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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

Grands yachts — Résistance, imperméabilité au mauvais temps et étanchéité des ouvertures vitrées —

Partie 2: Critères de conception, support structurel, installation et essais des ouvertures vitrées faisant partie intégrale de la structure adjacente (directement collées sur la cloison ou le bordé)

Reference number
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **2**

4 Symbols ... **10**

5 Bonding materials ... **11**
5.1 General ... 11
5.2 Physical characteristics ... 11
5.2.1 Flexural modulus ... 11
5.2.2 Elongation ... 11
5.2.3 Shear modulus ... 11
5.2.4 Tensile strength ... 11
5.2.5 Shore hardness ... 12
5.2.6 Environmental resistance ... 12
5.2.7 Long term properties ... 12
5.2.8 Preparation of bonding surfaces ... 12
5.2.9 Glazing material ... 12
5.3 Minimum material properties ... 12

6 Bonding arrangement ... **12**
6.1 Glazing ... 12
6.2 General ... 13
6.3 Sloped and overhead glazed openings — Bonding in tension ... 15
6.4 Insulated glazed units (IGUs) ... 15
6.5 Bonding limitations ... 16

7 Bonded joint design ... **16**
7.1 General ... 17
7.1.1 Overview ... 17
7.1.2 LC1 — Static permanent load only applicable to unsupported system ... 19
7.1.3 LC2 — Dynamic load ... 19
7.1.4 LC3 — Fatigue load ... 20
7.1.5 LC4 — Dynamic load (accounting for accidental internal loads) ... 20
7.1.6 Bondline parameters limitations ... 21
7.2 Design loads ... 21
7.3 Design parameters ... 22

8 Bonding installation ... **23**
8.1 Bonding application guidelines ... 23
8.2 Bonding installation procedures ... 24

9 Qualification of bonding personnel ... **24**

10 Survey of bonding ... **24**

11 Testing ... **24**
11.1 Testing of materials ... 24
11.2 Proof testing of bonded joint ... 25

Annex A (informative) **Worked example for bondline calculation** ... **26**

Annex B (informative) **Calculation method for bondline parameters with superimposed additional mechanical deflection and different design temperatures of glazing and substrate** ... **30**

Annex C (informative) **Example bonding procedures** ... **34**

Annex D (informative) **Special application glazing — Guidance** ... **35**

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Bibliography **36**

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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.

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

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

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.

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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

1 Scope

This document specifies technical requirements for direct adhesive bonding of glazing materials into recesses forming part of the structure of the ship and into frames that are fastened to the structure of the ship.

It is applicable to large yachts as defined in ISO 11336-1.

This document is limited to the bonding of independent glazed openings, where the bonded joint is designed to withstand local loads (from external loads coming from weather and sea conditions, internal impact loads from accidental passenger or cargo shifting, wind suction and accelerations due to ship motions).

Bonding of glazed openings where the glazing material is subjected to loads from global ship motions (bending, shear force and torsion), which are considered as structural glazed openings, are outside the scope of this document. Quantitative identification of the global deflection is also outside the scope.

Additionally, this document is limited to bonding that exhibits elastic behaviour, and excludes rigid bonding and nonlinear elastic bonding.

The design of the bonding for the following installation types is outside the scope of this document:

— fire protected areas;

— glazed bulwarks;

— underwater glazing;

— pool glazing;

— glazing for use in polar areas;

— unstepped IGUs.

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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48-5, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 5: Indentation hardness by IRHD pocket meter method*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

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ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 8339, *Building construction — Sealants — Determination of tensile properties (Extension to break)*

ISO 11003-1, *Adhesives — Determination of shear behaviour of structural adhesives — Part 1: Torsion test method using butt-bonded hollow cylinders*

ISO 11003-2, *Adhesives — Determination of shear behaviour of structural adhesives — Part 2: Tensile test method using thick adherends*

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*

DIN 53504, *Testing of rubber — Determination of tensile strength at break, tensile stress at yield, elongation at break and stress values in a tensile test*

DIN 6701-3:2015, *Adhesive bonding of railway vehicles and parts. Part 3 Guideline for construction design and verification of bonds on railway vehicles*

3 Terms and definitions

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

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

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

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

3.1
bonding material
adhesive material that is used to adhere or bond items together

3.2
bonding process
process to join two materials with an adhesive

3.3
bonded joint
joint between the *glazing* (3.6) and substrate, consisting of a *bonding material* (3.1) and a *sealing material* (3.4) if required

3.4
sealing material
material used to cover and protect (where necessary) the *bonding material* (3.1)

Note 1 to entry: The sealing itself is not considered to be part of the adhesive bond.

