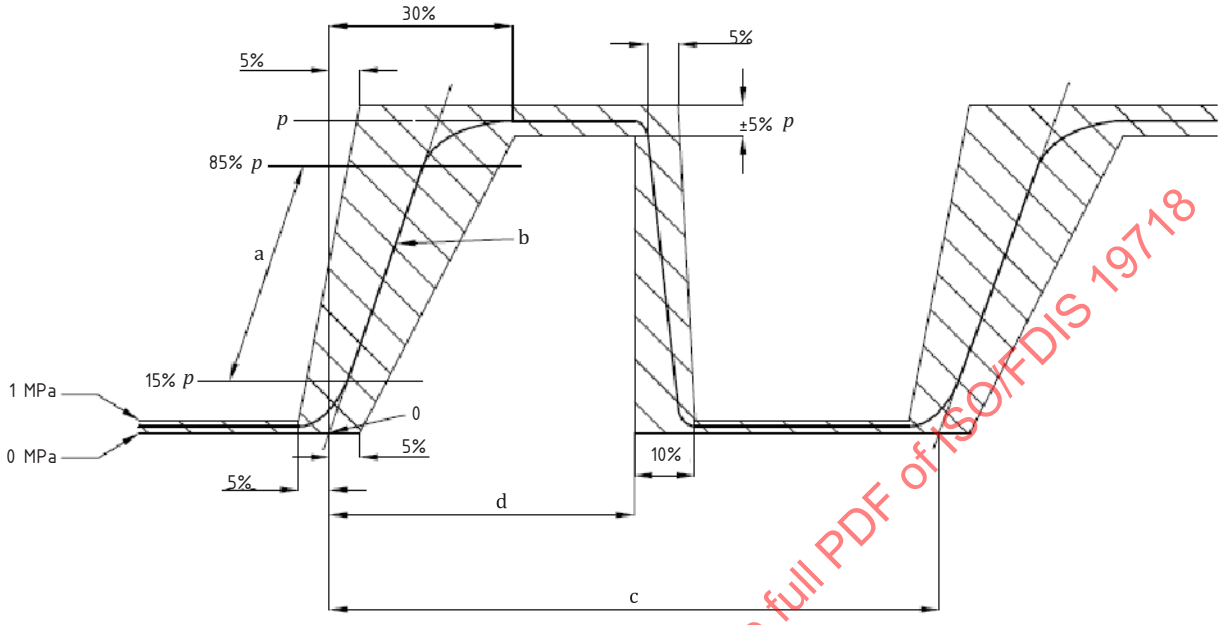
Hoses shall conform to the minimum bend radius values given in Table 4, when tested in accordance with ISO 10619-1.

Table 4 — Minimum bend radius

Nominal size	Minimum bend radius mm
5	70
6,3	70
8	100
10	110

9.2.4 Resistance to impulse

9.2.4.1 When tested in accordance with ISO 6803, the test fluid temperature shall be 55 °C. The pressure rise shall be contained within the wave form envelope shown in Figure 5.



Key

p test pressure

a Rate of rise to be determined between these points.

b Secant pressure rise.

c One pulse cycle (0,2 Hz to 0,5 Hz).

d 45 % to 55 % of the cycle.

Figure 5 — Pressure pulse wave

9.2.4.2 When tested at impulse pressure equal to 133 % of the maximum working pressure, the hose assemblies shall withstand a minimum of 200 000 impulse cycles.

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

9.2.4.4 This test shall be considered a destructive test and the test pieces shall be discarded.

9.2.5 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 pieces shall be discarded.

9.2.6 Cold flexibility

When tested in accordance with method B of ISO 10619-2:2011 at a temperature of –20 °C there shall be no cracking of the lining or cover. The test pieces shall not leak or crack when subjected to a proof pressure test in accordance with ISO 1402 after regaining ambient temperature.

9.2.7 Ozone resistance

When tested in accordance with Method 1 or 2 of ISO 7326:2016, no cracking or deterioration of the cover shall be visible under ×2 magnification.

