
**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**

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**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)*



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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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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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 (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 12, *Large yachts*. [ISO 11336-2:2020](https://standards.iteh.ai/catalog/standards/sist/1916258f-c732-4d81-8cac-4e28cd76785f/iso-11336-2)

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*

ISO 11336-2:2020(E)

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.

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 ship's 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.

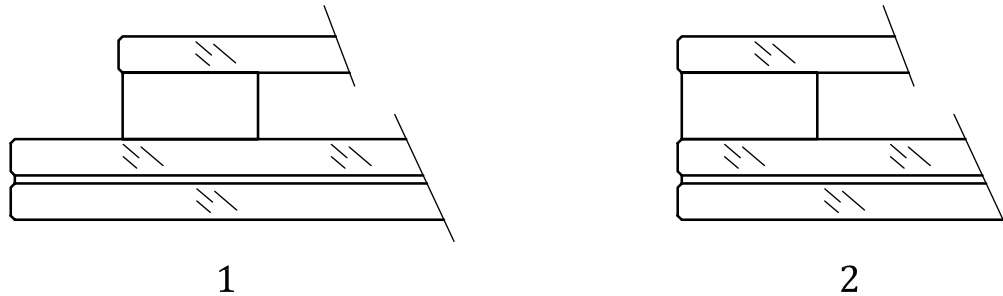
Note 2 to entry: See [Figure 1](#).

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.

**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**

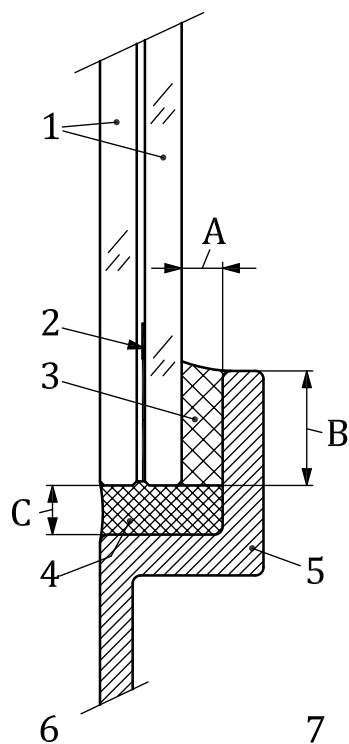
in case of flush or recessed glazing, distance between the edge of the glazing and substrate and/or adjacent glazing, measured in the plane of the glazing

Note 1 to entry: See [Figures 2 to 4](#) for illustrative sketches.

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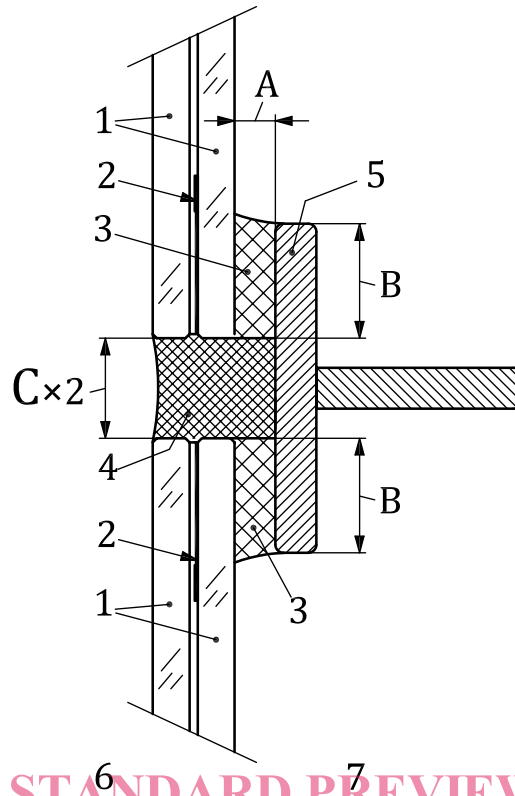
Key

- 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](#)

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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 $2 \times C$)

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