INTERNATIONAL STANDARD

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Thermoplastic tubing and hoses for automotive use —

Part 1: Non-fuel applications

Tubes et tuyaux en thermoplastique pour l'industrie automobile — Partie 1: Applications sans carburant

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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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The committee responsible for this document is 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 13775-1:2000), which has been technically revised.

ISO 13775 consists of the following parts, under the general title *Thermoplastic tubing and hoses for automotive use*:

— *Part 1: Non-fuel applications*

— *Part 2: Petroleum-based-fuel applications*

Annex A, Annex B, and Annex F of this part of ISO 13775 are for information only.

Introduction

This part of ISO 13775 defines the requirements of extruded thermoplastic tubing/hoses for non-fuel applications for automotive use. In addition, it can also be applied as a classification system to enable original equipment manufacturers (OEMs) to detail a "line call-out" of tests for specific applications where these are not covered by the four main types (see example in Annex A). In this case, the tubing or hose would not carry any marking showing this part of ISO 13775, but may detail the OEM's own identification markings as shown on their part drawings.

Thermoplastic tubing and hoses for automotive use —

Part 1:
Non-fuel applications

WARNING — Persons using this part of ISO 13775 should be familiar with normal laboratory practice. This part of ISO 13775 does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This part of ISO 13775 specifies the test requirements and the test methods for extruded thermoplastic tubing and hoses for use in vehicles powered by internal-combustion engines, excluding use in air braking systems (see ISO 7628), fuel lines (see ISO 13775-2), and high-pressure hydraulic systems. This part of ISO 13775 is intended especially for use by original equipment manufacturers (OEMs).

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 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

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

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

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 3865:2005, *Rubber, vulcanized or thermoplastic — Methods of test for staining in contact with organic material*

ISO 4926, *Road vehicles — Hydraulic braking systems — Non-petroleum-base reference fluids*

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

ISO 7628:2010, *Road vehicles — Thermoplastics tubing for air braking systems*

ISO 8031:2009, *Rubber and plastics hoses and hose assemblies — Determination of electrical resistance and conductivity*

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

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

ISO 30013, *Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties*

3 Classification and materials

The product shall consist of an extruded thermoplastic material with or without an integral reinforcement. The product may also have an inner veneer to impart improved fluid resistance and/or heat resistance. It may also have an extruded outer cover to improve environmental resistance and/or flame resistance. The outer cover is not necessarily bonded to the tubing or hose.

Four types of tubing and hose for specific applications are specified as follows:

— Type 1: Tubing or hose for vacuum and electronic control;

— Type 2: Tubing or hose for coolant systems;

— Type 3: Tubing or hose for screen/headlamp wash systems;

— Type 4: Tubing or hose for exhaust gas recirculation systems.

4 Dimensions

Diameters and wall thicknesses shall be as given in Table 1.

The wall thickness shall be the sum of the individual thicknesses of the various elements in the construction of the tubing or hose. The thickness of each individual element shall be such that it is able to carry out its own function and the total function of the tubing or hose.

Table 1 — Nominal sizes, internal diameters, and wall thicknesses

Nominal size	Internal diameter mm	Wall thickness (min.) mm
2	2 ± 0,1	0,9
4	4 ± 0,1	0,9
6	6 ± 0,1	0,9
6	6 ± 0,1	1,35
7,5	7,5 ± 0,1	1,12
8	8 ± 0,1	0,9
8	8 ± 0,1	1,35
9	9 ± 0,1	1,35
10	10 ± 0,1	1,8
12	12 ± 0,1	1,35
12	12 ± 0,1	1,8
14	14 ± 0,1	1,8

5 Requirements

The following tests shall be selected for each application of the tubing or hose based on the performance requirements of the finished product. All tests shall be carried out without the unbonded protective cover.

a) Burst pressure: When determined in accordance with ISO 1402, the minimum burst pressure for all constructions shall be 2 MPa gauge (20 bar).

b) Proof pressure: When determined in accordance with ISO 1402, the proof pressure for all constructions shall be 1 MPa gauge (10 bar).

c) Cold impact resistance: After cold impact testing at −40 °C in accordance with ISO 7628:2010, 9.3, all constructions shall show no evidence of external fracture or cracking and shall meet the burst pressure requirements of a).

d) Heat ageing resistance: After ageing at one or more of the following sets of conditions in accordance with ISO 188, all constructions shall meet the cold impact requirements of c).

1) 1 000 h at 70 °C.

2) 1 000 h at 100 °C.

3) 1 000 h at 125 °C.

4) 1 000 h at 135 °C.

5) 168 h at 100 °C.

6) 168 h at 125 °C.

7) 168 h at 140 °C.

8) 168 h at 150 °C.

e) Resistance to light: All constructions shall meet the cold impact requirements of b) after 1 000 kJ/m^2 xenon-arc exposure in accordance with ISO 30013.

