INTERNATIONAL STANDARD

ISO 13775-2

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Thermoplastic tubing and hoses for automotive use —

Part 2: Petroleum-based-fuel applications

Tubes et tuyaux en thermoplastique pour l'industrie automobile —

Partie 2: Applications pour carburants à base de pétrole

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 13775 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13775-2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

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

Annexes A, B and C of this part of ISO 13775 are for information only.

Introduction

This specification defines the requirements of extruded thermoplastic tubing/hoses for petroleum-based-fuel applications for automotive use. In addition, it may 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 six main types (see example in annex A). In this case, the tubing or hose would not carry any marking showing this ISO specification number, but may detail the OEM’s own identification markings as shown on their part drawings.

Thermoplastic tubing and hoses for automotive use —

Part 2:
Petroleum-based-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 test requirements and test methods for extruded thermoplastic tubing and hoses for use in petroleum-based-fuel lines in vehicles powered by internal-combustion engines. This specification is intended especially for use by original equipment manufacturers (OEMs).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13775. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13775 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

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

ISO 1746, *Rubber or plastics hoses and tubing — Bending tests.*

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

ISO 4639-3:1995, *Rubber tubing and hoses for fuel circuits for international-combustion engines — Specification — Part 3: Oxidized fuels.*

ISO 4925, *Road vehicles — Non-petroleum base brake fluid.*

ISO 7628-2:1998, *Road vehicles — Thermoplastics tubing for use in air braking systems — Part 2: Mounting on vehicle and test methods.*

ISO 8031, *Rubber and plastic hoses and hose assemblies — Determination of electrical resistance.*

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

ISO 8308, *Rubber and plastics hoses and tubing — Determination of transmission of liquids through hose and tubing walls.*

ISO 11758, *Rubber and plastics hoses — Exposure to a xenon arc lamp — Determination of changes in colour and appearance.*

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 reduced fuel vapour permeability. 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.

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

Type 1: feed and return lines from the fuel tank to the engine compartment — gasoline engines;

Type 2: feed and return lines from the fuel tank to the engine compartment — diesel engines;

Type 3: feed and return lines in the engine compartment — moderate-temperature (100 °C) environment — gasoline engines;

Type 4: feed and return lines in the engine compartment — high-temperature (125 °C) environment — gasoline engines;

Type 5: feed lines in the engine compartment — diesel engines;

Type 6: multi-layer tubing or hoses for vapour lines.

4 Dimensions

Bore 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 bores, internal diameters and wall thicknesses

Nominal bore	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 for approval of products

The following tests shall be selected for each application of the tubing or hose, based on the performance requirements of the finished product. The tests to be carried out for each type of tubing or hose classified in clause 3 are given in Table 2.

a) Burst pressure: When determined in accordance with ISO 1402, the minimum burst pressure for all constructions shall be 55 bar gauge (5,5 MPa).

b) Cold impact resistance: After cold impact testing at – 40 °C in accordance with subclause 7.4 of ISO 7628-2:1998, all constructions shall show no evidence of external fracture or cracking and shall meet the burst pressure requirements of a).

c) 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 b):

   1) 1 000 h at 70 °C

   2) 1 000 h at 100 °C

   3) 1 000 h at 125 °C

   4) 168 h at 100 °C

   5) 168 h at 125 °C

   6) 168 h at 140 °C

d) 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 11758.

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 prior to final assembly of the vehicle.

e) Resistance to fuels: When tested in accordance with annex D of ISO 4639-3:1995, using one or more of the following test fuels, all constructions shall meet the cold impact requirements of b) and the adhesion requirements of k) 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) A mixture of 85 % by volume of liquid C (ISO 1817) and 15 % by volume of methyl tertiary-butyl ether (MTBE).

   4) Liquid F (ISO 1817) (simulated diesel fuel), with or without 10 % by volume of rape seed methyl ester.

