INTERNATIONAL STANDARD

ISO 13591

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1997-12-15

Small craft — Portable fuel systems for outboard motors

Navires de plaisance — Installations à carburant portatives pour moteurs hors-bord

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.

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.

International Standard ISO 13591 was prepared by Technical Committee ISO/TC 188, *Small craft*.

Annexes A and B of this International Standard are for information only.

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1 Scope

This International Standard specifies requirements for the design, materials and testing of portable fuel systems with a rated capacity of 27 l or less for carrying and storage of flammable liquids used for outboard motors installed on small craft with up to 24 m length of hull.

It does not apply to pressurized fuel systems.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1817:—[1], *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 8469:1994, *Small craft — Non-fire-resistant fuel hoses.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 flammable liquid: Liquid with flash point less than 60 °C (closed cup test) and a Reid vapour pressure below 280 kPa (absolute) at 38 °C.

3.2 portable fuel tank: Tank for carrying and storing flammable liquids with a capacity of 27 l or less which is intended to form part of a portable fuel system.

3.3 portable fuel system: System consisting of portable fuel tanks with filler caps and vents, fuel connectors, fuel lines and related accessories intended to be connected to fuel systems on outboard motors.

4 General requirements

4.1 Portable fuel tanks shall be designed to permit convenient handling, securing on board the craft and removal for refilling outside the craft.

NOTE — Hereafter portable fuel tanks are referred to as tanks.

1) To be published. (Revision of ISO 1817:1985)

4.2 The total volume of the tank shall be such that in normal filling position an expansion space of at least 5 % of the rated capacity at 20 °C shall be provided. The filler opening shall be positioned such that the expansion space cannot be filled when the tank is in its normal filling position.

4.3 An automatically or manually closable vent shall be incorporated in portable fuel systems.

4.4 On tanks used for unleaded petrol, the inner diameter of the filler neck shall be minimum 21,5 mm and maximum 23,5 mm. On tanks used for other fuels the inner diameter of the filler neck shall be greater than 30 mm.

4.5 All tank openings shall be above the fuel liquid level when the tank is in normal operation or storage positions and shall have liquid- and vapour-tight closures.

4.6 The tank shall be designed so that it can be carried with one hand.

4.7 The shape of the tank shall discourage stacking.

4.8 Materials used in portable fuel systems shall be arranged to minimize galvanic corrosion encountered in normal marine service.

4.9 Plastic and elastomeric materials shall contain a UV-inhibitor.

4.10 The colour of the tank shall be red.

4.11 The tank shall be marked with a symbol indicating the fuel for which the system is designed.

4.12 Solder with a melting point lower than 450 °C shall not be used in the construction of metal tanks.

5 Performance requirements

5.1 General tests

5.1.1 Stability test

Fill a tank, complete with fittings, etc., to its nominal capacity with the fuel intended to be used. Place the tank in its normal operating position on a flat surface which is inclined at an angle of 35° from the horizontal and which gives enough friction to prevent sliding. Rotate the tank over 360° at 15° intervals.

If the tank has a storage position which is different from its operating position, the test shall be repeated with the tank in the storage position, but with the plane inclined 20° from the horizontal.

Evaluation:

The tank shall not tip over in any position.

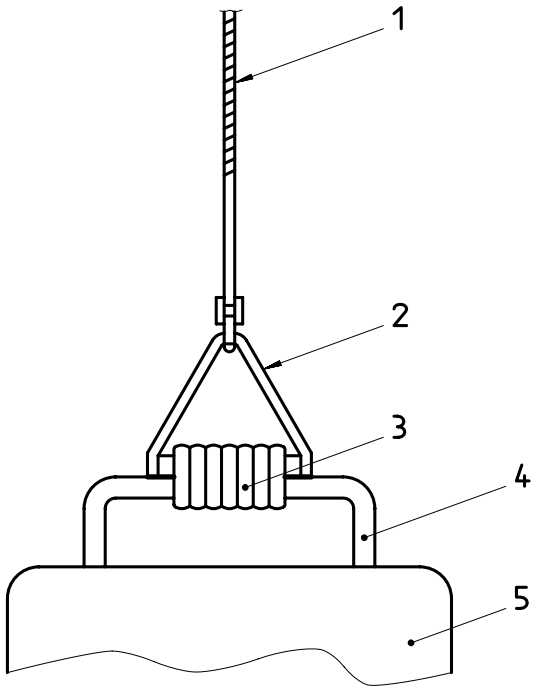
5.1.2 Carrying handle test

Prepare three tanks according to figure 1. Fill each tank to nominal capacity with water and secure closures.

