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Thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of hydrocarbons, solvents and chemicals — Specification

Tuyaux et flexibles multicouches (non vulcanisés) thermoplastiques pour le transfert des hydrocarbures, des solvants et des produits chimiques — 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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of 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 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*.

This second edition cancels and replaces the first edition (ISO 27126:2014), which has been technically revised, based on EN 13765:2018.

The main changes compared to the previous edition are as follows:

— the normative references have been updated and changed (Clause 2);

— lower minimum and/or higher maximum temperature have been added upon agreement with the manufacturer (Clause 4);

— some austenitic steel wire has been added (Clause 5);

— change in length and twist at proof pressure instead maximum working pressure have been modified (Clause 7);

— the electrical resistance requirement between end fittings has been modified (Clause 7);

— marking of the hose and assembly has been updated (Clause 10);

— in Annex D, thickness has been replaced by outside diameter (equals to the distance between the two plates) and tolerances on test force have been added;

— in Annex H, requirements have been added;

— in Annex K and Annex L, tests requirements have been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of hydrocarbons, solvents and chemicals — Specification

WARNING — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to determine the applicability of any other restrictions.

1 Scope

This document specifies requirements for four types of thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for carrying hydrocarbons, solvents and chemicals. It specifies bore sizes from 25 mm to 300 mm, working pressures from 0,4 MPa (4 bar) to 1,4 MPa (14 bar) and working temperatures from −30 °C to 150 °C, according to type.

Type 1 hoses are suitable for vapour applications. Types 2 to 4 hoses are suitable for liquid applications.

NOTE 1 See Annex A concerning the selection of the material for the inner wall of layers and any polymeric coating of the internal wire helix related to the chemical(s) to be conveyed by the hoses and/or hose assemblies.

NOTE 2 It is intended that the manufacturer be consulted where a polymeric coated internal wire is being considered for use with low conductivity hydrocarbons or chemicals.

This document does not apply to hoses and hose assemblies for:

— aircraft refuelling (see ISO 1825);

— fuel dispensing (see ISO 5772);

— oil burners (see ISO 6806);

— liquefied petroleum gas and liquefied natural gas (see ISO 27127);

— fire fighting (see ISO 14557);

— offshore liquefied natural gas (see EN 1474-2);

— refrigeration circuits.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 209, *Aluminium and aluminium alloys — Chemical composition*

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1402:2021, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1817:2015, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 2411, *Rubber- or plastics-coated fabrics — Determination of coating adhesion*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 7233:2021, *Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum*

ISO 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8031:2020, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

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

ISO 10619-1, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

ISO 10619-2, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

ISO 16143-3:2014, *Stainless steels for general purposes — Part 3: Wire*

EN 590, *Automotive fuels — Diesel — Requirements and test methods*

EN 10088-3:2014, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

4 Classification

Hoses shall be classified according to working pressure and working temperature range as given in Table 1.

Table 1 — Pressure and temperature range

	Type 1		Type 2		Type 3		Type 4	
	MPa	bar	MPa	bar	MPa	bar	MPa	bar
Maximum working pressure	0,4	4	1,0	10	1,4	14	1,4	14
Proof pressure	0,6	6	1,5	15	2,1	21	2,1	21
Minimum burst pressure	1,6	16	4	40	5,6	56	5,6	56
Vacuum rating	0,05	0,5	0,09	0,9	0,09	0,9	0,09	0,9
Working temperature range (°C)	−20 to +60		−30 to +80		−30 to +80		−30 to +150	
NOTE 1 bar = 0,1 MPa.								

Upon agreement with the manufacturer, lower minimum and/or higher maximum temperature are allowed depending on the materials used and the compatibility with the fluid conveyed at those temperatures. Other properties and requirements mentioned in this document shall be met.

5 Materials and construction

5.1 General

Hoses shall be constructed as shown in Figure 1 and shall consist of the following:

— an internal wire helix (see 5.2);

— a multi-ply wall of layers of films and fabrics made of thermoplastics that in combination give the required properties and provide a complete seal (see also Annex A);

— a cover consisting of a fabric with abrasion resistant polymeric coating;

— an external wire helix (see 5.2).