   5) PN180 oxidized fuel in accordance with annex A of ISO 4639-3:1995.

f) Resistance to stress cracking: When tested in accordance with subclause 7.9 of ISO 7628-2:1998, all constructions shall show no evidence of stress cracking and shall meet the cold impact requirements of b).

g) Resistance to battery acid: When tested in accordance with subclause 7.11 of ISO 7628-2:1998, all constructions shall show no evidence of cracking or degradation and shall meet the cold impact requirements of b).

h) Resistance to surface contamination by engine oil and petroleum-based hydraulic fluid: When tested in accordance with annex B, using ISO 1817 Oil 3, all constructions shall meet the cold impact requirements of b) and the adhesion requirements of k) where applicable.

i) Resistance to surface contamination by non-petroleum hydraulic (brake/clutch) fluid: When tested in accordance with annex B, using hydraulic fluid to ISO 4926, all constructions shall meet the cold impact requirements of b) and the adhesion requirements of k) where applicable.

j) Adhesion: For any constructions with two or more co-extruded or 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.

k) Flame resistance: When tested in accordance with annex C, the tubing or hose shall withstand a minimum of 60 s exposure to flame without loss of pressure.

l) Internal cleanliness: When determined in accordance with annex B of ISO 4639-3:1995, the insoluble impurities shall not exceed 5 g/m^2 and the fuel-soluble impurities shall not exceed 3 g/m^2.

m) Fuel permeability: When determined in accordance with ISO 8308, the permeability to a mixture of 85 % by volume of liquid C (ISO 1817) and 15 % by volume of methanol shall not exceed 25 g/m^2/24 h.

n) Electrical resistance: When determined in accordance with ISO 8031, the electrical resistance shall not exceed 10 MΩ.

o) Resistance to kinking: When determined in accordance with ISO 1746, the maximum coefficient of deformation (T/D) shall not exceed 0,7.

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

Table 2 — Requirements for the most frequent applications for petroleum-based-fuel-line tubing and hose

Test (clause 5)	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
a	X	X	X	X	X	X
b	X	X	X	X	X	X
c1	X	X	NA	NA	NA	X
c2	NA	NA	X	NA	X	NA
c3	NA	NA	NA	X	NA	NA
c4	X	X	NA	NA	NA	X
c5	NA	NA	X	NA	X	NA
c6	NA	NA	NA	X	NA	NA
d	NA	NA	NA	NA	NA	NA
e1	X	NA	X	X	NA	X
e2	X	NA	X	X	NA	X
e3	X	NA	X	X	NA	X
e4	NA	X	NA	NA	X	NA
e5	X	NA	X	X	NA	X
f	X	X	X	X	X	X
g	NA	NA	X	X	X	NA
h	NA	NA	X	X	X	NA
i	NA	NA	X	X	X	NA
j	X	X	X	X	X	X
k	X	X	X	X	X	X
l	X	X	X	X	X	X
m	X	X	X	X	X	X
n	X	NA	X	X	NA	NA
o	X	X	X	X	X	X

X = test shall be carried out; NA = test is not applicable.

6 Marking

All constructions shall be continuously marked 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 bore;

e) the word "Fuel";

f) the month and year of manufacture.

EXAMPLE MN, ISO 13775-2, Type 1, 6, Fuel, 06/1999.

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 tubing or hose could be specified using a matrix

Material: ISO 13375-2 clause 5

Burst pressure 30 bar	X	a
	X	b
		c1
1 500 h at 100 °C	X	c2
		c3
		c4
	X	c5
		c6
		d
	X	e1
		e2
	X	e3
		e4
Peroxide No. PN90	X	e5
	X	f
	X	g
	X	h
	X	i
	X	j
	X	k
	X	l
Fuel-soluble impurities 1 g/m^2	X	m
8 MΩ max.	X	n
	X	o
	X	p
Burst pressure at 100 °C: 20 bar	X	z1
Colour blue	X	z2

Annex B
(normative)

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)

Method of test for flame resistance

WARNING — This test is hazardous and extreme care shall be taken to avoid injury to persons and damage to property.

C.1 Test equipment/materials

Flame chamber, construction as shown in Figures C.1 to C.5.

Reagent-grade methanol.

Timing device, capable of measuring to the nearest 1 s.

C.2 Test preparation

This test shall be carried out on a straight hose specimen manufactured by the correct process for the product type and of sufficient length to fit into the test fixture rather than a complete assembly.

