Technical Specification

ISO/TS 23099

First edition
2026-03

Large yachts — A methodologic framework to assess large yachts (30m+) on their environmental performance and credentials

Grands yachts — cadre méthodologique pour évaluer les qualifications et les performances environnementales des grands yachts (30 m et plus)

Reference number
ISO/TS 23099:2026(en)

Contents

Page

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 12, *Ships and marine technology - Large yachts*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document has been developed in response to growing industry demand for a realistic and transparent methodology to assess and compare large yachts regarding their environmental performance while in operation. Increasingly, yachts are being promoted as “green” or “sustainable” without quantifiable criteria, while simultaneously more clients are looking for references to understand the environmental footprint of yachts.

The International Maritime Organization (IMO), with the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI Energy Efficiency Design Index (EEDI),[18] has developed an instrument for ships, however yachts are generally not subject to EEDI. Based on voluntary attempts, the EEDI was determined to be inadequate for the specific application to large yachts due to its narrow scope and different operational assumptions.

Elaborating on results of a five-years joint industry project, the document draws on collaboration between major shipyards, naval architects, classification, environmental experts and research institutes. It provides a framework with requirements not covered by legislation for yachts over 30 m and below 5 000 Gross Tonnage (GT), and complementary for yachts over 5 000 GT. It can be seen as pro-active self-regulation to set new industry standards, providing a sector specific, goal-driven approach.

Specifically, the EEDI methodology presumes continuous vessel movement, whereas yachts typically spend approximately 90 % of operational time anchored or docked in harbour.[1] The substantial energy consumption occurring during these stationary periods cannot be neglected, as propulsion typically accounts for about only half of a yacht's annual energy use and hotel power the other half. Therefore, it was necessary to develop a robust method, starting with a realistic, standardized operational profile for large yachts. The approach is system-based rather than behaviour-based, using installed equipment data and verified performance across a fixed operational profile, ensuring a repeatable and verifiable calculation method.

While EEDI focuses primarily on CO_2 emissions during ship operation, other MARPOL regulations address additional pollutants such as NOx and SOx. A comprehensive method based on life cycle assessment (LCA) (see ISO 14040)[19] has been used to accurately evaluate total environmental impacts, measuring both downstream emissions (CO_2, NOx, SOx) and upstream processes including fuel production, shore-based energy, and urea production. Although the current scope of this document emphasizes operational energy, it is structured to allow future integration of yacht manufacturing, maintenance, and end-of-life stages. This document aligns with MARPOL Annex VI and the IMO Life-Cycle GHG guidelines by accounting for both Well-to-Tank (WtT) and Tank-to-Wake (TtW) contributions to a yacht’s total Well-to-Wake (WtW) impact. In general terms, the calculation of the well-to-wake impact follows the formula below.

Well-to-Wake impact = power demand × operational profile × (specific Well-to-Tank impact + specific Tank-to-Wake impact)

The power demand is based on vessel specific propulsion and auxiliary power input, thus rewarding yachts with either improved naval architecture or improved onboard systems with less environmental impact, or both.

The subsequent environmental impact is expressed in terms of “ecopoints” a common environmental indicator when applying Life Cycle Assessments (LCA) incorporating various environmental parameters including CO_2, NOx, particulate matter (PM) and more. Alternatively, the impact can be translated into CO_2eq, a broader recognized metric.

Since 2019, a joint industry project and other index initiatives[20] have emerged to address yacht specific environmental assessments. This document includes elements of these methods and aims to provide the yachting sector with a single methodology and reference for clarity, unity and most importantly to accelerate progress with assessing and subsequently improving the environmental performance of both the existing fleet and new build projects.

Use of this document enables early, consensus-based use of a maturing method and allows timely updates as data availability and alternative fuels evolve.

Large yachts — A methodologic framework to assess large yachts (30m+) on their environmental performance and credentials

1 Scope

This document specifies a methodology to calculate the environmental impact of operational energy use for large yachts and enables the comparative assessment of a yacht's environmental performance against a defined baseline fleet. The method established herein is robust and based on the best available data, with transparency and comparability across various yacht types and technical characteristics. This document explicitly addresses operational energy consumption during the yacht's use phase, emphasizing the efficiency of onboard systems benchmarked against the found average operational profile and the environmental emissions coming from this energy, both upstream and downstream. It excludes behavioural variables arising from individual yacht operation patterns. Additionally, the production and maintenance materials and processes (upstream impacts), as well as yacht end-of-life considerations (part of downstream impacts), are outside the scope of this document.

The operational profile specified in this document assumes that the yacht is professionally crewed year-round and capable of independent transoceanic voyages.

