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**Large yachts — Strength, weathertightness and watertightness of glazed openings —
Part 1: Design criteria, materials, framing and testing of independent glazed openings**

*Grands yachts — Résistance, étanchéité aux intempéries et étanchéité à l'eau des ouvertures
vitrées — Partie 1: Critères de conception, matériaux, encadrement et essais des ouvertures
vitrées indépendantes*

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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~~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).

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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.

~~ISO 11336-1~~This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 12, *Ships and marine technology — Large yachts*.

This second edition cancels and replaces the first edition (ISO 11336-1:2012), which has been technically revised.

The main changes are as follows:

- ~~— the Scope extended for: Length;~~ has been expanded to include length, number of passengers; and glazing materials;
- ~~Design — the design~~ pressure model has been parameterized and adapted to cover larger yachts;
- ~~More 'advanced'~~ — more advanced scantling calculation methods; have been added;
- ~~New — a new~~ approach on robustness of superstructure and hull glazing; has been added;
- ~~— Backgrounds of selected changes are described in greater detail in Annex H (Informative)~~
- ~~— Annex H has been replaced with information on the main changes since the first edition;~~

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— [Annexes I and J have been added.](#)

A list of all parts in the ISO 11336 series can be found on the ISO website.

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Large yachts — Strength, weathertightness and watertightness of glazed openings — Part 1: Design criteria, materials, framing and testing of independent glazed openings

1 Scope

This document specifies technical requirements for independent glazed openings on large yachts, taking into account navigation conditions, the location of the opening and the materials, framing and testing.

Large yachts are yachts with length of the hull, L_H , higher or equal to 24 m, used for sport or pleasure and commercial operations.

This document is suitable for the design of glazed openings on all large yachts. However, where yachts carry more than 12 passengers, the additional requirements (set by the appropriate marine administration) for fire integrity and damage stability are outside the scope of this standard.

The opening and the associated closing appliances considered in this document are only those that are above the deepest waterline (dsw) and are critical for the ship integrity related to weathertightness and watertightness, i.e. those that can lead to ingress of water in the hull in case of rupture, dislocation or loss of the pane or its mounting. This document is related and limited to independent glazed openings in which the pane is supported solely by simple linear support at the edges, as outlined in the scantling determination methods in 5.6. Glazing in which the rotation at the edges is constrained more than it would be by a single bond line in accordance with ISO 11336-2, is not covered by the methods defined in 5.6 of this document. This document, excluding annexes, is limited to glazing of any shape, which is simply supported along all edges, they are excluded horizontally. Horizontally positioned glazing is excluded.

NOTE This document is based on the experience of ship window and glass manufacturers, shipbuilders and authorities who apply to ships the regulations of SOLAS, as amended^[7], and of the International Convention of Load Lines, as amended^[6], noting the provisions by the SOLAS Protocol of 1988, Article 8, as agreed by the appropriate Marine Administration, and on the experience gained with application of the Large Commercial Yacht Code and the REG Yacht Code^[16].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 178, *Plastics. — Determination of flexural properties*

ISO 1751, *Shipbuilding Ships and marine structures — Ships' technology — Ships' side scuttles*

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ISO 3903, [ShipbuildingShips](#) and marine ~~structures~~—[Ships'technology — Ships'](#) ordinary rectangular windows

ISO 5797, [Ships and marine technology](#)— Windows and side scuttles for fire-resistant constructions

ISO 6345, [Shipbuilding and marine structures](#)— Windows and side scuttles— Vocabulary

ISO 12543-1, [Glass in building](#)— Laminated glass and laminated safety glass— Part 1: ~~Definitions~~[Vocabulary](#) and description of component parts

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 21005, [ShipbuildingShips](#) and marine technology— Thermally toughened safety-~~glass~~ panes for windows and side scuttles

ISO-6721-10, [Plastics — Determination of the dynamic mechanical properties of rigid plastics — Part 10: Complex shear viscosity using a parallel-plate oscillatory rheometer](#)

EN 1288-3, *Glass in building — Determination of the bending strength of glass — Part 3: Test with specimen supported at two points (four point bending)*

EN 1990:2008, *Eurocode — Basis of structural design*

EN 12150-1:2000, *Glass in building — Thermally toughened soda lime silicate safety glass — Part 1: Definition and description*

EN 12337-1, *Glass in building — Chemically toughened soda lime silicate safety glass — Part 1: Definition and description*

