
**Small craft — Permanently installed
petrol and diesel fuel tanks**

Petits navires — Réservoirs à carburant à essence et diesel installés à demeure

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Foreword

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ISO 21487 was prepared by Technical Committee ISO/TC 188, *Small craft*.

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Small craft — Permanently installed petrol and diesel fuel tanks

1 Scope

This International Standard establishes requirements for design and test of petrol and diesel fuel tanks for internal combustion engines that are intended to be permanently installed in small craft of up to 24 m length of hull.

For installation requirements, ISO 10088 applies.

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 1817:2005, *Rubber, vulcanized — Determination of the effect of liquids*

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

ISO 11192:2005, *Small craft — Graphical symbols*

ISO 12215-5, *Small craft — Hull construction and scantlings — Part 5: Design pressures for monohulls, design stresses, scantlings determination*¹⁾

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

petrol

hydrocarbon fuel or blend of hydrocarbon fuels which is liquid at atmospheric pressure and is used in spark ignition engines

3.2

diesel

hydrocarbon fuel or blend of hydrocarbon fuels which is liquid at atmospheric pressure and is used in compression ignition engines

3.3

spark ignition engine

engine in which an electrical spark is produced to ignite the fuel/air mixture

1) To be published.

3.4

compression ignition engine

engine in which ignition is obtained by means of compressing the fuel/air mixture

3.5

permanently installed

securely fastened so that tools need to be used for removal

4 General properties

4.1 Resistance to liquids in contact

4.1.1 All seals such as gaskets, o-rings and joint-rings shall be of non-wicking, i.e. non-fuel absorbent, material.

4.1.2 All materials used shall be resistant to deterioration by the fuel for which the system is designed and to other liquids or compounds with which the material can come in contact as installed under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.

4.1.3 The melting point of materials used for manufacturing of plastic fuel tanks shall be higher than 150 °C.

4.2 Copper-based alloys

Copper-based alloys for fittings are acceptable for direct coupling with all tank materials specified in Table 1, except aluminium. Copper-based alloy fittings are allowed for aluminium tanks only if a galvanic barrier is arranged between fitting and tank.

4.3 Provisions to tanks

4.3.1 Provisions shall be made to enable the fuel level or quantity in the tank to be determined.

4.3.2 Metal tanks shall be designed or installed so that no exterior surface will trap water.

4.3.3 Rigid fuel suction tubes and fill pipes which extend near the tank bottom shall have sufficient clearance to prevent contact with the bottom during normal operation of the craft.

4.3.4 All non-integral tank supports, chocks or hangers shall either be separated from the surface of metal tanks by a non-metallic, non-hygroscopic, non-abrasive material or welded to the tank.

4.3.5 If baffles are provided, the total open area provided in the baffles shall be not greater than 30 % of the tank cross section in the plane of the baffle.

4.3.6 Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom or trap vapour across the top of the tank.

4.3.7 The fuel fill pipe on the tank shall have a minimum inside diameter of 31,5 mm.

4.3.8 Each ventilation pipe on the tank shall have a minimum inside diameter of 11 mm (95 mm²).

4.3.9 Suitable metallic tank materials and minimum recommended material thicknesses required for corrosion resistance are given in Table 1. Other materials may be used if they demonstrate equivalent fuel and corrosion resistance.

Table 1 — Metallic tank materials

Material	Minimum nominal sheet thickness for corrosion resistance	Fuel
	mm	
Copper, internally tin-coated	1,5	Petrol only
Aluminium alloys containing no more than 0,1 % copper	2,0	Diesel and petrol
Stainless steel, with all welding deposits removed	1	Diesel and petrol
Mild steel	2	Diesel only
Mild steel externally hot-dip zinc-coated after fabrication	1,5	Diesel only
Mild steel externally and internally hot-dip zinc-coated after fabrication	1,5	Petrol only
Aluminized steel	1,2	Diesel and petrol

4.4 Petrol fuel tanks

Petrol fuel tanks shall comply with the requirements of Clause 5.

