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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

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 third edition cancels and replaces the second edition (ISO 13775-1:2015), which has been technically revised.

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

— normative references have been updated (Clause 2);

— Clause 3 has been added.

A list of all parts in the ISO 13775 series can be found on the ISO website.

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.

Introduction

This document defines the requirements for extruded thermoplastic tubing/hoses for non-fuel applications for automotive use. In addition, it can 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 referring to this document 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 document should be familiar with normal laboratory practice. This document 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 health and safety practices and to ensure compliance with any national regulatory conditions.

1 Scope

This document 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 document is intended especially for use by original equipment manufacturers (OEMs).

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

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

ISO 1817:2015, *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 3865:2020, *Rubber, vulcanized or thermoplastic — Methods of test for staining in contact with organic material*

ISO 4926, *Road vehicles — Hydraulic braking systems — Non-petroleum-based reference fluid*

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 8031:2020, *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 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 30013, *Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties*

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 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.

5 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

6 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 c) 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 are 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 % volume fraction of liquid C (ISO 1817:2015, Table A.1) and 15 % volume fraction of methanol.

   2) A mixture of 15 % volume fraction of liquid C (ISO 1817:2015, Table A.1) and 85 % volume fraction of methanol.

   3) Liquid F (ISO 1817:2015, Table A.1) (simulated diesel fuel).

g) Resistance to engine coolant.

   1) Surface contamination: When tested in accordance with Annex B using a mixture of 50 % volume fraction of water and 50 % volume fraction 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 % volume fraction of water and 50 % volume fraction of ethane-1,2-diol and aged for 1 000 h at the temperature selected for the

1 000 h heat ageing resistance test d), 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, 9.10, 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 oil no 3 specified in ISO 1817:2015, Table A.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 oil no 3 specified in ISO 1817:2015, Table A.3 and aged for 1 000 h at the temperature selected for the 1 000 h heat ageing resistance test d), 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 according to ISO 4926 and aged for 1 000 h at the temperature selected for the 1 000 h heat ageing resistance test d), 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 % volume fraction of water and 50 % volume fraction of propan-2-ol and aged for 1 000 h at the temperature selected for the 1 000 h heat ageing 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 3865:2020, 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 8031:2020, 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.

7 Frequency of testing

Type testing is carried out in order to confirm that all the material, construction and test requirements of this document are met by the method of manufacture and hose design. Type tests shall be repeated at least every 5 years or whenever a change in method of manufacture or materials occurs.

Routine tests are those tests that shall be carried out on all hoses and hose assemblies prior to dispatch.

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

Production acceptance tests are those tests which should preferably be carried out by the manufacturer to control the quality of its products.

Production acceptance tests are given in Annex F. The frequencies specified in Annex F are given for guidance only.

8 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 identification, e.g. XXX;

b) the reference number of this document, i.e. ISO 13775-1;

c) the type, e.g. Type 1;

d) the nominal size, e.g. 6;

e) the medium carried, e.g. Vacuum;

f) the quarter and year of manufacture, e.g. 1Q/2021.

EXAMPLE XXX, ISO 13775-1, Type 1, 6, Vacuum, 1Q/2021.

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

For item b), the hose manufacturer shall use the latest edition of this document; otherwise, the year of publication shall be included in the marking.