EN 13195-1, *Aluminium and aluminium alloys. Specifications for wrought and cast products for marine applications (shipbuilding, marine and offshore)*

EN-16612, *Glass in building. Determination of the lateral load resistance of glass panes by calculation*

ISO-29584-1, [Glass in building](#) — Pendulum impact testing and classification of safety glass

ISO-11336-2, *Large yachts — Strength, weathertightness and watertightness of glazed openings — Part 2: Glazed opening integrated into adjacent structure (elastically bonded to bulkhead or shell) design criteria, structural support, installation and testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6345 and the following 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><https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/><https://www.electropedia.org/>

3.1

glazed opening

opening in the hull, [superstructure \(3.26\)](#) or deckhouse of a ship structure to be fitted with a transparent or translucent material

3.2

independent glazed opening

glazed opening (3.1) where the mechanical behaviour of the *pane* (3.5) can be considered independent from adjacent structure because the pane is mounted in such a way that it is isolated from deformations of the supporting structure, and the only loads on the pane are lateral pressure and effect of gravity and inertia

3.3

not independent glazed opening

glazed opening (3.1) where the mechanical behaviour of the *pane* (3.5) cannot be considered independent from adjacent structure, e.g. pane bonded directly into a seat in such a way that it is carrying in-plane loads or is subjected to out-of-plane deformations of the supporting structure

3.4

appliance

device made of a *pane* (3.5) and a fixing system, used to cover an opening in the hull, [superstructure \(3.26\)](#) or deckhouse

3.5

pane

sheet of material fixed within or to a supporting structure

3.6

glazing

transparent or translucent *pane* (3.5)

3.7

unsupported dimensions

clear dimensions between the supports bearing the *pane* (3.5) [ISO 11336-1](#) [ist/9139bd66-1373-4473-ba6d-7e1fbc5ec210/iso-11336-1](#)

NOTE See Annex A.

3.8

deadlight

secondary watertight closure fitted to a *glazed opening* (3.1) and which is fitted on the inside of the vessel

3.9

storm shutter

portable protective closure fitted to a *glazed opening* (3.1) and which is fitted on the outside (weatherside) of the vessel

3.10

flag administration

government of the state whose flag the yacht flies

3.11

certifying authority

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flag administration (3.10) or ~~the~~ organization to whom the flag administration delegates certifying authority

3.12

service

description of the service limitations for which a yacht is assessed to be suitable

3.13

commercial operation

~~yachts engaged in operation for~~ commercial use, [involving yachts](#) carrying no cargo and generally not more than 12 passengers or not needing to comply with passenger ship requirements

3.14

pleasure operation

[operation involving](#) private yachts not engaged in trade

3.15

operational range

range for which a yacht is assessed to be suitable

~~3.16~~

~~operational range~~ **Note 1 to entry: For unrestricted range yachts**

~~the operational range is the~~ extended distance from safe haven where conditions experienced can exceed wind force 8 (Beaufort scale), excluding extreme conditions.

~~3.17~~

~~operational range~~ **Note 2 to entry: For intermediate range yacht**

~~yachts the operational range is a~~ distance of not more than 200 nautical miles (~~370 km~~) from a safe haven.

~~3.18~~

~~operational range~~ **Note 3 to entry: For a short range yacht**

~~the operational range is a~~ distance of not more than 60 nautical miles (~~111 km~~) from a safe haven.

~~3.19~~ 16

freeboard deck

uppermost complete deck exposed to weather and sea, which has permanent means of closing all openings in the weather part thereof, and below which all openings in the sides of the ship are fitted with permanent means of watertight closing

Note 1 to entry: At the decision of the owner and subject to the approval of the administration, a lower deck can be designated as a freeboard deck, provided it is a complete and permanent deck continuous in a fore and aft direction at least between the machinery space and peak bulkheads and continuous athwart-ships.

3.2017

standard superstructure height

h_{std}

height parameter expressed in meters (m) which is used for the calculation of the design load.

Note 1 to entry: For vessels up to 75 m load line length, the height is taken as 1,8 m.

Note 2 to entry: For vessels over 125 m load line length, the height is taken as 2,3 m.

Note 3 to entry: For vessels of intermediate lengths, the height is obtained by linear interpolation.