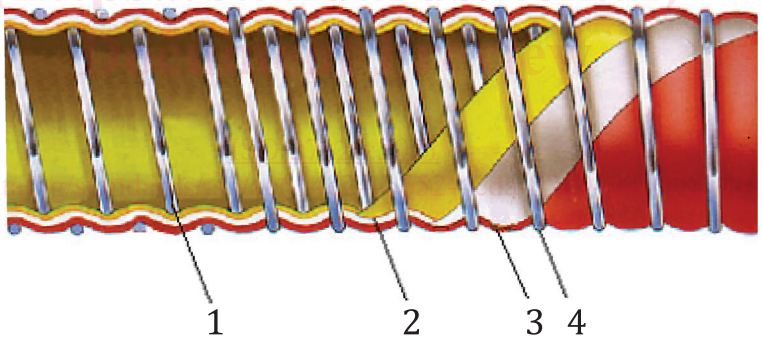
5.2 Internal and external wire

Wire shall be chosen in accordance with its chemical resistance from one of the following materials:

— austenitic stainless-steel wire conforming to EN 10088-3:2014, Table 2, numbers 1.4306, 1.4401, 1.4404 or 1.4436 (X3CrNiMo17-13-3) or ISO 16143-3:2014, Table 1: X2CrNi19-11, X5CrNiMo17-12-2, X2CrNiMo17-12-2;

— carbon steel wire conforming to Annex B and either galvanised in accordance with Annex C or sheathed in a polymeric material of a minimum wall thickness of 0,5 mm, resistant to liquid hydrocarbon or liquid chemicals as agreed between purchaser and manufacturer (see Annex A);

— aluminium wire conforming to ISO 209.



Key

1 internal wire
2 film
3 fabric
4 external wire

Figure 1 — Section of a typical thermoplastic multi-layer hose

6 Dimensions

6.1 Inside diameters, with tolerances and minimum bend radii

When measured in accordance with ISO 4671, the value of the inside diameter of the hose shall conform to Table 2. When tested by the method specified in ISO 10619-1 the value of the minimum bend radius shall be as given in Table 2. The hose shall show no sign of permanent deformation of the cross-section i.e. kinking.

Table 2 — Dimensions and minimum bend radii

Dimensions in millimetres, except where specified as "inch"

Inside diameter		Tolerance	Minimum bend radii			
			Type 1	Type 2	Type 3	Type 4
mm	inch					
25	1	±1	125	125	200	200
32	1 1/4	±1	150	150	200	200
38	1 1/2	±1	150	150	200	200
40	1 1/2	±1	150	150	200	200
50	2	±1	200	200	225	225
65	2 1/2	±2	200	200	225	225
75	3	±2	280	280	300	300
80	3	±2	300	300	350	350
100	4	±2	400	400	400	400
125	5	±2	500	500	500	—
150	6	±2	575	575	575	—
200	8	±3	800	800	800	—
250	10	±3	1 000	1 000	1 000	—
300	12	±3	1 200	1 200	1 200	—

6.2 Tolerance on length

When tested in accordance with ISO 4671, the tolerance on the measured length of delivered hose assemblies shall be +2 % to –1 %.

7 Performance requirements of hoses and hose assemblies

7.1 Cover

When tested in accordance with ISO 2411, the adhesion between the fabric used for the outer cover and its abrasion resistant coating shall be not less than 1,5 kN/m.

7.2 Hoses

When tested in accordance with the methods given in Table 3, the physical properties of the hoses shall conform to Table 3.

Table 3 — Physical properties of hoses

Property	Unit	Requirements	Method(s)
Proof pressure	MPa (bar)	No leakage or other signs of damage at pressure given in Table 1.	ISO 1402 with pressure increase not less than 0,17 MPa/min (1,7 bar/min)
Change in length at proof pressure (max.)	%	10	ISO 1402:2021, 8.2 with the initial length measured when the hose is pressurized to 0,07 MPa (0,7 bar) for 2 min
Twist at proof pressure (max.)	°/m	10	ISO 1402:2021, 8.2 with the initial reading taken when hose is pressurized to 0,07 MPa (0,7 bar) for 2 min