9.2.8 Electrical conductivity

This test applies to Grade 2 hose assemblies only (this test shall not be applied to hoses with a perforated cover).

When tested in accordance with Annex D, the current reading shall be no greater than 50 µA.

9.3 Frequency of testing

The minimum frequency of testing shall conform to the schedule given in Annex A.

Type tests are those tests carried out in order to verify that the hose meets all requirements of this document.

Routine tests are those tests carried out on each length of finished hose.

Production tests are those tests carried out per batch. Schedule given in Annex B is for guidance only.

10 Type tests

Type testing is carried out in order to confirm that all the materials, construction and test requirements of this document have been met by the method of manufacture and hose design.

Type testing shall be repeated at least every five years or whenever a change in the method of manufacture or materials occurs.

Type testing shall be performed for all sizes, classes and types except those of same size and construction.

11 Marking

11.1 Hoses

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

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

b) the number of this document, i.e. ISO 19718;

c) for Grade 2 hoses the words ”non-conductive” shall appear in each marking;

d) nominal size, e.g. 10;

e) maximum working pressure, in megapascals and in bars, or either, with units indicated, e.g. 70 MPa (700 bar); and

f) quarter and last two digits of year of manufacture, e.g. 2Q17.

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.

EXAMPLE 1 XXX/ISO 19718/10/70 MPa (700 bar)/2Q17.

EXAMPLE 2 XXX/ISO 19718/non-conductive/10/70 MPa (700 bar)/2Q17.

11.2 Hose assemblies

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

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

b) maximum working pressure of the assemblies, in megapascals and in bars, or either, with units indicated, e.g. 70 MPa (700 bar); and

NOTE The maximum working pressure of the assembly is the lowest maximum working pressure of any of its components.

c) month and last two digits of year of assembly, e.g. 02/16.

EXAMPLE XXX/70 MPa (700 bar)/02/16

12 Test report

When requested by the purchaser, the manufacturer or the supplier shall supply a test report representing the purchased product (each length or batch of hoses or hose assemblies).

13 Recommendations for packaging and storage

These are given in ISO 8331.

Recommendations for lengths of supplied hoses and hose assemblies are given in Annex C.

Annex A
(normative)

Test frequency

Table A.1 gives the frequency of testing for type tests and routine tests (see 9.3 and Clause 10 for description of these tests).

Table A.1 — Test frequency for type tests and routine tests

Property	Type tests Frequency: at initial product qualification, in the event of product changes after initial qualification and after 5 years	Routine tests Performed on each length of hose or each hose assembly
Compound tests	**Per length**	
Oil resistance test for cover	X	N/A
Oil resistance test for lining	X	N/A
Hose tests	**Per length**	
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
Measurement of concentricity	X	X
Proof pressure test	X	X
Burst test	X	N/A
Change in length test	X	N/A
Minimum bend radius	X	N/A
Cold bend test	X	N/A
Ozone resistance test	X	N/A
Hose assembly tests	**Per assembly**	
Proof pressure test	X	X
Burst test	X	N/A
Impulse test	X	N/A
Leakage test	X	N/A
Electrical conductivity (Grade 2 only)	X	N/A
X = Test required N/A = Test not applicable.		

Annex B
(informative)

Production tests

Table B.1 gives the suggested frequency for production tests (see 9.3), to be carried out per batch or per 10 batches.

A batch is defined as 3 000 m of hose.

Table B.1 — Recommended test frequency

Property	Production tests	
	Per batch	Per 10 batches
Compound tests		
Oil resistance test for cover	N/A	N/A
Oil resistance test for lining	N/A	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
Measurement of concentricity	X	X
Proof pressure test	X	X
Burst test	X	X
Change in length test	X	X
Cold bend test	N/A	X
Ozone resistance test	N/A	N/A
Hose assembly tests		
Proof pressure test	X	X
Burst test	X	N/A
Impulse test	N/A	N/A
Leakage test	X	N/A
Electrical conductivity (Grade 2 only)	X	N/A
X = Test required, N/A = Test not applicable.		