INTERNATIONAL STANDARD

ISO 12216

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Small craft — Windows, portlights, hatches, deadlights and doors — Strength and watertightness requirements

Petits navires — Fenêtres, hublots, panneaux, tapes et portes — Exigences de résistance et d'étanchéité

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12216 was prepared by Technical Committee ISO/TC 188, *Small craft*.

Annexes A, B, C, D and E form integral parts of this International Standard. Annexes F and G are for information only.

Small craft — Windows, portlights, hatches, deadlights and doors — Strength and watertightness requirements

1 Scope

This International Standard specifies technical requirements for windows, portlights, hatches, deadlights and doors on small craft of hull length up to 24 m, taking into account the type of craft, its design category, and the location of the appliance.

The appliances considered in this International Standard are only those that are critical for the craft's watertightness, i.e. those that could lead to flooding in case of rupture of the plate.

This International Standard is mostly intended to be used for recreational craft, but it may be used for non-recreational small craft of hull length up to 24 m, excluding lifeboats. However, it is not applicable to commercial or work boats used in severe conditions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6603–1:2000, *Plastics — Determination of multiaxial impact behaviour of rigid plastics — Part 1: Non-instrumented impact testing*

ISO 7823–1:—[1], *Poly(methyl methacrylate) sheets — Types, dimensions and characteristics — Part 1: Cast sheets*

ISO 8666:—[2], *Small craft — Principal data*

ISO 9094-1:—[2], *Small craft — Fire protection — Part 1: Craft with a hull length of up to and including 15 m*

ISO 9094-2:—[2], *Small craft — Fire protection — Part 2: Craft with a hull length of over 15 m*

ISO 11812:2001, *Small craft — Watertight cockpits and quick-draining cockpits*

ISO 12217 (all parts):2002, *Small craft — Stability and buoyancy assessment and categorization*

EN 356:1999, *Glass in building — Security glazing — Testing and classification of resistance against manual attack*

EN 1063:1999, *Glass in building — Security glazing — Testing and classification of resistance against bullet attack*

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1) To be published. (Revision of ISO 7823-1:1998)

2) To be published.

3 Terms and definitions

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

3.1
appliance
device made of a plate and possibly a framing system, used to cover an opening in the hull or superstructure of a boat

EXAMPLE Windows, portlights, hatches, deadlights, doors, sliding appliances, escape hatches.

3.2
plate
sheet of material, which may be transparent, that is fixed on the boat structure either directly or via a framing system

3.2.1
stiffened plate
plate equipped with stiffeners

3.2.2
non-stiffened plate
plate directly fixed on its supports

3.2.3
glazing
transparent or translucent plate

3.2.4
unsupported dimensions of a plate
clear dimensions between the supports bearing the plate

NOTE See annexes B and C.

3.3
passage
clear opening through which people or material may pass

NOTE This definition can be used in defining passage dimensions and passage area.

3.4
window
portlight
glazed appliance

NOTE The term “portlight” is generally used for a small window.

3.5
deck hatch
appliance fitted on decks and superstructures

3.6
companionway door
door or closing appliance intended to close a companionway opening

3.7
escape hatch
appliance intended to provide an exit and designated means of escape

3.8
multihull escape hatch
appliance allowing a viable means of escape in the event of inversion

NOTE As this hatch is not normally totally immersed in the upright and inverted position, it is usually fitted below deck level on the hull side, nacelle or crossarm bottom, or transom.

