INTERNATIONAL STANDARD

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Small craft — Fire-resistant fuel hoses

Petits navires — Tuyaux à carburant souples résistant au feu

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7840 was prepared by Technical Committee ISO/TC 188, *Small craft*.

This third edition cancels and replaces the second edition (ISO 7840:1994), which has been technically revised.

Small craft — Fire-resistant fuel hoses

1 Scope

This International Standard specifies general requirements and physical tests for fire-resistant hoses for conveying petrol and diesel oil, designed for a working pressure not exceeding 0,34 MPa for hoses with nominal bore up to and including 10 mm and 0,25 MPa for hoses with larger bore in craft of hull length up to 24 m.

It applies to hoses for small craft with permanently installed fuel systems. It does not apply to hoses entirely within the splash well at the stern of the craft connected directly to an outboard engine.

Specifications for non-fire-resistant fuel hoses are contained in ISO 8469:1994, *Small craft — Non-fire-resistant fuel hoses*.

2 Normative references

The following referenced documents are indispensable for the application 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 3:1973, *Preferred numbers — Series of preferred numbers*

ISO 1307:1992, *Rubber and plastics hoses for general-purpose industrial applications — Bore diameters and tolerances, and tolerances on length*

ISO 1402:1994, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1817:1999, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 7233:—[1)], *Rubber and plastics hoses and hose assemblies — Determination of suction resistance*

ISO 7326:1991, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 10088:2001, *Small craft — Permanently Installed fuel systems and fixed fuel tanks*

3 General requirements

Hoses complying with this International Standard shall present a non-porous, smooth inner surface, free from defects and chemical contaminants.

Hoses shall demonstrate suitability for marine use by complying with the requirements of the tests in Clause 5.They shall be marked according to Clause 6.

1) To be published. (Revision of ISO 7233:1991)

4 Nominal bore

Table 1 gives some of the inner diameters based on series R 10 of ISO 3. Tolerances shall conform to ISO 1307 or the values given in Table 1.

Table 1 — Inner diameters and tolerances

Dimensions in millimetres

Inner diameter, *d*	Tolerance
3,2 4 5	± 0,5
6,3 7 8 9,5 10 12,5 16 19 20	± 0,75
25 31,5 38	± 1,25
40 50 63	± 1,5

5 Physical tests on finished hose

New specimens shall be used for each of the tests below.

5.1 Bursting pressure

Fill three hoses or test pieces from the hoses with Test Liquid C as specified in ISO 1817:1999 and store them for 7 days in air at an ambient temperature of 23 °C ± 2 °C.

Empty the liquid out and fill the hoses or test pieces with cold water; subject them to bursting pressure as described in ISO 1402.

The bursting pressure shall be at least 1,4 MPa for hoses of 10 mm or smaller inner diameter and 1,00 MPa for hoses with a larger bore.

5.2 Vacuum-collapse test

Carry out the test In accordance with ISO 7233:—[1)], method A using the test conditions specified in Table 2.

Table 2 — Pressure conditions for the vacuum collapse test

Inner diameter, d mm	Vacuum kPa
$d \leqslant 10$	80
$10 < d \leqslant 25$	35
$d > 25$	No test required

The time shall be 60 s and the diameter of the sphere 0,8 d (inner diameter).

5.3 Volume change In liquid C

Determine the change in volume of the hose (tube and cover) by the procedure described in ISO 1817.

Place the test pieces in liquid C at an ambient temperature of 23 °C ± 2 °C for 70 h ± 2 h.

If the hose is made of a homogeneous compound (with or without reinforcement), the swelling in liquid C shall not exceed 35 % by volume, as measured by displacement in water. For hose with an inner layer of fuel-resistant material and a cover of another material, mainly intended for weather and ozone resistance, the increase in volume in liquid C shall not exceed 35 % for the tube and 120 % for the cover.

5.4 Mass reduction In liquid C

Determine the reduction in mass of the inner layer by the procedure described in ISO 1817. Fill three hoses or test pieces from the hoses with Test Liquid C, as specified in ISO 1817:1999, and store them for 7 days in air at an ambient temperature of 23 °C ± 2 °C.

The reduction in mass of the inner layer shall not exceed 8 % of the initial mass of the test pieces.

NOTE A reduction in mass of 8 % corresponds to a decrease in volume of approximately 10 %.

5.5 Fire resistance

Test the hose in accordance with the method described in Annex A.

5.6 Effect of ozone

The hose shall be tested as described in ISO 7326:1991, Method 1. The sample shall show no visible cracks at × 7 magnification.

5.7 Fuel permeation

A permeation rate shall be tested. When tested according to the method described in Annex B or equivalent test method, the hoses shall be classified in the following way and marked in accordance with Clause 6:

Type 1: shall be hoses with a permeation rate of 100 g/m^2 or less per 24 h.