Leave a minimum of 75 mm slack in the wire rope. Allow each tank to drop freely once.

Evaluation:

After the drop test, each tank shall be pressure tested with air at an internal pressure of 35 kPa. None of the tanks shall leak.



Key

1 6 mm (0,25 in) diameter wire rope (non-flexible steel), 1 m to 2 m (3 ft to 6 ft) long

2 Stirrup: 10 mm (0,375 in) diameter steel rod, bent and welded to a 100 mm (4 in) length of 20 mm (0,75 in) diameter steel bar

3 Single layer wrap of 8 mm (0,3125 in) diameter polypropylene rope to distribute loading over 75 mm (3 in) length of handle

4 Tank handle

5 Tank

Figure 1 — Handle arrangement for free fall test

5.1.3 Tightness of filler cap and fittings test

The test shall be carried out in a room with a stabilized temperature of 30 °C ± 2 °C.

Carry out the test on three tanks equipped with a connection for a pressure line in the bottom or in one of the walls and filled with 1 l of a test fluid consisting of

— 42,5 % 2,2,4-trimethylpentane;

— 42,5 % toluene;

— 15,0 % methanol.

Close the tanks and store them for 28 days in a position such that the internal parts of the cap and the fittings are in contact with the test fluid.

Empty the tanks and immediately fill them to their nominal capacity with a test fluid consisting of 95 % water and 5 % wetting agent (e. g. Laventin W). Threaded caps shall be closed with a torque of 5 N·m.

Immediately apply an internal over pressure of 160 kPa for 10 min with the filler cap pointing down.

Evaluation:

There shall be no leakage; all tanks shall pass the test.

5.2 Tests on metal tanks

5.2.1 Low temperature drop test

Carry out the test on three tanks filled to their nominal capacity with a blend of 50 % glycol and 50 % water. Stabilize the tanks and their contents to –18 °C ± 2 °C.

Screw-filler caps shall be torqued to 5 N·m.

Raise the tank to 1,2 m above a flat, horizontal concrete surface and drop the tank so that it strikes on a corner.

Evaluation:

The tanks shall show no evidence of leakage.

5.2.2 Internal pressure test

Carry out the test on three tanks. Threaded closures shall be closed with a torque of 9 N·m and other closures shall be secured in their normal manner. Condition the tanks at –34 °C for at least 6 h, allow to return to room temperature, and condition for a further 2 h at 70 °C. Apply internal pressure by means of an adapter inserted into a drilled hole. There shall be no sign of rupture or leakage when the internal pressure is increased progressively to 135 kPa at 70 °C over a period of 30 s to 60 s and maintained for a further 5 min. While the pressure is being held, coat the tanks with a soap solution or other suitable medium.

Evaluation:

All tanks shall pass the test without leakage. Deformation is allowed.

5.3 Tests on non-metal tanks

5.3.1 Low temperature drop test

Carry out the test on three sample tanks complete with fittings. Fill the tanks to their nominal capacity with a blend of 50 % glycol and 50 % water.

Screw threaded filler caps shall be torqued to 5 N·m. Stabilize tanks and contents to –18 °C ± 2 °C.

Immediately drop each tank three times from a height of 1,2 m onto a flat horizontal concrete surface. Each tank shall strike once on the filler cap, bottom and a corner. The centre of gravity shall be directly above the specified point of impact.

Evaluation:

There shall be no leakage; all tanks shall pass the test.

5.3.2 Internal pressure-duration test

Carry out the test on three tanks. Threaded closures shall be closed with a torque of 9 N·m and other closures shall be secured in their normal manner. Condition the tanks at 23 °C for at least 6 h, then at 34 °C for at least 6 h, allow to return to room temperature, and condition for a further 2 h at 70 °C. Increase the internal pressure progressively to 135 kPa at 70 °C over a period of 30 s to 60 s. Maintain the pressure and temperature for a further 4 h.

Release the pressure in the tanks and condition them at 23 °C for at least 6 h, prior to testing at that temperature. Secure the closures. Increase the internal pressure progressively to 100 kPa over a period of 30 s to 60 s. Maintain the pressure for a further 5 min.

