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Large yachts — Weathertight doors — Strength and weathertightness requirements

Grands yachts — Portes étanches aux intempéries — Exigences de résistance et d'étanchéité aux intempéries

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Foreword

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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 SC 12, *Large yachts*.

Large yachts — Weathertight doors — Strength and weathertightness requirements

1 Scope

This International Standard specifies technical requirements for weathertight hinged, sliding, and pantograph doors for manual and powered operation providing access to accommodation and service areas on large yachts, taking into account the location of the appliance.

This International Standard only considers design loads applied to the door and transmitted into the frame and the adjacent structure. Loads imparted from the yacht's structure into the door or in its associated frame are not considered in this International Standard.

Unframed glazed doors are outside the scope of this International Standard.

Forward facing multi-leaf doors on the weather deck are outside the scope of this International Standard.

Large yachts are of *L* greater than or equal to 24 m, in use for sport or pleasure and commercial operations.

The appliances considered in this International Standard are primarily those that are intended to achieve weathertightness as required by International Convention on Load Lines 1966 as amended by the Protocol of 1988 (ICLL), (i.e. those fitted in position 1 and position 2) as defined in this regulation.

NOTE This International Standard is based on the experience of ship door, window, and glass manufacturers, shipbuilders, and authorities who apply to ships the regulations of the ICLL, noting the provisions of Article 8 "equivalents", as agreed by the appropriate marine administration

2 Normative references

The following 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 6345, *Shipbuilding and marine structures — Windows and side scuttles — Vocabulary*

ISO 11336-1:2012, *Large yachts — Strength, weathertightness and watertightness of glazed openings — Part 1: Design criteria, materials, framing and testing of independent glazed openings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6345, ISO 11336-1, and the following apply.

3.1
certifying authority
flag administration or the organization delegated by the flag administration

3.2
door
closing appliance for an access opening in a vertical plane

Note 1 to entry: This is an assembly consisting of one or more opening leaves and a frame that is permanently secured to the yacht's structure.

3.2.1
hinged door
door where *leaf/leaves* (3.6) is/are fixed and pivoted on one edge and generally open(s) outwards

Note 1 to entry: See Figures 1 to 3.

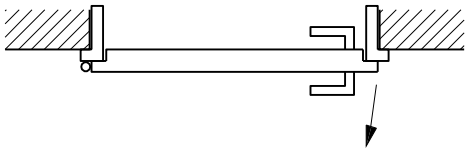

Figure 1 — Hinged door, single leaf

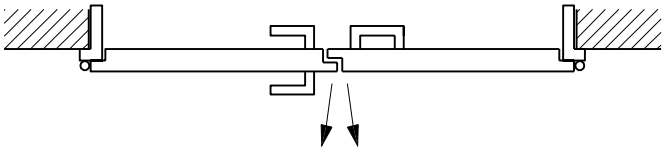

Figure 2 — Hinged door, double leaf

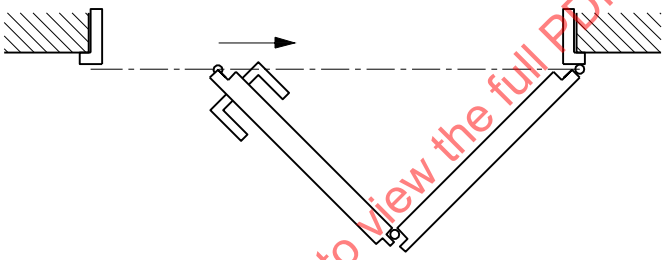

Figure 3 — Sliding door, folding type

3.2.2
sliding door
door where *leaf/leaves* (3.6) is/are free to slide in a vertical plane and leaf/leaves are secured at the top and the bottom

Note 1 to entry: See Figure 4.

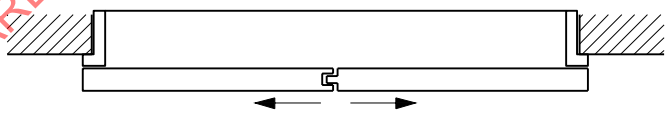

Figure 4 — Sliding door, double leaf

3.2.3
pantograph door
plug door fixed on a cantilever hinge either from the top or the side

Note 1 to entry: See Figure 5.