3.9
deadlight
shutter
secondary watertight closure, fitted to a window, a hatch or a door, and which may be fitted inside or outside the plate

3.10
closing appliance
device used to cover an opening in the cockpit, hull or superstructure

3.11
sliding appliance
appliance that can slide in a rabbet or a frame

3.11.1
framed plate sliding appliance
plate mechanically connected to a frame that slides in a rabbet or a frame

3.11.2
frameless plate sliding appliance
plate without frame that slides in a rabbet or a frame

3.12
design category
description of the sea and wind conditions for which a boat is assessed to be suitable

3.12.1
design category A
category for "ocean" sailing
boat designed for extended voyages where conditions experienced may exceed wind force 8 (Beaufort Scale) and significant wave heights of 4 m and above, but excluding abnormal conditions (e.g. hurricanes)

3.12.2
design category B
category for "offshore" sailing
boat designed for offshore voyages where conditions up to and including wind force 8 (Beaufort Scale) and significant wave heights up to and including 4 m may be experienced

3.12.3
design category C
category for "inshore" sailing
boat designed for voyages in coastal waters, large bays, estuaries, lakes and rivers, where conditions up to and including wind force 6 (Beaufort Scale) and significant wave heights up to and including 2 m may be experienced

3.12.4
design category D
category for sailing in "sheltered waters"
boat designed for voyages in sheltered waters, small bays, estuaries, lakes, rivers and canals, where conditions up to and including wind force 4 (Beaufort Scale) and maximum occasional wave heights up to and including 0,5 m may be experienced

3.13
sailing boat
boat for which the primary means of propulsion is by wind power, having:

$$A_S \geqslant 0{,}07 \times (m_{LDC})^{2/3}$$

where

A_S is the projected sail area according to ISO 8666;

m_{LDC} is the loaded mass of the boat, expressed in kilograms.

NOTE Motor sailers are regarded as sailing boats.

3.14
motor boat
boat designed to use engine power as its primary means of propulsion

3.15
waterline
side projection of the flotation plan, when the boat is upright and in fully loaded ready-for-use conditions

3.16
length of hull
L_H
length of hull according to ISO 8666

3.17
appliance location area
area of the boat where the appliance is fitted

NOTE See annex A for sketches showing examples of appliance location areas.

3.17.1
area I
part of the hull sides situated above waterline, i.e. up to its intersection with the weather deck (for decked craft), or the upper edge of the hull (for open craft or partially decked craft), but only to the following upper boundary:

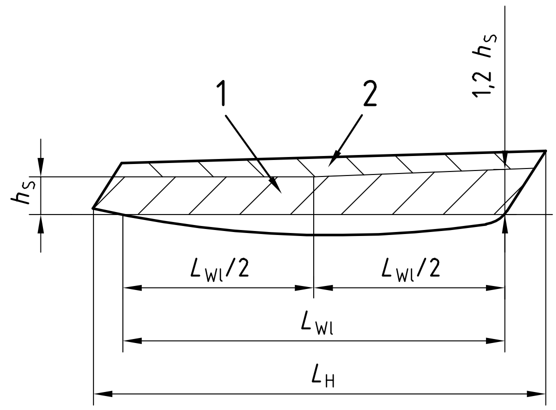
— a horizontal line located at the height h_S above waterline in the rear half of the waterline (see Figure 1);

— a sloped line having a height h_S at mid waterline, and a height $1{,}2h_S$ at the front end of the waterline, with

  — $h_S = L_H/12$ for sailing monohulls,

  — $h_S = L_H/17$ for motor boats, sailing catamarans and central hull of sailing trimarans.

NOTE The outer hulls of sailing trimarans are considered to be entirely in Area I.



Key

1 Area I

2 Area II b

Figure 1 — Limits of Areas I and II b

3.17.2
area II a
area, other than Area I, where persons are liable to walk or step, such as decks, superstructures, cockpit soles, at an inclination of less than 25° to the horizontal in a longitudinal direction, and at an inclination of less than 50° to the horizontal in the transversal direction respectively for sailing monohulls, or 25° for multihulls

3.17.3
area II b
areas from the hull sides not belonging to Area I

NOTE 1 The following areas may be included if they correspond to the definition:

— transoms of all types of craft;

— rear faces of transverse girders of multihulls when located above the waterline.

