
**Large yachts — Diesel engines for
main propulsion and essential
auxiliaries — Safety requirements**

*Grands yachts — Moteurs diesel pour la propulsion principale et les
moteurs auxiliaires essentiels — Exigences de sécurité*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee 12, *Large yachts*.

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Introduction

This International Standard defines the safety requirements for diesel engines installed in large yachts and promotes a risk based approach for diesel engines intended for propulsive or essential auxiliaries for power generation.

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Large yachts — Diesel engines for main propulsion and essential auxiliaries — Safety requirements

1 Scope

This International Standard specifies the safety requirements for diesel engines with a rated power of 100kW and over for propulsion and essential auxiliaries for power generation for large yachts 24 m and over in hull length, measured in accordance with ISO 8666:2002, and of less than 500 GT which are in commercial use for sport or pleasure, and do not carry cargo and do not carry more than twelve passengers.

The engine in terms of this International Standard is understood as the prime mover up to its driving extremities for power take off(s).

This International Standard does not cover engines used for generating the emergency source of electrical power.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3046-1, *Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods* — Additional requirements for engines for general use

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

ISO 8666:2002, *Small craft — Principal data*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 15540, *Ships and marine technology — Fire resistance of hose assemblies — Test methods*

ISO 25197, *Small craft — Electrical/electronic control systems for steering, shift and throttle*

IEC 60068-2-6, *Environmental testing — Part 2-6: Test Fc Vibration (sinusoidal)*

IEC 60092-101, *Electrical installations in ships — Part 101: Definitions and general requirements*

IEC 60092-504:2001, *Electrical Installations in ships — Part 504: Special Features — Control and Instrumentation*

IEC 60332-2-1, *Tests on electric and optical fibre cables under fire conditions — Part 2-1: Test for vertical flame propagation for a single small insulated wire or cable — Apparatus*

IEC 60332-2-2, *Tests on electric and optical fibre cables under fire conditions — Part 2-2: Test for vertical flame propagation for a single small insulated wire or cable — Procedure for diffusion flame*

IEC 60533, *Electrical and Electronic Installations in Ships — Electromagnetic Compatibility*

IEC 60695-11-5, *Fire hazard testing — Part 11-5: Test flames — Noodle flame test method — Apparatus, confirmatory test arrangement and guidance*

3 Terms and definitions

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

3.1 auxiliary machinery

machinery to provide the vessel with sufficient energy (mechanically, hydraulically or electrically) to operate equipment and systems including essential services on-board the vessel under all foreseen and defined weather and sea conditions

3.2 diesel engine

an internal combustion engine that uses the heat of highly compressed air to ignite a spray of fuel introduced after the start of the compression stroke

3.3 essential auxiliaries

electric generators and associated power sources supplying essential services

3.4 essential services

services essential for propulsion and steering, and safety of the ship

EXAMPLE Steering gears; pumps for controllable pitch propellers; fuel oil supply pumps, fuel valve cooling pumps, lubricating oil pumps and cooling water pumps for main and auxiliary engines necessary for propulsion; azimuth thrusters which are the sole means for propulsion/steering with lubricating oil pumps and cooling water pumps; electrical equipment for electric propulsion plant with lubricating oil pumps and cooling water pumps; electric generators and associated power sources supplying the above equipment; hydraulic pumps supplying the above equipment; control, monitoring and safety devices/systems for equipment to essential services; starting air and control air compressors; fire pumps and other fire extinguishing medium pumps; ventilating fans for engine rooms and machinery spaces; shaft lubrication; navigation, communication, fire detection systems, etc.

3.5 failure

termination of the ability of an item to perform a required function

Note 1 to entry: After failure, the item has a fault.

Note 2 to entry: "Failure" is an event, as distinguished from "fault", which is a state.

Note 3 to entry: The concept, as defined, does not apply to items consisting of software only.

[SOURCE: IEV, 191-04-01]

3.6 fault

state of an item characterized by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

Note 1 to entry: A fault is often the result of a failure of the item itself, but can exist without prior failure.

Note 2 to entry: In practice, the terms "fault" and "failure" are often used synonymously.

[SOURCE: IEV, 191-05-01]

3.7 harm

physical injury or damage to health

[SOURCE: ISO 12100:2010, 3.5]

3.8**hazard**

potential source of harm

Note 1 to entry: The term “hazard” can be qualified in order to define its origin (for example, mechanical hazard, electrical hazard) or the nature of the potential harm (for example, electric shock hazard, cutting hazard, toxic hazard, fire hazard).