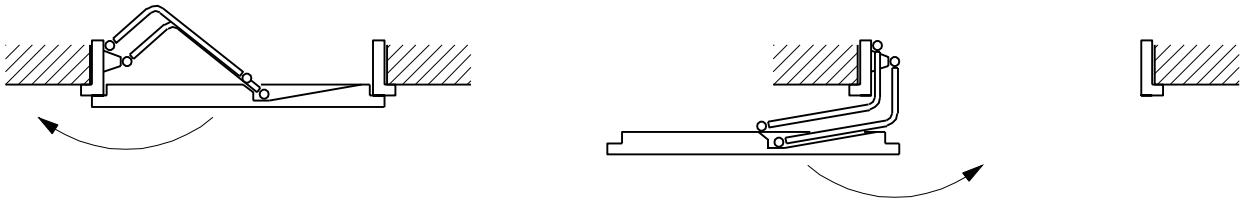

Figure 5 — Pantograph door

3.3
flag administration
government of the state whose flag the yacht flies

3.4
forward facing position
any vertical surface within 20 ° normal to transverse axis

Note 1 to entry: See Figure 6.

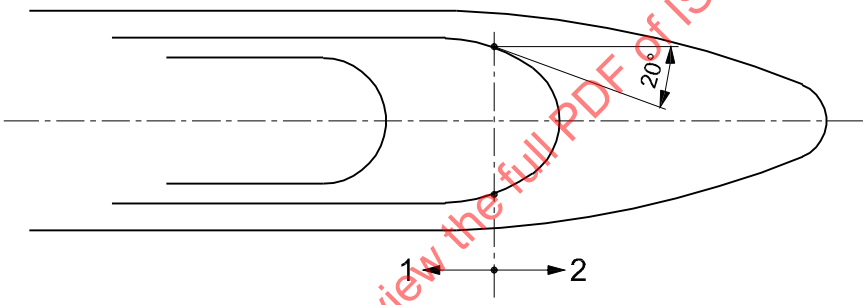

Figure 6 — Forward facing position

3.5
glazing
transparent or translucent pane installed in door *leaf/leaves* (3.6)

[SOURCE: ISO 11336-1:2012, 3.6, modified]

3.6
leaf
leaves
opening section of a door assembly

3.7
operation mode
allowed mode to open and close the door, manually or by a power drive mechanism

3.7.1
manually operated door
door that is opened and closed by hand

3.7.2
power operated door
door that is opened and closed by electrical or hydraulic motor

3.8
storm shutter
portable protective closure fitted to the glazing and which is fitted on the outside

3.9
weather deck
uppermost complete weathertight deck extending to the side shell fitted as an integral part of the vessel's structure and which is exposed to the sea and weather

4 Symbols and abbreviated terms

a smaller side of plate panel

AP aft end of the load line length (L)

A_s shear area of stiffeners and frames

α aspect ratio of single plate field

b larger side of plate panel

b' breadth of deckhouse at the position considered

B' breadth of ship on the exposed weather deck at the position considered

c_a aspect ratio coefficient of plate panel

c_B block coefficient

c_L factor based on vessel length

dsw deepest seagoing waterline

f_B factor based on the breadth of the deckhouse in relation to the breadth of the vessel

f_L factor based on longitudinal location

f_{pl} material factor

γ_m safety factor for structural resistance

h vertical distance from dsw to midpoint of plate field or stiffener

h_f additional height above

h_{sill} vertical distance from dsw to top of door sill

h_{std} standard superstructure height

k factor considering end conditions for bending

L load line length

l unsupported span of stiffener

m factor considering aspect ratio of load distribution

n factor relating to location and vessel length

p_d design pressure

q factor considering end conditions for shear

R_{eH} yield strength

$R_{p0,2}$ offset yield strength at 0,2 % plastic deformation

R_m tensile strength

s spacing of stiffeners

σ_a allowable stress

t_k addition for corrosion or production tolerance

W_{sf} section modulus of stiffeners

x distance between midpoint of door considered and *AP*

5 Design Criteria

5.1 General

NOTE Other International Standards and regulations, e.g. dealing with stability, buoyancy, watertight and weathertight integrity, and fire safety, can have restrictions on the position of appliances which are outside the scope of this International Standard and which are, therefore, not treated here. It is, however, necessary for the builder or user to ensure that the appliances comply with other relevant International Standards.