NOTE 2 Areas placed below the waterline are not covered by this International Standard.

NOTE 3 Areas on which people may stand or step, even inadvertently, are part of Area II a.

EXAMPLE Top of sailboat coachroof on which one may stand or attend to sails.

NOTE 4 Superstructure areas on which people may not normally stand or step, are not part of Area II a, but Area III.

EXAMPLE Top of motorboat wheelhouse out of normal working deck areas.

3.17.4
area III
area, other than Area I or II

EXAMPLE Superstructures, decks or cockpits soles which cannot be considered as belonging to Area II.

NOTE On some boat types, Area III may be divided into particular areas. For example superstructure front and superstructure sides on motorboats.

3.17.5
area IV
parts of Area III protected from the direct impact of sea or slamming waves

EXAMPLE Cockpit sides, rear faces of superstructures.

NOTE Areas other than the ones given in the example may be included in Area IV. The protection against impact from the sea shall be taken into account by the manufacturer.

3.18
type of plate end connection

NOTE See annex B for sketches showing examples of types of plate end-connection.

3.18.1
semi-fixed
SF plate
plate fixed in a way to restrict deflection and prevent lateral movement at its boundaries

EXAMPLE Unframed or framed plate, if bolted and/or glued.

3.18.2
simply supported
SS plate
plate that can deflect at its boundaries and/or perform lateral movement

EXAMPLE Unframed plate, whether hinged or sliding.

3.18.3
flexibly connected plate
simply supported plate where the connection is achieved by an elastic support around the perimeter of the plate

NOTE A car windscreen joint, shown in Figure B.3, is a flexibly connected plate where there is no overlap between the plate and its support, hence the plate may be pushed in the boat by the outside pressure.

3.19
watertightness
capacity of an appliance or a fitting to prevent ingress of water inside the boat

3.20
degree of watertightness
capacity of an appliance or fitting to resist ingress of water according to the conditions of exposure to water

3.20.1
degree of watertightness 1
protection against effects of continuous immersion in water

3.20.2
degree of watertightness 2
protection against effects of temporary immersion in water

3.20.3
degree of watertightness 3
protection against splashing water

3.20.4
degree of watertightness 4
protection against water drops falling at an angle of up to 15° from the vertical

3.21
glass material

3.21.1
annealed glass
sheet glass
glass as delivered directly from the fabrication cycle without subsequent treatment

3.21.2
tempered glass
toughened safety glass
glass where better mechanical properties are obtained by thermal treatment

3.21,3
chemically reinforced glass
glass where better mechanical properties are obtained by chemical treatment

3.21.4
monolithic glass
glass consisting of one ply of glass

3.21.5
laminated glass
multi-layer sheet having glass as outer plies, where the inside plies are made of plastic inter-layers, plastic sheets, glass, or other glazing material

4 General requirements

4.1 General

Other International Standards, e.g. dealing with stability and buoyancy, may 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.

4.2 Strength

The strength of plates, framing, tracks and fastening shall meet the requirements of this International Standard.

4.3 Positive closure

Opening appliances shall be positively fixed, when closed, to avoid any inadvertent opening.

EXAMPLES Bolts, latches.

4.4 Watertightness

To avoid flooding, all appliances shall be designed and fixed to prevent substantial ingress of water when closed.

4.4.1 Minimum degree of watertightness

The required minimum degree of watertightness of an appliance is a function of the boat's design category. These requirements are given in Table 1.

The required degree of watertightness of prefabricated appliances shall be tested by the appliance manufacturer before installation on the craft, according to Table 1, using the test method defined in D.1.1.

The required degree of watertightness of any appliance, after installation on the craft, shall meet the requirements of Table 1.

If tests are made, the method described in D.1.2 should be used. Tests are however not normally required.