4.5 Diesel fuel tanks

Diesel fuel tanks shall comply with the requirements of Clause 6.

4.6 Installation of non-integral tanks

4.6.1 Tank mechanical fixing

Non-integral tanks shall be installed so that the loads due to the mass of the full tank are safely introduced into the structure, with due consideration given to upward and downward acceleration due to the craft's movements at maximum speed in the sea. In this respect, continuous flexible supports spreading loads are preferable to rigid ones.

Metal or textile hold-down straps are considered as a good practice provided that chafe and corrosion are kept to a minimum.

4.6.2 Other installation requirements

For other installation requirements (filling, vent lines, fuel circuit, etc.), ISO 10088 applies.

5 Petrol fuel tanks: design and tests

5.1 Design

5.1.1 Petrol fuel tanks shall not be integral with the hull.

5.1.2 Petrol fuel tanks shall have all fittings and openings on top, except metallic fill and ventilation pipes, which may be connected to the sides or ends of metal petrol fuel tanks, provided that they are welded to the tank and reach above the top of the tank.

5.1.3 Tank drains are not permitted on petrol fuel tanks.

5.2 Tests to be performed

- 5.2.1 Petrol fuel tanks shall be leakage tested in accordance with 7.1.2.
- 5.2.2 Petrol fuel tanks shall be pressure-impulse tested in accordance with 7.2.
- 5.2.3 Non-metallic petrol fuel tanks shall meet the fire test in accordance with 7.3 and 7.4.

6 Diesel fuel tanks: design and tests

6.1 Design

- 6.1.1 Diesel fuel tanks may be constructed independent of or integral with the hull. Care should be taken to avoid penetration of fuel in the hull.
- 6.1.2 Diesel fuel integral tanks shall be built in accordance with ISO 12215-5.
- 6.1.3 Diesel fuel tanks may have side inspection openings. Fittings in the bottom, sides or ends are allowed provided that each connection has a shut-off valve directly coupled to the tank. The valve shall be protected or located to prevent physical damage or be of at least 25 mm nominal diameter.
- 6.1.4 Diesel fuel tank drains, where fitted, shall have a shut-off valve with a plug on the outlet that can only be removed by the use of tools, or the handle of the drain shut-off valve shall be removable with the valve in its closed position.

6.2 Tests to be performed

- 6.2.1 Diesel tanks shall be leakage tested in accordance with 7.1.2.
- 6.2.2 Diesel tanks shall be pressure tested in accordance with 7.1.3.

7 Tests

7.1 Hydraulic pressure test

7.1.1 General

WARNING — Take care not to exceed the maximum static test pressure. Do not use solutions containing ammonia for testing.

7.1.2 Leakage test

Each test fuel tank shall be internally tested with a hydraulic pressure with all its accessories. The test pressure shall be the greatest of

- 20 kPa;
- 1,5 times the highest hydrostatic pressure to which the tank may be subjected in service (maximum fill-up height above tank top).

The static test pressure shall be applied for 5 min without pressure drop or rise. After the test, the test fuel tank shall not show any leakage when using a leak detection method other than the pressure-drop method.

7.1.3 Hydraulic pressure/strength type test

After the leakage test (7.1.2), a test fuel tank, representative of the tank series type, with all its accessories shall be pressurized again as given in 7.1.3.1 to 7.1.3.2.2.

7.1.3.1 Metal tanks

The pressure shall be gradually increased to the greater of

- 20 kPa;
- 1,5 times the highest hydrostatic pressure to which the tank may be subjected in service (maximum fill-up height above tank top).

This pressure shall be maintained for 1 min.

During this time, the tank shell shall not crack or leak; however, it may be permanently deformed.

7.1.3.2 Thermoplastic tanks

Prior to the hydraulic pressure test, thermoplastic tanks shall be stored filled with test liquid C in accordance with ISO 1817 or the fuel for which the tank is fabricated for at least 28 days at an ambient temperature of not less than 21 °C. The hydraulic pressure test shall be performed immediately after emptying the test liquid out of the tank.