Type 2: shall be hoses with a permeation rate of 300 g/m^2 or less per 24h.

5.8 Cold-flex test

For straight hose of 19 mm inside diameter and under, condition hose samples for 5 h at − 20 °C ± 2 °C. Flex in the cold chamber through 180° from the centreline to a diameter of 10 times the maximum outside diameter of the hose. The flexing shall take place within 4 s and the hose shall not fracture or show any cracks, checks or break in the tube or cover.

For straight hose of larger than 19 mm inside diameter and all preformed hose, prepare three specimens 100 × 6 mm from the whole hose wall. Cold condition as above in an unrestrained loop positioned between two jaws 50 mm wide and 64 mm apart. While in the cold chamber, bring the jaws together rapidly until they are 25 mm apart. The specimens shall not fracture or show any cracks, checks or breaks.

5.9 Abrasion test: 38 mm and larger fuel-fill hose with helical wire imbedded reinforcement

Hose samples of 38 mm bore shall be selected for the test. Larger bore hose sizes to be qualified by the test shall not have a cover thickness or construction less than those of the test samples.

Three identical 38 mm bore hose samples shall be tested. Condition hose for at least 24 h at 23 °C ± 2 °C and 50 % ± 5 % relative humidity. The test hose shall be mandrel- (core-) supported and rotated at a constant speed of 80 r/min ± 2 r/min. Subject hose to a laterally moving abrasive surface, i.e. 80 grit aluminium oxide (Al_2O_3) emery cloth, parallel to the longitudinal axis of the hose. The abrasive surface shall be (25 ± 5) mm × (75 ± 5) mm affixed to a hard surface which will cycle back and forth 75 mm ± 5 mm in each direction while loaded with a constant normal force of 45 ± 5 N. One test cycle shall equal one 360° rotation of the outside diameter of the hose and one back and forth movement of the abrasive surface. After 1000 cycles, the three test samples shall have no helical wire reinforcement exposed at the point of contact with the abrasive surface.

5.10 Dry heat resistance

After heat aging for 70 h at 100 °C ± 2 °C, specimens taken from the cover material shall not have a reduction in tensile strength of more than 20 % of the tested value or a reduction in elongation of more than 50 %.

5.11 Oil resistance test

After 70 h immersion in reference oil ISO 1817:1999, Oil number 3 at 100 °C ± 2 °C specimens taken from the tube shall not have a reduction of tensile strength or elongation exceeding 40 % of the tested value, or a volumetric change of − 5 to + 25 %. Specimens taken from the cover material shall not have a volumetric change outside the range of 0 to + 100 %.

5.12 Adhesion test

The force required to separate a 25 mm width sample of bonded adjacent layers, such as the tube and cover of hose material, by tensile force on partially separated layers applied in opposite directions, at 23 °C ± 2 °C, shall be not less than 27 N.

6 Marking

To comply with this International Standard, a hose shall be marked at least every 0,3 m with

— the name or trademark of the manufacturer or supplier,

— the last two figures of the year of manufacture,

— inner diameter, mm,

— “ISO 7840 - A1” or “ISO 7840 - A2”.

NOTE “A” is used to designate a fire resistant type of fuel hose. “1” is used to designate a fuel hose with a fuel permeation rate of 100 g/m^2 or less per 24 h. “2” is used to designate a fuel hose with a fuel permeation rate of 300 g/m^2 or less per 24 h.

The marking shall be in letters and figures at least 3 mm high and shall withstand washing with ordinary detergents.

Additional information may be included in the marking.

Annex A
(normative)

Fire test

A.1 Principal

The hose filled with heptane is subjected to fire. The hose shall withstand the test for 2,5 min without leakage after ignition of the fuel in the tray.

A.2 Sampling

At least three hose samples shall be tested in turn.

A.3 Equipment

The test shall be performed in a sheltered area free from draught, permitting a free inflow of air during the test, at a temperature of + 20 °C ± 5 °C. The test equipment shall be designed to conform to that shown in Figure A.1. The fuel tray shall be square, 350 mm × 350 mm, with vertical sides. Commercial heptane with a distillation interval of 80 °C to 110 °C is used as fuel. The fuel and water temperature shall be + 20 °C ± 2 °C.

A.4 Test procedure

A.4.1 Preparation

Mount the test equipment to conform to Figure A.1 without mounting any test object. Non-measurable draught effects in the area could influence the flame and if so, the position of the fuel tray shall be changed, in order to as far as possible embrace the hose and one of its ends in the flame.

The hose end-connections to the test fixture (Figure A.1) shall be made as specified in subclause 6.4 of ISO 10088:2001.

A.4.2 Test

Fill the hose with fuel by opening the tank valve. Ensure that no air is left in the hose. Adjust the fuel level to 900 mm.