All door leaves shall be permanently attached or retained (as applicable to door type) to the frame and/or adjacent structure in which they are fitted. All doors shall be arranged such that the external loads are transferred in compression to the door frame or to the adjacent structure.

Doors forming part of the designated escape routes shall also comply with the requirements of 5.6.

5.2 Location

The height of the lower edge of the opening above the respective deck shall not be less than the sill height specified in the applicable national or international regulations. Weathertight doors as specified in this International Standard shall not be installed in positions below the freeboard deck, in the superstructure side or if considered buoyant in the stability calculation. See Figure 7.

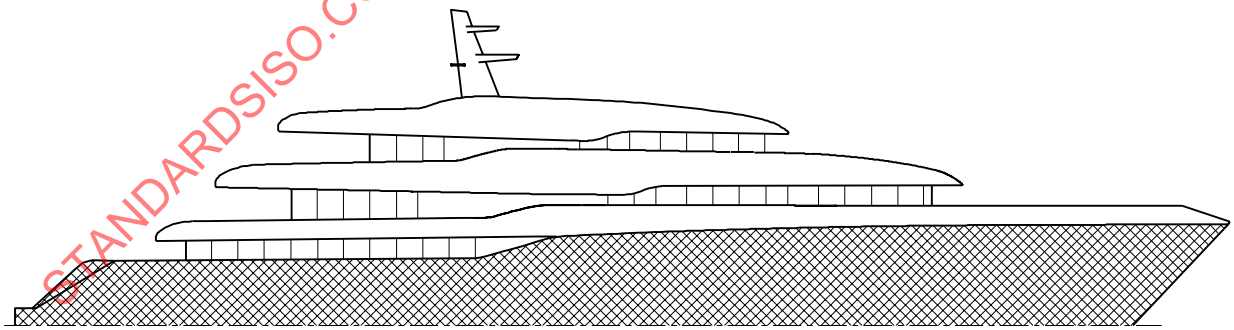

Figure 7 — Area where weathertight doors are not permitted

5.3 Material

The materials for the construction of the doors and frames made of steel or aluminium with dimensions as defined in 5.4.3 and properties appropriate for marine applications shall comply with the requirements of the certifying authority.

Where doors and/or frames are made of composite material or wood, the pressure requirements given in 5.4.2 may be applied with special considerations given to the strength and stiffness taking into account equivalent factors of safety.

Where the door incorporates glazing, the requirements of ISO 11336-1 shall be applied.

NOTE Unframed glazed doors are outside the scope of this International Standard.

5.4 Strength

5.4.1 General

The strength of doors shall meet the requirements of this International Standard or of the relevant International Standards cited in the normative references when applicable. To achieve equivalency with ICLL, only external hydrostatic loads coming from weather and sea conditions are considered for the application of this International Standard.

The yacht's structure shall be sufficiently stiffened to take the external loads from the door. Where other than external loads are required to be considered for safe operation and structural integrity, they are to be appropriately addressed.

5.4.2 Design Pressures

The design pressure, p_d, in kN/m^2 is given by:

$$p_d = n\,(f_L\,c_L - h)\,f_B$$

where

n is the factor relating to location and vessel length;

is equivalent to $20 + L/12$ for unprotected fronts with $h_{sill} \le h_1$;

is equivalent to $10 + L/12$ for unprotected fronts with $h_1 < h_{sill} \le h_2$;

is equivalent to $5 + L/15$ for unprotected fronts with $h_{sill} > h_2$ and for sides and protected fronts;

is equivalent to $7 + 0{,}01\,L - 8\,x/L$ for aft ends with $x/L \le 0{,}5$;

is equivalent to $5 + 0{,}01\,L - 4\,x/L$ for aft ends with $x/L > 0{,}5$;

f_L is the factor based on longitudinal location;

is equivalent to $1{,}0 + [(x/L - 0{,}45)/(c_B + 0{,}2)]^2$ for $x/L \le 0{,}45$;

is equivalent to $1{,}0 + 1{,}5\,[(x/L - 0{,}45)/(c_B + 0{,}2)]^2$ for $x/L > 0{,}45$, for aft ends $c_B = 0{,}8$;

c_L is the factor based on vessel length;

is equivalent to $0{,}1\,L\,e^{(-L/300)} \le 11{,}0$;