7.1.3.2.1 Thermoplastic of density $> 935 \text{ kg/m}^3$

The pressure shall be gradually increased to the greater of

- 20 kPa;
- 1,5 times the highest hydrostatic pressure to which the tank may be subjected in service (maximum fill-up height above tank top).

This pressure shall be maintained for 60 min.

During this time, the tank shell shall not crack or leak; however, it may be permanently deformed.

7.1.3.2.2 Thermoplastic of density $\leq 935 \text{ kg/m}^3$

The pressure shall be gradually increased to the greater of

- 20 kPa;
- 1,5 times the highest hydrostatic pressure to which the tank may be subjected in service (maximum fill-up height above tank top).

This pressure shall be maintained for 5 h.

During this time, the tank shell shall not crack or leak; however, it may be permanently deformed.

7.2 Pressure-impulse type test for petrol fuel tanks

7.2.1 A test fuel tank, representative of the tank series type, shall not exhibit any leakage or other signs of failure after 25 000 cycles of pressure impulses.

7.2.2 The pressure-impulse test of thermoplastic tanks shall be conducted on the test tank prepared in accordance with 7.1.3.2.

7.2.3 The test tank fully filled with water shall be mounted using support, chocks or brackets, either furnished with the tank or as intended to be used in a craft installation.

7.2.4 The test tank shall be attached to a regulated source of pressure of either air, nitrogen or water. The control mechanism of the pressure source shall then be set to cause pressure in the test tank, measured at its top-most surface, to vary from 0 kPa to 2 kPa to 0 kPa at a rate of not more than 15 cycles per minute.

7.2.5 Before and after the pressure-impulse test, the tank shall meet the requirements of 7.1.

7.3 General fire-resistance test of non-metallic petrol fuel tanks

7.3.1 This test shall be conducted to qualify tanks if the actual installation conditions are not known.

7.3.2 Prior to the fire test, the test tank shall be subjected to the hydraulic test specified in 7.1 and the test liquid shall be removed.

7.3.3 The test tank shall be supported at its ends and at each baffle in a test enclosure. The enclosure shall be a fire-resistant box closed on its top, bottom and ends, and only open on one of its sides (see Figure 1). The clearance between the test tank and the test enclosure shall be at least 50 mm on the sides, 150 mm on the ends and between 175 mm and 850 mm on the top.

7.3.4 The lowest point of the test tank shall be vertically 75 mm above the liquid surface of the reservoir containing heptane. The sides of the reservoir shall extend 50 mm beyond the vertical sides and 150 mm beyond the ends of the test tank. The reservoir shall be made leakproof and accommodate enough heptane to burn continuously for at least 2,5 min. See Figure 1.

7.3.5 The area in which the test is to be conducted shall be free from draughts but shall allow a free inflow of air during the test.

7.3.6 Fill the test tank to 25 % of its rated capacity with the intended fuel.

All openings in the tank shall be capped or plugged, except fuel tank vent lines which shall be extended outside the fire-test area. Components fixed on the tank or in the test rig that are not intended to be tested shall be sufficiently heat protected.