Note 2 to entry: The following items can have a negative effect on bonding materials:

— UV Light,

— seawater,

— chemicals (from cleaning compounds and or biological degradation).

Unless the bonding is specifically designed to be resistant to the above items, it must be protected by a seal or *sealing material* (3.4). The sealing material (if present) combines with the bonding to form a weather or watertight seal.

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3.5
elastic bonding
bonding where the *bonded joints* (3.3) are capable of transferring forces and distributing stresses evenly and show a high degree of flexibility (ability to return to its original shape after deformation)

Note 1 to entry: Its purpose is to hold the *glazing* (3.6) in place, and to maintain its attachment to the structure (transmitting loads from the glazing to the ships structure). Additionally, it provides the watertight/weathertight boundary, whilst allowing rotational deflection and expansion/contraction of the glazing and/or the supporting structure.

3.6
glazing
transparent or translucent pane

3.7
glazed opening
opening in the hull, superstructure or deckhouse of a ship structure fitted with *glazing* (3.6)

3.8
independent glazed opening
glazed opening (3.7) where the mechanical behaviour of the pane can be considered independent from adjacent structures

EXAMPLE *Framed appliance* (3.9).

3.9
framed appliance
independent glazed opening (3.8) where the glass is clamped into a frame structure consisting of a frame and a mechanical retainer

Note 1 to entry: For a framed appliance, the weight of the glass is mainly kept by the frame and the retainer. A rubber gasket or an adhesive is used in this construction to prevent the direct contact between glass and frame and to achieve watertightness or weathertightness.

3.10
appliance
device made of *glazing* (3.6) and adhesive or frame, used to cover and protect an opening in the hull, superstructure or deckhouse

3.11
glazed opening integrated into adjacent structure
glazed opening (3.7) where the mechanical behaviour of the pane cannot be considered independent from adjacent structures

EXAMPLE Pane bonded directly into a frame.

3.12
insulated glazing unit
IGU
glazing (3.6) made of multiple panes, either monolithic or laminated, separated by sealed gaps filled with gas (air, argon, etc.)

3.13
stepped IGU
IGU (3.12) where one of the panes is fixed to the framing while the other pane is not supported by the framing structure

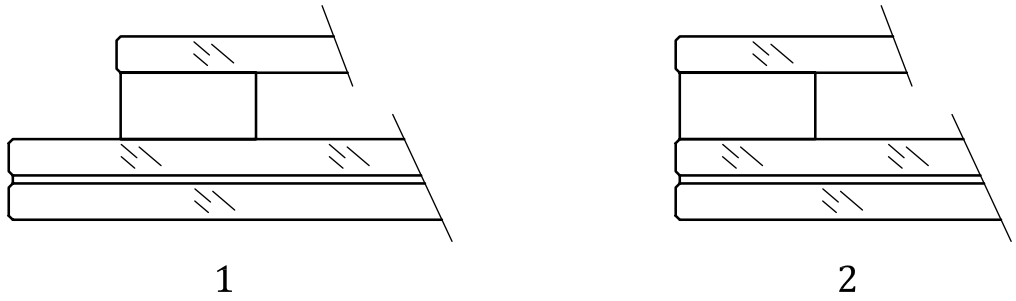
Note 1 to entry: The bonding of stepped IGUs can be designed using the approach defined in this document.

Note 2 to entry: See Figure 1.

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3.14
unstepped IGU
IGU (3.12) where both panes are supported by the framing structure

Note 1 to entry: See Figure 1.