NOTE This test is for applications that require exposure to daylight either during normal vehicle usage or on chassis that may be stored in the open air prior to final assembly of the vehicle.

f) Resistance to surface contamination by fuels: When tested in accordance with Annex B using the following test fuels as specified, all constructions shall meet the cold impact requirements of c) and the adhesion requirements of l), where applicable.

1) A mixture of 85 % by volume of liquid C (ISO 1817) and 15 % by volume of methanol.

2) A mixture of 15 % by volume of liquid C (ISO 1817) and 85 % by volume of methanol.

3) Liquid F (ISO 1817) (simulated diesel fuel).

g) Resistance to engine coolant.

1) Surface contamination: When tested in accordance with Annex B using a mixture of 50 % by volume of water and 50 % by volume of ethane-1, 2-diol, all constructions shall meet the cold impact requirements of c) and the adhesion requirements of l), where applicable.

2) Long-term resistance: When filled with a mixture of 50 % by volume of water and 50 % by volume of ethane-1, 2-diol and aged for 1 000 h at the temperature selected for the 1 000 h heat resistance test c), all constructions shall meet the cold impact resistance of c) and the adhesion requirements of l), where applicable.

h) Resistance to stress cracking: When tested in accordance with ISO 7628:2010, 9.8, all constructions shall show no evidence of stress cracking and shall meet the cold impact requirements of c).

i) Resistance to battery acid: When tested in accordance with ISO 7628:2010, 9.11, all constructions shall show no evidence of cracking or degradation and shall meet the cold impact requirements of c).

j) Resistance to engine oil and petroleum-based hydraulic fluid.

1) Surface contamination: When tested in accordance with Annex B, using ISO 1817 oil no. 3, all constructions shall meet the cold impact requirements of c) and the adhesion requirements of l), where applicable.

2) Long-term resistance: When filled with ISO 1817 oil no. 3 and aged for 1 000 h at the temperature selected for the 1 000 h heat resistance test c), all constructions shall meet the cold impact requirements of c) and the adhesion requirements of l), where applicable.

k) Resistance to non-petroleum hydraulic (brake/clutch) fluid.

1) Surface contamination: When tested in accordance with Annex B, using ISO 4926 compatibility fluid, all constructions shall meet the cold impact requirements of c) and the adhesion requirements of l), where applicable.

2) Long-term resistance: When filled with non-petroleum hydraulic fluid to ISO 4926 and aged for 1 000 h at the temperature selected for the 1 000 h heat resistance test c), the tubing shall meet the cold impact requirements of c) and the adhesion requirements of l), where applicable.

l) Adhesion (for any constructions with two or more bonded layers only): When determined in accordance with the appropriate procedure of ISO 8033, the separation force between bonded layers shall not be less than 1,5 kN/m.

m) Flammability: When tested in accordance with ISO 3795, no construction shall burn at a rate exceeding 100 mm/min.

n) Internal cleanliness: When determined in accordance with Annex C, the insoluble impurities shall not exceed 5 g/m^2.

o) Resistance to screen washing fluid: When filled with a mixture of 50 % by volume of water and 50 % by volume of propan-2-ol and aged for 1 000 h at the temperature selected for the 1 000 h heat resistance test d), all constructions shall meet the cold impact resistance requirements of c) and the adhesion requirements of l), where applicable.

p) Staining of paint surfaces by material extraction by screen wash fluid: When tested in accordance with ISO 3865:2005, method B, except using screen wash fluid as given in o) in place of distilled water, there shall be no staining of the painted metal surface.

q) Electrical resistance: When determined in accordance with ISO 8031:2009, 4.5 to 4.7, the electrical resistance shall not exceed 10 MΩ.

r) Resistance to kinking: When determined in accordance with ISO 10619-1, the maximum coefficient of deformation (T/D) shall not exceed 0,7.

The mandrel diameter shall be 140 mm for tubing or hoses up to nominal size 10, 220 mm for nominal size 10 and up to and including nominal size 12, and 300 mm for nominal size 14.

s) Resistance to reduction of internal air pressure: When tested in accordance with ISO 7233 at 0,03 MPa absolute (0,3 bar) pressure and 100 °C, the hose or tubing shall not collapse by more than 50 % after 10 min.

6 Frequency of testing

Type tests and routine tests shall be as specified in Annexes D and E, respectively.

Type tests are those required to confirm that a particular hose or hose assembly design manufactured by a particular method from particular materials meets all the requirements of this part of ISO 13775. 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 all sizes and types except those of the same size and construction.

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

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

7 Marking

All constructions shall be continuously marked on the hose, if not both on the hose and the cover, with at least the following information:

a) the manufacturer's name or trade mark;

b) the number of this part of ISO 13775;

c) the type number;

d) the nominal size;

e) the medium carried;

f) the quarter and year of manufacture.