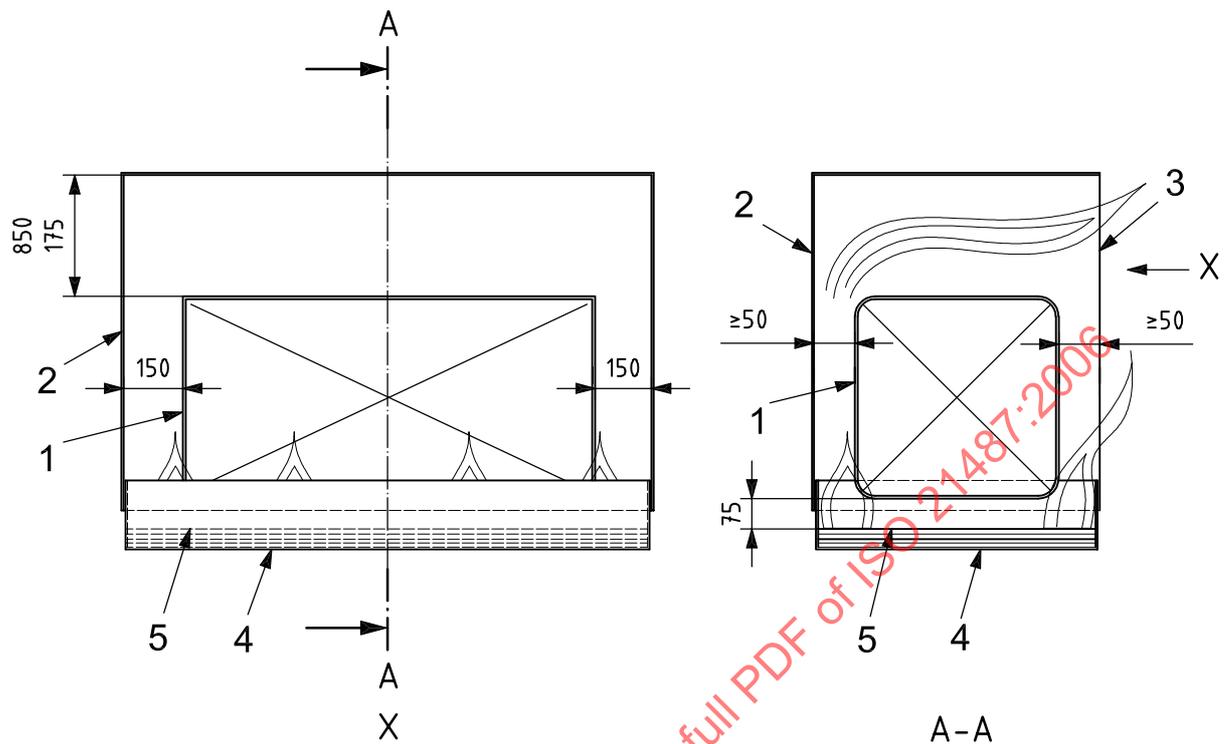
7.3.7 The heptane in the reservoir shall be ignited and permitted to burn for a continuous period of 2,5 min. The temperature at at least one point within 25 mm of the test tank shall be at least 650 °C some time during the test.

7.3.8 At the end of the 2,5 min test period, any continued burning shall be extinguished.

7.3.9 After cooling down, the test tank shall be examined for leakage. It shall be drained and pressure tested with a slowly increased air or inert gas pressure up to 1,8 kPa.

The tank shall show no evidence of leakage when checked with methods other than the pressure-drop method.

Dimensions in millimetres

**Key**

- 1 tank to be tested
- 2 test enclosure
- 3 open part of the enclosure
- 4 bottom of heptane pan
- 5 top of heptane level

Figure 1 — Sketch of test tank and test enclosure**7.4 As-installed fire-resistance test of non-metallic petrol fuel tanks**

7.4.1 This test shall be conducted to qualify tanks intended to be installed in a particular craft model, or series, where the installation conditions are specified or otherwise controlled.

7.4.2 Install the test tank in an actual or simulated hull section of sufficient size to simulate fire conditions aboard the craft. All structural elements shall be made of the same material as that used on the craft, or of a material of equivalent flammability.

7.4.3 To qualify a tank intended for use in a craft series, the test tank shall be installed in a simulated hull section providing the maximum fire exposure representative of that series.

7.4.4 Prior to the fire test, the test tank shall meet the requirements of 7.1. Then, the test pressure shall be released.

7.4.5 The area in which the test is to be conducted shall be free from draughts but shall allow a free inflow of air during the test.

7.4.6 Fill the test tank to 25 % of its rated capacity with the intended fuel.

All openings shall be capped or plugged, except fuel tank vent lines which shall be extended outside the fire-test areas. Components fixed on the tank or in the test rig that are not intended to be tested shall be sufficiently heat protected.