Key

1 stepped IGU

2 unstepped IGU

Figure 1 — Stepped and unstepped IGU glazing

3.15
bonded window
glazed opening (3.7) where the glass is attached to the adjacent structure by an adhesive

Note 1 to entry: For a bonded window, the adhesive holds the weight of the glass and keeps the glass in its position under load. Bonded windows can be used like a framed window in any position on board of a large yacht.

3.16
substrate
material from which the frame, hull or superstructure is constructed, which can include filler, primer, and paint systems

EXAMPLE Steel, aluminium, fibre reinforced plastic (FRP), or wood.

3.17
surface preparation
process of treating the surface of a substance in order to increase its adhesion, which includes applying components such as activators, cleaners and primers

3.18
UV protection
UV light blocking border, applied to the surface or within the laminate of the glazing, designed to protect the bond from UV light

3.19
spacer
element used to support the glass weight and to secure positioning during installation and bond cure, that is removed prior to the application of the sealing

3.20
setting block
element used to support the glass weight and to secure positioning during installation and bond cure, left in place throughout the lifetime of the bonding but considered not to take any load

Note 1 to entry: The setting block must be chemically compatible and must have a shore hardness less than the surrounding bonding and sealing.

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3.21
resting pad
element designed to support the glass weight and to secure positioning during installation, bond cure and during the lifetime of the bonding

Note 1 to entry: A resting pad is left in place throughout the lifetime of the bonding, and must be chemically compatible. It must have a shore hardness greater than the surrounding bonding and sealing, so as to support the glass weight throughout the lifetime of the bonding.

3.22
bonding width
distance along the mating faces of the substrate and adhesive, and the adhesive and *glazing* (3.6)

Note 1 to entry: See Figures 2 to 4 for illustrative sketches.

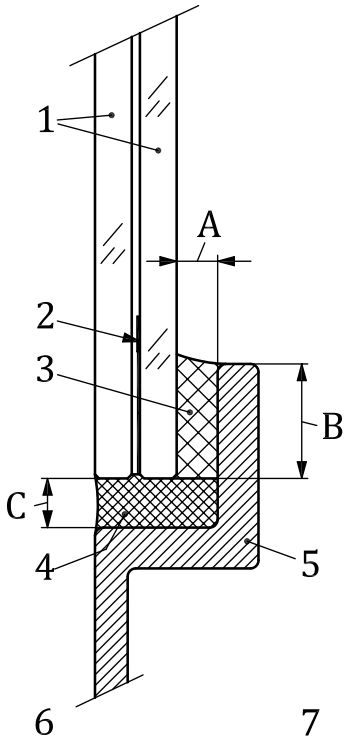
3.23
bonding thickness
distance between the mating faces of the substrate and the glazing

Note 1 to entry: See Figures 2 to 4 for illustrative sketches.

3.24
sealing gap
in case of flush or recessed glazing, distance between the edge of the glazing and substrate and/or adjacent glazing, measured in the plane of the glazing

Note 1 to entry: See Figures 2 to 4 for illustrative sketches.

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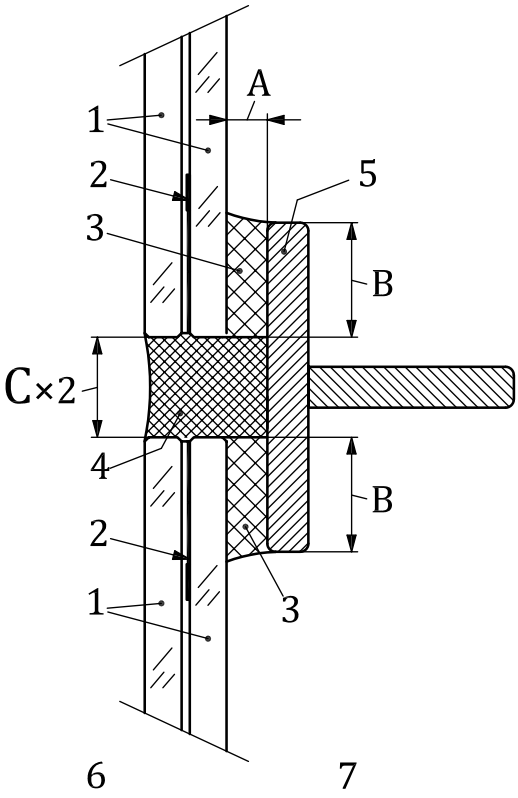