Table 3 *(continued)*

Property	Unit	Requirements	Method(s)
Burst pressure	MPa (bar)	≥ values in Table 1	ISO 1402
Bend	—	No leakage or visible damage when the hose is bent to the radius given in Table 2 and subjected to proof pressure.	ISO 10619-1
Vacuum	MPa (bar)	No damage after 30 min when subjected to values in Table 1.	ISO 7233:2021, method B
Crush recovery (max.)	%	3	Annex D
Fuel resistance	MPa (bar)	No leakage at proof pressure	Annex E
Thermal ageing	—	No leakage at proof pressure given in Table 1.	Annex F
Flammability	—	See Annex G.	Annex G
Low temperature flexibility	—	Test at minimum temperature given in Table 1	ISO 10619-2
Ozone resistance 72 h at 40 °C (cover only)	—	No cracks observed at × 2 magnification	ISO 7326:2016, method 3

7.3 End fittings

End fittings shall be made from materials depending on their chemical resistance to the product conveyed.

For all types of end fittings, the part of the fitting that enters the hose and forms the means by which the fitting is connected to the hose shall be provided with scrolls or protrusions on the surface that correspond to the pitch of the internal helix wire of the hose.

7.4 Hose assemblies

Hose assemblies shall be fitted with end fittings as described in 7.3.

End fittings shall be attached to the hose by one of the following methods:

a) by the use of a seal and a metal ferrule which is swaged or crimped;

b) by the use of a thermoset resin or multi-components e.g. epoxy and a metal ferrule that is swaged or crimped.

When tested in accordance with the methods given in Table 4, the physical properties of hose assemblies shall conform to Table 4.

Table 4 — Physical properties of hose assemblies

Property	Unit	Requirements	Method(s)
Proof pressure[a]	MPa (bar)	No leakage or other signs of weakness at pressure given in Table 1	ISO 1402 with pressure increase not less than 0,17 MPa/min (1,7 bar/min)
Bend	—	No leakage or visible damage when the hose is bent to the radius given in Table 2 and subjected to proof pressure	ISO 10619-1
Series of hydrostatic tests	MPa (bar) % °/m	≥ burst pressure given in Table 1 change in length given in Table 3 twist as given in Table 3	Annex H
Security of end fitting	MPa (bar)	No leakage at proof pressure given in Table 1	Annex I and ISO 1402
Electrical resistance between end fittings	Ω	< 100 Ω per assembly	ISO 8031:2020, 4.8.1
Burst pressure[b]	MPa (bar)	≥ value given in Table 1	ISO 1402
Leak tightness	—	No leakage of air when subjected to 0,35 MPa (3,5 bar) for 5 min	Annex J

[a] If the maximum working pressure of the fittings is lower than the maximum working pressure of the hose, the proof pressure of the hose assembly shall be reduced to 1,5 time of the maximum working pressure of the fittings.

[b] If the maximum working pressure of the fittings is lower than the maximum working pressure of the hose, the burst pressure of the hose assembly shall be reduced to 4 times of the maximum working pressure of the fittings.

7.5 Electrical continuity

There shall be electrical continuity between both internal and external wires and the end fittings. Where a wire is sheathed in polymeric material the sheath shall be stripped back for some of the length that engages with the fittings or the ferrule to ensure continuity.

Manufacturers shall demonstrate by testing or calculation that the measured overall electrical resistance of the hose assembly incorporates both internal and external wires being part of the circuit.

For the transfer of non conductive fluids the use of a hose with a non polymeric coated internal wire should be considered.

8 Test frequency

Routine tests shall be carried out on each hose assembly and in accordance with Annex K, Table K.1.

It is recommended that batch tests are carried out for every 10 000 m of manufacture or once a year, varying the sizes and types and in accordance with Annex L, Table L.1.

9 Type tests

Type tests are those tests carried out to determine that the hose assembly design, materials and methods of manufacture confirm that the hose or hose assembly meets all the requirements of this document.

Type tests shall be carried out on at least three sizes of hose including the smallest and the largest size of each type in the manufacturer's range.

Type tests shall be repeated and the results recorded at least once every five years or whenever a change in the materials and/or method of manufacture is made.