Pour 0,5 L of water and 1 L of heptane into the fuel tray and ignite the heptane. The fuel tray shall be placed so that two of the sides are parallel with the test object. Ensure that a stable flame is maintained and that the flame embraces the hose and one of its fittings for the duration of the test.

Allow the heptane to burn and record the time to leakage.

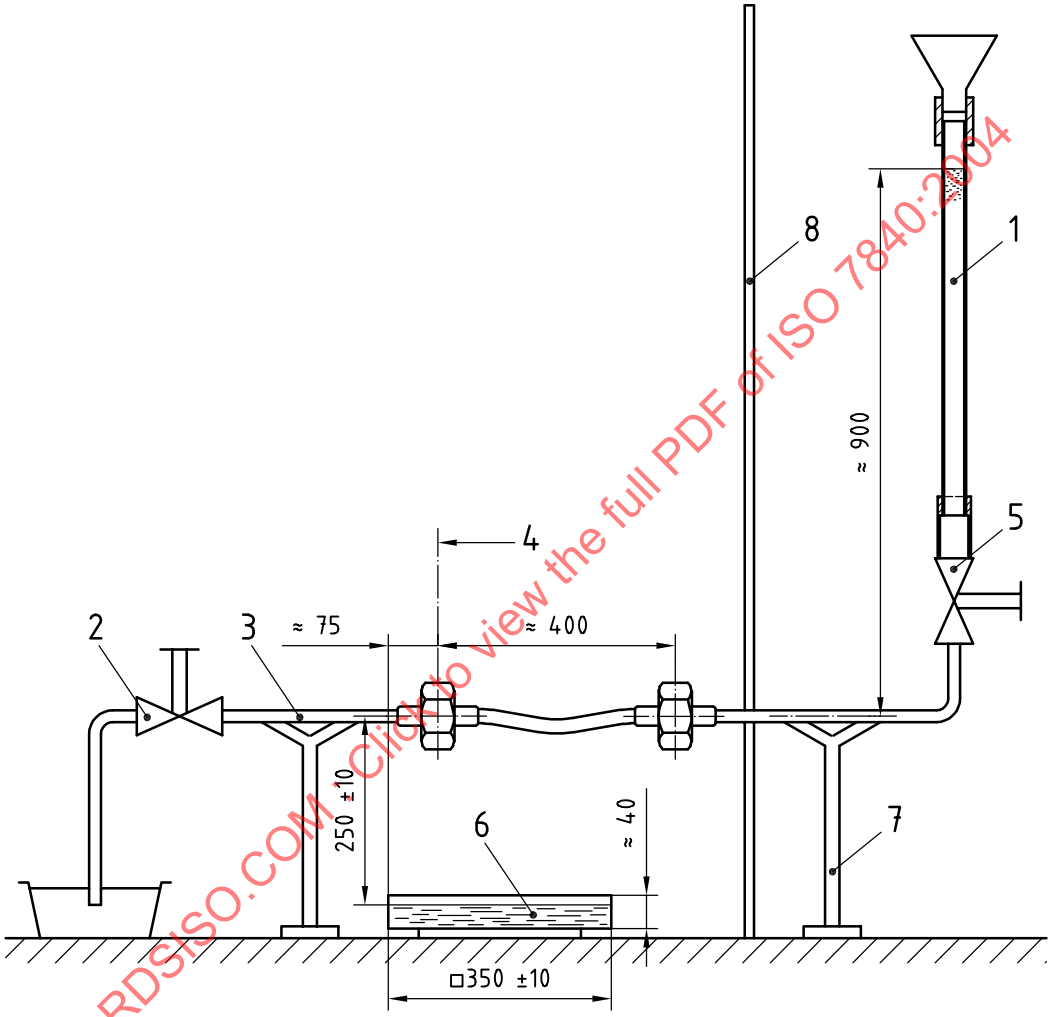
The test is terminated when leakage occurs or when 2,5 min have elapsed.

If the flame is very unstable during the test and if it does not expose the test hose to a full extent during at least 75 % of the test lapse, or if the time to leakage in any test deviates by more than 30 s from the determined mean value, another two hose samples shall be tested.

After each test, the fuel lines and fuel tray shall be cooled to ambient temperature before a new test object is mounted and water and fuel, respectively, are refilled.

WARNING — Large flames and burning waste fuel could occur at leakage, therefore the test shall be performed in a non-combustible environment and with personnel equipped with protective equipment and fire-fighting equipment.

Dimensions in millimetres



Key

1 glass tube
2 discharge valve
3 fuel line, steel pipe
4 end of test object, mounted without axial stress
5 fuel valve
6 fuel tray 0,5 l water, 1 l heptane
7 steel stand
8 metallic heat shield

Figure A.1