Evaluation:

The tanks shall not rupture or leak when tested. All tanks shall pass the test. Deformation is allowed.

5.3.3 Permeation of fuel

Carry out the test on three tanks with filler caps, weighed to an accuracy of ± 0,1 %.

Fill the tanks to their nominal capacities with a test fluid consisting of 70 % 2,2,4-trimethylpentane and 30 % toluene.

Tighten the caps with a torque of 5 N·m and re-weigh each to an accuracy of ± 0,1 %.

Store the tanks at 23 °C ± 2 °C for 30 days, then re-weigh the tanks with contents to an accuracy of ± 0,1 %.

Calculate the percentage of mass loss using the following equation:

$$\text{Mass loss} = \frac{m_2 - m_3}{m_2 - m_1} \times 100$$

where

m_1 is the mass of the empty tank;

m_2 is the mass of the tank plus fluid before storage;

m_3 is the mass of the tank plus fluid after storage.

Report the mass loss.

After cutting apart, visually examine the internal surfaces of one tank.

Evaluation:

The tank shall not show any evidence of tackiness or other obvious defects.

The mass loss from the tank shall not exceed 1 %.

5.3.4 Stress-cracking test on polyethylene tanks

Take three tanks from the production.

Fill the tanks to their nominal capacity with a fluid consisting of 95 % water and 5 % wetting agent (e.g. Laventin W), preheated to 70 °C ± 2 °C.

Close the tanks (screw threaded caps with a torque of 5 N·m), connect the pressure line and submerge tanks in a test bath containing the same fluid at the same temperature. Keep the tank submerged in the fluid for one hour at test temperature without internal pressure. Follow with an internal pressure of 50 kPa built-up for 10 s to 15 s, without pressure shocks for an additional 5 h.

Evaluation:

There shall be no leakage or visible cracks after the test.

5.3.5 Flammability test

Expose three tanks to a standard 10 mm diameter Bunsen burner with a blue flame approximately 25 mm high with a cone-tip temperature of 900 °C and the flame tip impinging on the side of the tank for 10 s.

Evaluation:

There shall be no flare up.

NOTE — Flare up means a continuously increasing burning rate such as occurs when a match is ignited.

5.4 Tests on elastomeric materials (gaskets and seals)

5.4.1 Immersion test

Test three specimens from each type and size of material as follows:

Immerse the three specimens in liquid as specified in 5.1.3 for 70 h at 23 °C ± 2 °C.

Assess the change in mass and volume of the specimens using the measurement technique and calculation procedures given in ISO 1817.

Evaluation:

The elastomeric components shall not show:

— swelling greater than 25 %;

— shrinkage greater than 1 %;

— mass loss greater than 10 %.

5.4.2 Oven ageing test

Expose three specimens to 100 % oxygen atmosphere at a gauge pressure of 2 MPa ± 70 kPa at a temperature of 70 °C ± 1 °C for 96 h.

For gaskets of a diameter or diagonal dimension greater than 20 mm, a 25 mm diameter mandrel shall be used. For gaskets with a diameter or diagonal dimension of 20 mm or smaller, a 13 mm mandrel shall be used.

After exposing to oxygen, keep the gaskets and the test mandrel at a temperature of 0 °C ± 1 °C for at least 2 h before testing.

Bend the gasket through 180° around the mandrel at a bend rate of approximately 90°/s at the test temperature of 0 °C ± 1 °C.

Evaluation:

The gaskets shall show no cracking after bending.

5.5 Fuel hose assemblies

5.5.1 The hoses shall meet the requirements of ISO 8469.

5.5.2 Fuel hoses shall be flexible, so that they will not crack, check or break if coiled around a diameter equal to four times the outside diameter of the hoses after 8 h of exposure to temperatures of 0 °C and 60 °C.

5.5.3 Each fuel hose connection shall be capable of withstanding a static pull load of 180 N for one minute.

5.5.4 The fuel hose assembly, when connected to the tank and disconnected from the engine, shall not permit leakage of fuel when the tank is subjected to an internal pressure of 135 kPa.

6 Identification

The tank shall carry the following information:

a) trademark or name of manufacturer;

b) nominal capacity, in litres;

c) model designation;

d) year of manufacturing, in numeral or code;

e) ISO 13591, with characters at least 4 mm high;

f) type of fuel symbol(s), at least 25 mm high;

g) fire risk symbol, at least 25 mm high.