Insert a straight length of aluminium rod into the specimen to provide support for the test. The support rod shall be long enough to extend completely across the test chamber and shall be less than one-half the nominal bore of the tubing or hose.

Attach the specimen to the test fixture and check for leaks with an applied pressure of 1,5 bar gauge (0,15 MPa).

Fill the fuel pan with a sufficient quantity of methanol to burn for at least 90 s.

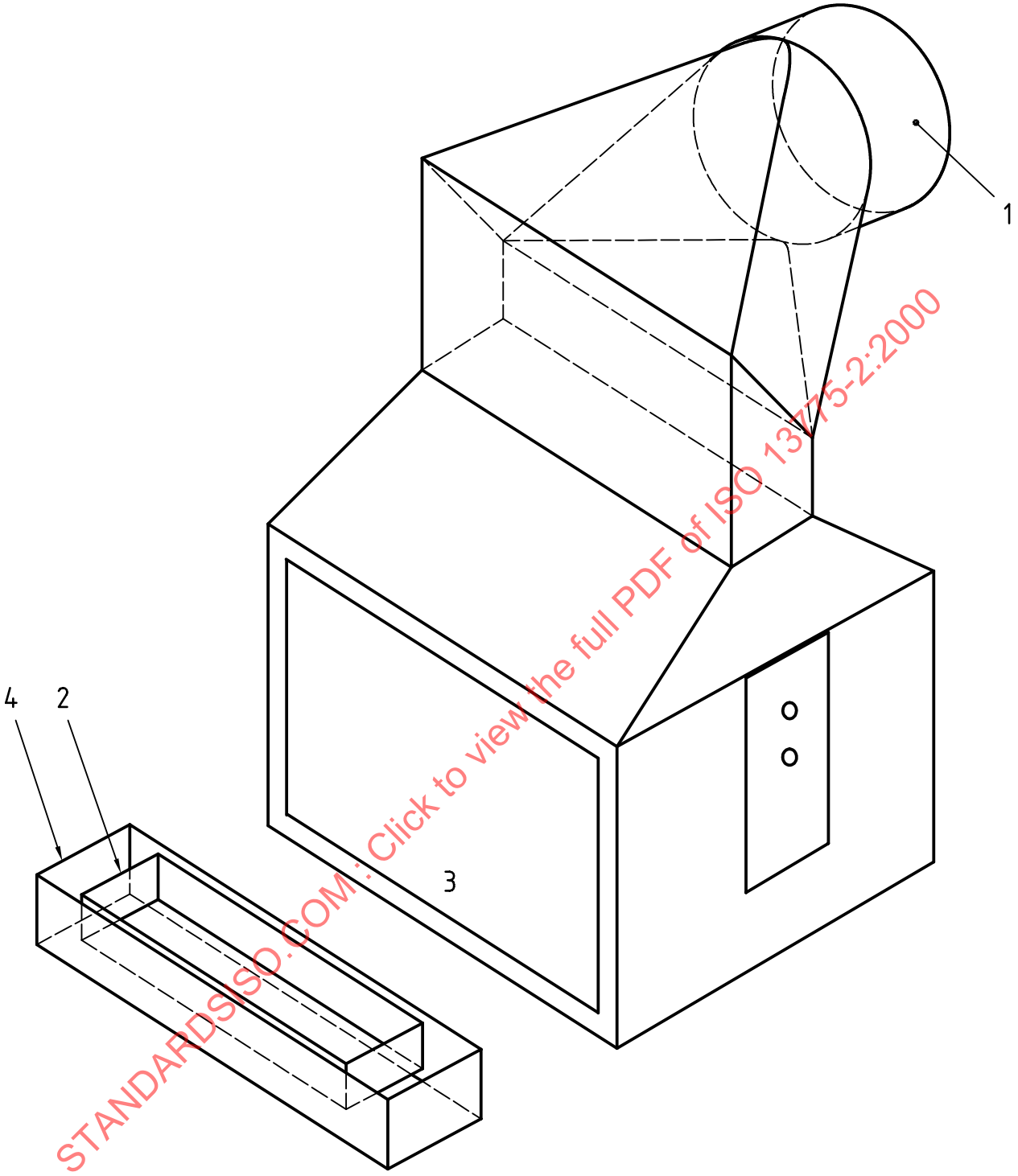
Fill the fuel coolant pan completely with water.