f_B is the factor based on the breadth of the deckhouse in relation to the breadth of the vessel;

is equivalent to $0{,}3 + 0{,}7\,b'/B' \ge 0{,}475$;

h_{sill} is the vertical distance from dsw to top of door sill, in m;

h is the vertical distance from dsw to midpoint of plate field or stiffener, in m;

h_1 is equivalent to $h_{std} + h_f$;

h_2 is equivalent to $2\,h_{std} + h_f$;

h_{std} is the standard superstructure height, in m;

is equivalent to 1,05 + 0,01 L, with $1.8 \leq h_{std} \leq 2.3$;

h_f is the additional height above dsw;

is equivalent to $0,6 - 0,22\ (L/100)^3 + 1,03\ (L/100)^2 + 0,48\ (L/100)$;

c_B is the block coefficient with $0,6 \leq c_B \leq 0,8$;

b' is the breadth of deckhouse at the position considered, in m;

B' is the breadth of ship on the exposed weather deck at the position considered, in m;

L is the load line length, in m ;

is equivalent to ≤300 m;

x is the distance between midpoint of door considered and AP;

dsw is the deepest seagoing waterline.

In no case p_{dp} is to be taken less than = 8,5 kPa.

5.4.3 Scantlings

For doors of conventional design, i.e. plated and stiffened construction, the following requirements shall be met.

The scantlings shall be dimensioned such that under load the function of the seal is not compromised.

5.4.3.1 Plating

The thickness of the plating is to be not less than the following:

t is equivalent to $15,8\ a\ (p_d \times 1,125/\sigma_a)^{0,5} c_a + t_k$;

is equivalent to ≥3,0 mm;

a is the smaller side of plate panel, in mm;

b is the larger side of plate panel, in mm;

α is the aspect ratio of single plate field;

is equivalent to a/b (≤1,0);

c_a is the aspect ratio coefficient of plate panel;

is equivalent to $[(3 + \alpha^2)^{0,5} - \alpha]\ 3^{-0,5}$;

σ_a is the allowable stress;

is equivalent to $R_{eH} f_{pl} / \gamma_m$;

t_k is the addition for corrosion or production tolerance;

is equivalent to 0,5 mm for steel and aluminium;

f_{pl} is the material factor;

is equivalent to $R_m/(1{,}5\ R_{eH})$;

is equivalent to ≤ 1,0;

R_{eH} is the yield strength, in N/mm²;

is equivalent to $R_{p0,2}$ for aluminium;

R_m is the tensile strength, in N/mm²;

γ_m is the safety factor for structural resistance;

is equivalent to 1,1 for steel and aluminium.

5.4.3.2 Framing and stiffening

The section modulus of stiffeners and frames W_{sf}, in cm³, is not to be less than the following:

W_{sf} is equivalent to $825/6\ s\ l^2 p_d k/\sigma_a$;

s is the spacing of stiffeners, in m;

l is the unsupported span of stiffener, in m;

m is the factor considering aspect ratio;

is equivalent to $(s/l)/6\ [4 - (s/l)^2]$ with $s \leq l$;

k is the factor considering end conditions for bending;

is equivalent to $0{,}75 - m^2$ for both ends simply supported;

is equivalent to $0{,}75 - 0{,}925\ m^2$ for one end fixed;

is equivalent to $0{,}5 - 0{,}75\ m^2$ for both ends fixed.

The shear area of stiffeners and frames A_s, in cm², is not to be less than the following:

A_s is equivalent to $8{,}66\ p_d s\ l\ q/\sigma_a$;

q is the factor considering end conditions for shear;

is equivalent to $1 - m$ for both ends fixed or simply supported;

is equivalent to $1{,}25 - m - 0{,}308\ m^2$ for one end fixed, at fixed end;

is equivalent to $0{,}75 - m + 0{,}308\ m^2$ for one end fixed, at free end.

The maximum deflection of the stiffening members should not exceed $l/150$.

5.4.4 Doors of unconventional design

Doors of alternative arrangement shall be designed using the pressures from 5.4.2 considering the allowable stresses and deflections calculated according to 5.4.3.

Alternative methods of calculations or tests may be considered. Particular attention shall be paid to the boundary conditions used at the edge of the door and the modelling of the support.