3.2118

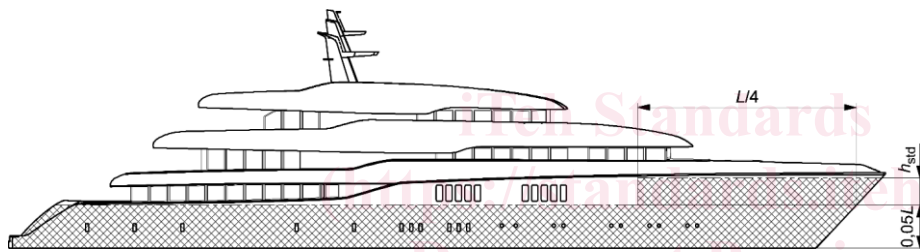
load line length

L
 96 % of the total length on a waterline at 85 % of the least moulded depth measured from the top of the keel, or as the length from the fore side of the stem to the axis of the rudder stock on that waterline, if that is greater

NOTE **Note 1 to entry:** For ships without a rudder stock, the length, L , is taken as 96 % of the waterline at 85 % of the least moulded depth.

3.2219 limits in glazed openings

maximum size of *glazed openings* [specified in this document\(3.1\)](#) below a line 0,05 times ship length, [measured](#) from dsw (deepest seagoing waterline) or less than $L/4$ aft of a line drawn at the intersection of the $0,05 L$ and the stem, and below a line drawn at $0,05 L + h_{std}$, not exceeding $0,85 \text{ m}^2$ (see [Figure 1](#)).



Note 1 to entry: See [Figure 1](#).

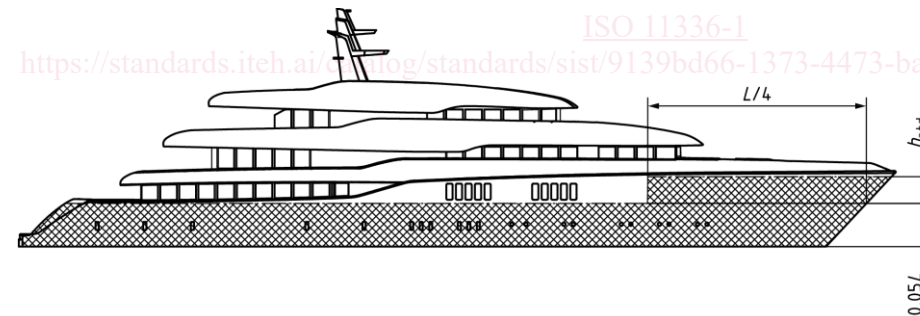


Figure 41 — Area in which glazed openings are limited to $0,85 \text{ m}^2$

3.2320 large yacht

yachts in use for sport or *pleasure* [\(3.14\)](#) and *commercial operations*, [\(3.13\)](#), with a length of the hull, L_H , higher or equal to 24 m

Note 1 to entry: The [length of the hull](#), L_H , is measured according to ISO 8666.

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[3.2421](#)

weathertightness

capacity to prevent that, in any sea conditions, water will penetrate into the ship

Note 1 to entry This definition has been adapted from the term “weathertight” taken from the International Convention on Load Lines (ICLL), Annex I, Regulation 3 (12). This is interpreted generally as indicating that weathertightness is required from the exterior only, as opposed to *watertightness* (3.2522), indicating the ability to withstand from both inside and outside.

[3.2522](#)

watertightness

capacity of an appliance to prevent the passage of water through the structure in any direction under a head of water for which the surrounding structure is designed

[3.2623](#)

strength

capacity of a structure to maintain full structural integrity under the action of loads

[3.2724](#)

design loads

external hydrostatic loads according to which glazed openings strength is assessed

[3.2825](#)

hull

part of the yacht within the envelope of the side shell and decks taken into account for the assignment of freeboard and for stability evaluation

[3.2926](#)

superstructure

decked structure on the freeboard deck, extending from side to side of the yacht or with side plating not being inboard of the shell plating more than 4 % of the yacht breadth

[SOURCE ICLL:1966, Regulation 3, 10 (a)], modified — “ship” replaced with “yacht”]

[3.3027](#)

deckhouse

structure enclosing a space that is normally accessible and used for accommodation or service and that does not qualify as a *superstructure* (3.26) and that can be positioned on the freeboard deck, and/or the tiers above

[3.3128](#)

wheelhouse

control position occupied by the officer of the watch

[3.3329](#)

glass ply

plate made of an inorganic non-crystalline solid exhibiting a glass transition behaviour

[3.3430](#)

thermally toughened safety glass

glass where strength increase is obtained by a thermal treatment resulting in the introduction of permanent compression stress on both sides of its cross section

[3.3531](#)