C.3 Test procedure

Apply 1,5 bar gauge (0,15 MPa) air pressure to the specimen.

Simultaneously ignite the pan of methanol and start the timing device.

Stop the test by extinguishing the flames if no pressure loss has occurred after 60 s.

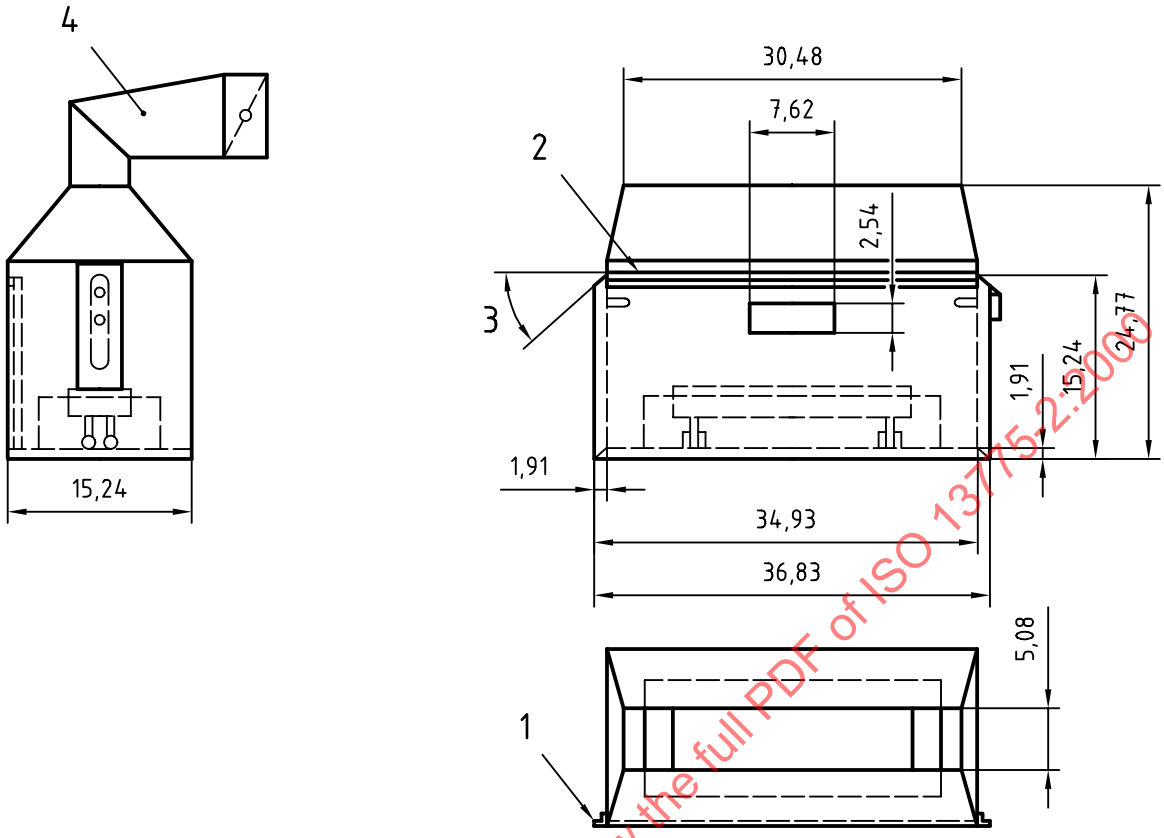


Key

1 Damper location
2 Fuel pan
3 Door
4 Fuel coolant pan

Figure C.1 — Flame chamber — General arrangement

Dimensions in centimetres



Key

1 Aluminium angle, 0,318 cm × 1,91 cm
2 Piano hinge
3 Angle typically 45°
4 Sheet-metal elbow boot with damper, 5,72 cm × 30,48 cm × 15,24 cm

Figure C.2 — Flame chamber — General dimensions