
**Small craft — Inboard diesel engines —
Engine-mounted fuel and electrical
components**

*Petits navires — Moteurs intérieurs diesels — Éléments des circuits
d'alimentation et des systèmes électriques fixés sur le moteur*

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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.

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

ISO 16147 was prepared by Technical Committee ISO/TC 188, *Small craft*.

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Small craft — Inboard diesel engines — Engine-mounted fuel and electrical components

1 Scope

This International Standard establishes requirements for the design and installation of engine-mounted fuel and electrical components on diesel inboard-mounted engines for minimizing fuel leakage and the risk of and/or the spread of fire on small craft of hull length up to 24 m.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 IEC and ISO maintain registers of currently valid International Standards.

ISO 7840:1994, *Small craft — Fire-resistant fuel hoses*

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

ISO 10133:2000, *Small craft — Electrical systems — Extra-low-voltage d.c. installations*

3 Terms and definitions

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

3.1

engine-mounted

component fixed to the marine inboard engine and which will be in place while the engine is in operation

3.2

diesel fuel

hydrocarbon fuel or blends of hydrocarbon fuels which are liquids at atmospheric pressure and are used in compression-ignition engines

3.3

diesel engine

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

3.4

accessible

capable of being reached for inspection, removal or maintenance without removal of the permanent boat structure

NOTE Hatches are not regarded as permanent boat structures in this sense, even if tools are needed to open them.

3.5

low-pressure fuel line

hose or pipe for fuel supply to high-pressure pumps or injection pumps including leak-off and return pipes from high-pressure pumps, injection pumps, injectors, etc.

3.6

high-pressure fuel pipe

fuel pipes from high-pressure pumps or injection pumps including high-pressure accumulators (rails)

4 General

All material and components shall be suitable for use in a marine atmosphere and capable of operation within an ambient temperature range of $-10\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$ without failure or leakage, and be capable of being stored without operation within an ambient temperature range of $-30\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$ without failure or leakage.

5 Engine fuel system and components

5.1 General

5.1.1 Engine-mounted fuel and lubricating systems shall be leak free, such that there is no dripping or wetting of surface areas at the interface of connecting components and pipe joints due to misting atomization, or liquid from fuel or lubrication under normal operation.

5.1.2 All materials used in fuel systems shall be resistant to deterioration by the fuel and to other liquids or compounds with which they may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.

5.1.3 All sealing material, such as gaskets, o-rings, joint-rings, etc. shall be of the non-wicking, i.e. non-fuel-absorbent type.

5.1.4 Fuel filters and flexible hoses shall, individually or as installed, withstand a 2,5 min fire test as described in ISO 10088:2001, annex B or ISO 7840:1994, annex A.

5.2 High-pressure pipes

5.2.1 High-pressure pipes shall be suitable for the pressure and pressure impulses in the system and shall be made of, for example, welded or solid drawn-steel pipes.

5.2.2 High-pressure pipes shall be secured to prevent vibrations leading to pipe fracture at all operating engine speeds.

5.3 Low-pressure fuel lines

5.3.1 Low-pressure fuel lines shall be made of

- seamless copper or copper alloys, stainless steel, or corrosion-resistant coated mild steel pipe with a high temperature ($450\text{ }^{\circ}\text{C}$ or above) soldered or brazed end forms, or male/female straight-in pipes with compression-ring sealings and screwed compression connections, or
- flexible hose meeting the requirements of ISO 7840 secured by a metal hose clamp or permanently installed end fittings, such as a swaged sleeve, threaded insert or connections with compression ring sealings.

5.3.2 Hose connections having a nominal diameter of more than 25 mm shall have two hose clamps. The spud shall be at least 35 mm long, to provide space for the clamps.

5.3.3 All low-pressure pipes shall be secured into position so as to prevent damage due to excessive vibration leading to pipe fracture. All flexible hoses shall be located away from non-insulated components with a surface temperature above 200 °C, but remain accessible for inspection and maintenance.

5.4 Fuel filters

Fuel filters shall

- be independantly supported to avoid stress on pipe connections,
- be readily accessible, and
- not be mounted above turbochargers or uncooled exhaust gas manifolds.

6 Electrical systems and components of engines

6.1 D.C. installations

The d.c. negative ground/earth for electrical systems shall be

- a fully insulated earth return, or
- a ground earth return.

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6.2 Cranking motors

Earth-return cranking motors shall be earthed (d.c. negative ground/earth) to the earth return system of the engine.

6.3 Wiring and connections

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6.3.1 Cables and wiring shall be sized in accordance with ISO 10133.

6.3.2 Cables, wires and looms shall be

- of adequate length to prevent stressing of the cable and connections and chafing of the insulation,
- kept and secured well clear of rotating-shaft couplings, belts, etc., and
- supported to minimize the effects of vibration and chafing.

6.3.3 Wiring connections shall have the following protection:

- IP 67 as a minimum, if exposed to short-term immersion;
- IP 55 as a minimum, if exposed to splashing water;
- IP 20 as a minimum, if located in protected locations inside the craft.

6.4 Relays, fuse boxes and electronic control modules (ECMs)

Relays, fuses and ECMs shall have the following protection or be enclosed in boxes having the same protection level:

- IP 67 as a minimum, if exposed to short-term immersion;

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- IP 55 as a minimum, if exposed to splashing water;
- IP 20 as a minimum, if located in protected locations inside the craft.

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