Note 2 to entry: The hazard envisaged by this definition either:

— is permanently present during the intended use of the machine (for example, motion of hazardous moving elements, electric arc during a welding phase, unhealthy posture, noise emission, high temperature), or

— can appear unexpectedly (for example, explosion, crushing hazard as a consequence of an unintended/unexpected start-up, ejection as a consequence of a breakage, fall as a consequence of acceleration/deceleration).

[SOURCE: ISO 12100:2010, definition 3.6]

3.9**machinery spaces**

all spaces of category A and all other spaces containing propelling machinery, boilers, oil fuel units, internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces

3.10**machinery spaces of category A**

spaces and trunks to such spaces which contain: a) internal combustion machinery used for main propulsion; b) internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375kW; or c) any oil-fired boiler or oil fuel unit

3.11**machinery system**

all equipment necessary to operate reliable and safe main and auxiliary machinery

3.12**mass production**

<machinery> produced in quantity under quality control of material and parts, where parts are designed and machined to close tolerance for interchangeability and assembled with parts taken from stock requiring little or no fitting

3.13**propulsion**

component or components of thrust that permits a craft movement in any direction

3.14**rated power****declared power**

value of the power, declared by the manufacturer, which an engine will deliver under a given set of circumstances

[SOURCE: ISO 15540:1999, definition 3.3.1]

3.15**rated speed****declared speed**

speed at which, according to the statement of the engine manufacturer, the rated power is delivered

[SOURCE: ISO 15540:1999, definition 3.2.4]

3.16

readily accessible

capable of being reached quickly and safely without the use of tools

3.17

reliability

ability of a machine or its components or equipment to perform a required function under specified conditions and for a given period of time without failing

[SOURCE: ISO 12100:2010, definition 3.2]

3.18

recognised organization

independent company or body which has been authorized by the Flag Administration for inspection and survey duties on its behalf

3.19

risk

expression of the danger that an undesired event represents to persons, to the environment or to material property.

Note 1 to entry: The risk is expressed by the probability and consequences of an accident.

Note 2 to entry: The definition is different from the definition 3.12 of ISO 12100:2010.

3.20

SOLAS

International Convention for the Safety of Life at Sea, 1974, as amended

3.21

thrust

propulsive force from vessel's main propulsion system or bow or stern thrusters, or a combination thereof in order to move or rotate the craft

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4 Engine requirements

4.1 General requirements

The diesel engine, associated systems and fittings relating to propulsion and auxiliary power units shall be of a design and construction adequate for the service and environment for which they are intended. The design and instructions shall take into consideration protection so as to reduce any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards.

The diesel engine, equipment and associated systems and controls shall be supplied with all of the instructions essential for correct installation, maintenance and safe operation. Adequate information shall be supplied to identify any risk associated with the interfaces and equipment not within the scope of the engine manufacturer's supply.

4.2 Risk assessment

The requirements of ISO 12100 shall be complied with.

Potential hazards shall be assessed and risks shall be identified. As a minimum, the potential hazards in accordance with the hazard list in [Annex A](#) should be assessed. A risk analysis of the identified risks shall be conducted and include diesel engine and its associated systems (including controls). The analysis should demonstrate that suitable risk mitigation has been achieved. Results of a system functional failure analysis shall be documented and confirmed by a practical test programme drawn up from the analysis.

Details of risks, and the means by which they are mitigated, shall be included in the operating manual.

NOTE While FMEA (Failure Modes and Effect Analysis) is commonly adopted as an acceptable risk assessment technique, there are other methods which can be used and which, in certain circumstances, can offer an equally comprehensive insight into particular failure characteristics.

4.3 Ambient conditions

The diesel engine shall be designed to operate under the following environmental conditions:

- ambient machinery space air temperature from 0°C to 45°C;
- sea water temperature up to 32°C.

NOTE 1 The rated power(s), as declared by the manufacturer, are to include ISO power at ISO 3046-1 tropical conditions of 32°C/45°C.

NOTE 2 Other ambient conditions may be used as agreed between engine manufacturer and customer.

4.4 Inclinations

Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the vessel shall, as fitted in the vessel, be designed to operate when the vessel is upright and when inclined at any angle of list up to and including 15° either way under static conditions and 22,5° under dynamic conditions (rolling) either way and simultaneously inclined statically 5° and dynamically (pitching) 7,5° by bow or stern.

For sailing yachts special consideration shall be taken for any diesel engine to be operated under sailing condition.