Key

1 glazing
2 UV protection
3 bonding material
4 sealing material
5 substrate
6 outside
7 inside
A bonding thickness, see 3.23
B bonding width, see 3.22
C sealing gap, see 3.24

Figure 2 — Bonding from outside — Glazing to substrate

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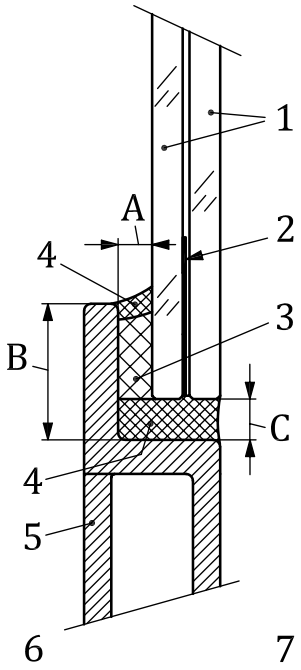


Key

1 glazing
2 UV protection
3 bonding material
4 sealing material
5 substrate
6 outside
7 inside
A bonding thickness, see 3.23
B bonding width, see 3.22
C sealing gap, see 3.24 (note that for a glass to glass bonding, the seal gap is 2 × C)

Figure 3 — Bonding from outside — Glazing to glazing and substrate

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Key

1 glazing
2 UV protection
3 bonding material
4 sealing material
5 substrate
6 outside
7 inside
A bonding thickness, see 3.23
B bonding width, see 3.22
C sealing gap, see 3.24

Note For limits of the use of windows bonded from the inside, see ISO 11336-1:2012, 6.2.2.

Figure 4 — Bonding from inside (see Note) — Glazing to substrate

3.25
bonding manufacturer
competent entity that provides the *bonding material* (3.1) and *sealing material* (3.4), the technical documentation and the application guidance for its use by the bonding installer

3.26
bonding installer
company, organisation, or person responsible for the installation of the *glazing* (3.6), bonding, and sealing

3.27
sloped glazed opening
glazed opening (3.7) where the installation is such that the plane of the *glazing* (3.6) of the appliance is orientated at an angle to vertical

3.28
overhead glazed opening
glazed opening (3.7) where the installation of the appliance is located where persons on board can be underneath

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3.29
walkable glazed opening
glazed opening (3.7) where the installation of the appliance is located in a position where persons can walk or stand on the opening during normal operations

3.30
retainer
structural or mechanical device that is fastened to the substrate and that prevents the glazing from falling out of the recess in the event of failure of the bonding material

3.31
filler
substance used to fill or fair the structure of a yacht prior to painting

3.32
reduction factor
factor used to take into account the effect of the reduced performance of an adhesive when exposed to a particular load (environmental) situation

Note 1 to entry: See 7.1 and 11.1.

3.33
temperature exposure
temperature range considered for the bonding likely to be experienced during the lifetime of the yacht

3.34
permanent static load
long duration load that does not change in magnitude

EXAMPLE *Self weight* (3.36).

3.35
dynamic cyclic load
short duration load that varies in cycles

EXAMPLE Wave or wind pressure, accelerations due to ship motions.

3.36
self weight
force exerted by gravity on a body

3.37
aging conditions
long term exposure to environmental conditions that can reduce the performance of a *bonding material* (3.1)

EXAMPLE UV, temperature.

3.38
design pressure
pressure acting on the *glazing* (3.6) due to the independent or combined actions of the wave impact and head of water

3.39
wind load
pressure or wind suction loads acting on the *glazing* (3.6) due to the movement of air

3.40
linear thermal expansion
change in linear dimension of a material in response to a change in temperature

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