NOTE For motor yachts, this operational assumption generally aligns with IMO MARPOL requirements, which apply to ships exceeding 400 GT that must be surveyed and certified for MARPOL compliance. Sailing yachts typically exhibit lower GT for equivalent length; however, their cruising behaviours align closely with motor yachts of comparable length.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
battery
rechargeable electrical energy storage system comprising one or more modules and associated ancillary equipment

3.2
ecopoint
single numerical indicator expressing annual environmental impacts arising from *yacht* (3.22) emissions from fuel usage, and shore-based electricity consumption

Note 1 to entry: Ecopoints represent a weighted aggregate derived from 18 environmental indicators using the eco-scarcity method. This method addresses multiple environmental impacts beyond typical legislative approaches primarily limited to CO_2.

3.3
environmental impact calculation
complete calculation method used to quantify the annual environmental impacts arising from *yacht* (3.22) operations

Note 1 to entry: This includes emissions coming from energy carriers use and shore-based electricity usage.

Note 2 to entry: This calculation forms the basis for determining *ecopoints* (3.2) or alternatively, the impact can be expressed in CO_2 equivalent (see Annex B).

Below the method is summarized in Formula (1), where Y represents yacht environmental performance.

$$Y = \sum_{k=1}^{n_o} Y_k \tag{1}$$

$$Y_k = \frac{\sum_{j=1}^{n_f} f_j \times \sum_{i=1}^{n_e} \frac{C_{sf,i}}{1E^6} \times P_i \times t_i + \frac{P_s}{1\,000} \times t_s \times f_s + \left(\sum_{j=1}^{n_m} f_j \times \left(\sum_{i=1}^{n_e} \frac{E_{S,ij}}{1\,000} \times P_i \times t_i \right) \times f_a \right)}{1\,000}$$

where

for each defined operational condition, Y_k shall be calculated;

n_f is the number of energy carriers;

f_j is the fuel or emission intensity factor [-], according to 8.2 and 8.3;

P_i is the engine loading, expressed in electrical kilowatts kWe, of each respective engine at the applicable operational condition, according to Clause 7;

P_s is the shore power, expressed in kilowatt hours (kWh), according to 7.2;

t_i is time, expressed in hours (h), per year of each respective engine running (operational profile), according to Clause 4;

t_s is the shore power time, expressed in hours (h), according to 4.1;

f_s is the emission factor of shore power according to 8.2;

$C_{sf,i}$ is the specific fuel consumption, expressed in grams per kilowatt hour (g/kWh), of each respective engine at the applicable operational condition;

$E_{S,ij}$ is the specific emission, expressed in g/kWh, of each respective engine at the applicable operational condition;

n_e is the number of engines;

t_s is the time connected to shore power, expressed in h;

f_s is the shore power impact factor;

n_m is the number of emissions' types;

n_o is the operational mode as per Table 1;

f_a is the factor of after-treatment systems, as per 7.6.3.

Note 3 to entry: The Y score represents the environmental Well-To-Wake intensity of a yacht based on the standard *operational profile* (3.13). Well-To-Tank intensity includes fuel and shore power energy consumption multiplied by their respective intensity factors. Tank-To-Wake intensity includes engine emissions mass multiplied by emission intensity factors and adjusted by the after-treatment factor.

3.4
engine
device converting fuel into mechanical energy, typically employed for propulsion or electrical power generation

Note 1 to entry: An internal combustion engine (ICE) is normally utilized, though gas turbines or steam turbines may also be included. Fuel conversion efficiency is load-dependent, resulting in specific emissions varying accordingly.

3.5
generator set
unit comprising an *engine* (3.4) and an alternator that supplies electric power to the main switchboard

Note 1 to entry: Specific fuel consumption and emissions are determined accounting for losses up to the main switchboard (e.g. rectifiers, alternator efficiency).

Note 2 to entry: Fuel cells or reformer/fuel-cell combinations are considered within this definition with their characteristic efficiencies and emissions.

3.6
gross tonnage
GT
measure of a ship's total internal volume used to express the vessel's overall size, rather than mass

3.7
hotel power
all onboard power consumption excluding propulsion power

Note 1 to entry: Loads include engine-room ventilation, steering, and cooling pumps, which vary across the *operational profile* (3.13).

3.8
hydrogeneration
recovery and conversion of excess sail power from a high-performance sailing rig into electrical energy by means of the *yacht's* (3.22) propellers

3.9
length waterline
value determined at half-load condition as employed within the vessel's stability calculations, representing average operational load conditions

3.10
life cycle assessment
LCA
compilation and evaluation of inputs, outputs, and potential environmental impacts of a product system throughout its life cycle

[SOURCE: ISO 14040:2006, 3.2]

3.11
main switchboard
junction point connecting electrical power supply systems, such as generators and power take-off units (PTOs), with electrical consumers associated with propulsion and auxiliary power demands onboard

3.12
motor yacht
yacht (3.22) utilizing exclusively *engines* (3.4) or generator sets for propulsion purposes

3.13
operational profile
standardized description of average annual *yacht* (3.22) operation used for comparative assessment

Note 1 to entry: A user-specific profile can be used to calculate impact for a specific operator; such results are not intended for fleet comparison.