EXAMPLE XXX, ISO 13775-1, Type 1, 6, Vacuum, 1Q/2015.

NOTE Parts made from short cut lengths may not be long enough to show the entire marking sequence.

Annex A
(informative)

Example of how a non-standard type of hose or tubing could be specified using a matrix

Material: ISO 13775-1, Clause 5

Burst pressure 3 MPa (30 bar).....	a	X
	b	X
	c	X
	d1	
1 500 h at 100 °C.....	d2	X
	d3	
	d4	
	d5	
	d6	
	d7	
	d8	X
	e	
	f1	X
	f2	
	f3	X
	f4	X
	g1	X
	g2	X
	h	X
	i	X
	k1	X
	k2	X
	k1	X
	k2	X
	l	X
Flammability 0 mm/min max.....	m	X
	n	X
	o	X
	p	
	q	
	r	
	s	

Annex B
(informative)

Method for determining the resistance to surface-contaminating fluids

Tightly plug the ends of sufficient specimens of tubing or hose to enable the cold impact test b) to be carried out. Fully immerse each specimen in the specified contaminating fluid for 2 h at 60 °C. At the end of the immersion period, wipe the fluid from the surface of the specimens and test as required.

Annex C
(normative)

Cleanliness and extractables test

C.1 General

This Annex specifies a method for the determination of the quantity of insoluble impurities ("dirt"), liquid C solubles, and waxy extractables present in hoses and tubing used in liquid-fuel circuits.

C.2 Principle

A quantity of ISO 1817 liquid C is left for a period of 24 h at ambient temperature inside a length of hose or tubing. After this time, the test piece is emptied and the inside washed by gravity flow of liquid C.

The total solution is collected and the insoluble matter filtered out, dried, and weighed. The remaining solution is evaporated to dryness and the total content of liquid C soluble material calculated. The waxy material is dissolved from this residue with methanol and the resulting solution is evaporated to dryness and weighed.

C.3 Apparatus and materials

C.3.1 **Glass filter funnel**.

C.3.2 **Evaporating dishes** (two).

C.3.3 **Beaker**, 250 cm.

C.3.4 **Fuel evaporator**, fitted with an extraction hood.

C.3.5 **Ventilated drying oven**, capable of being maintained at 85 °C ± 5 °C.

C.3.6 **Balance**, accurate to 0,1 mg.

C.3.7 **Sintered-glass filter**, porosity grade P3.

C.3.8 **Liquid C**, as specified in ISO 1817.

C.3.9 **Methanol**, minimum purity 99 %.

C.3.10 **Metal stoppers**, to seal the ends of the hoses/tubing.

C.4 Procedure

Take a length of hose or tubing between 300 mm and 500 mm in length and measure its internal dimensions. Plug one end with a metal stopper (C.3.10) and hang vertically. Fill this test piece fully with liquid C (C.3.8) and seal the top end with another metal stopper. Calculate the internal surface area in contact with liquid C taking into account the area in contact with the stoppers. Leave the test pieces for 24 h ± 30 min at 21 °C ± 2 °C.

At the end of this period, remove one of the stoppers and pour the contents into the beaker (C.3.3). Remove the other stopper and hang the hose or tubing vertically over the beaker. By means of the filter funnel (C.3.1), rinse the inside of the hose or tubing with five portions each of 20 cm^3 of liquid C.

Filter the entire contents of the beaker through the previously weighed sintered-glass filter (C.3.7) using a small amount of clean liquid C to rinse out the beaker. Collect the filtrate in a previously weighed evaporating dish (C.3.2). Dry the filter in the oven (C.3.5) at 85 °C ± 5 °C until a constant mass is obtained.

Calculate the total mass of insoluble matter.

Annex D
(normative)

Type tests

Table D.1 gives the tests to be carried out for type testing as defined in Clause 5.

Table D.1 — Type test

Test (see Clause 5)	Applicability			
	Type 1	Type 2	Type 3	Type 4
a	X	X	X	X
b	X	X	X	X
c	X	X	X	X
d1	NA	NA	X	NA
d2	NA	X	NA	NA
d3	X	NA	NA	NA
d4	NA	NA	NA	X
d5	NA	NA	X	NA
d6	NA	X	NA	NA
d7	X	NA	NA	NA
d8	NA	NA	NA	X
e	X	X	X	X
f1	X	X	X	X
f2	X	X	NA	X
f3	X	X	NA	X
g1	X	X	X	X
g2	NA	X	NA	NA
h	X	X	X	X
i	X	X	X	X
j1	X	X	X	X
j2	NA	NA	NA	X
k1	X	X	X	X
k2	NA	NA	NA	X
l	X	X	X	X
m	X	X	X	X
n	X	X	X	X
o	NA	NA	X	NA
p	NA	NA	X	NA
q	X	X	X	X
r	X	X	X	X
s	X	X	X	X

X test shall be carried out.

NA test not applicable.