Table 1 — Minimum degree of watertightness

Type of boat	Appliance location area	Type of appliance	Design category			
			A	B	C	D
Any	Area I	Any	2	2	2	2
Any	Area II	Any	2	2	3	4
Any	Area II	Sliding companionway hatch	3	3	3	4
Any	Area III	Any	3	3	3	4
Sailing monohull	Area IV	Any	3	3	3	4
Motor + Multihull	Area IV	Any	3	3	4	4

The above degrees of watertightness are only required for appliances. The degree of watertightness of any device which is not built into the appliance, for example a ventilation system, but fitted by the boat manufacturer after the purchase of prefabricated appliances, is outside the scope of this International Standard, but shall meet the requirements of any other relevant International Standard. Regarding watertightness of cockpits, the requirements of ISO 11812 shall be met.

4.4.2 Additional requirements related to watertightness

4.4.2.1 Sliding appliances

Sliding appliances shall not be used in Area I.

4.4.2.2 Deck hatches of trimaran outrigger hulls

Hatches fitted on the decks of trimaran outrigger hulls shall not be sliding appliances.

5 Plate materials

5.1 General

Appliance plates shall be made of

— a transparent glazing material, such as poly(methyl)methacrylate (PMMA), polycarbonate (PC), tempered glass (3.21.2), chemically reinforced glass (3.21.3) or laminated glass (3.21.5), or

— a non-transparent plate material, such as plywood (PW), glass-fibre reinforced thermosetting plastic (GRP), aluminium alloy, steel, etc.; or

— any other material of strength and stiffness equivalent to those cited above.

5.2 Acrylic sheet materials

Poly(methyl)methacrylate (PMMA) made with a technique other than the casting procedure shall have mechanical properties and resistance to ageing at least equal to those of cast PMMA.

5.3 Glass

5.3.1 Restrictions of usage

The use of glass is restricted to clauses 5.3.1.1 and 5.3.1.2 plus 6.1.1.1 for use of simply supported plates, 6.3.1.4 for use in Area I and 6.3.2 for use in Area II.

5.3.1.1 Monolithic glass

Monolithic glass (3.21.4) shall only be made of tempered glass (3.21.2), or chemically reinforced glass (3.21.3).

5.3.1.2 Laminated glass

The glass plies used in laminated glass (3.21.5) can be made of any type of glass.

6 Specific requirements

6.1 End connection and location of plate

6.1.1 Simply supported plates

6.1.1.1 Plates in Area I

Simply supported plates shall not be used in Area I:

— on sailing monohulls in design categories A and B and sailing multihulls in design category A;

— on motor boats in design category A.

On other types of craft and design categories, simply supported plates may be used provided that all the following conditions are met:

— the glazing material is PMMA or PC (see clause 5);

— the plate thickness is equal to 1,3 times the one required by clause 7;

— the fixing devices of the plate (hinge bolts, fixing knob, etc.) are not spaced more than 250 mm.

The above restrictions of use need not be considered if the appliance is equipped with a deadlight meeting the requirements of 6.3.6.

6.1.1.2 Flexibly connected plates

Flexibly connected plates may only be used on motor boats of design categories C and D in Areas III and IV.

6.1.2 Semi-fixed plates

6.1.2.1 Plates made of material other than glass

Semi-fixed plates may be used in boats of all design categories and in all location areas with the restrictions of the special requirements given in 6.3.

This type of end connection can be achieved by one of the following means.

a) Connected with a counter frame: The edge fixity is achieved by pinching the plate at its periphery between the boat shell or a frame and a counter frame. The counter frame shall be mechanically fastened and/or glued to the structure of the boat.

b) Connected by gluing: The edge fixity is achieved by gluing the plate at its periphery to the boat shell, to the structure of the boat or to a frame. This gluing can either be in a rabbet or a face, edge gluing or any combination of these gluing methods.

c) Connected by direct fastening: The edge fixity is achieved by fastening the plate inside its periphery to the shell, the structure of the boat or to a frame by correctly spaced and sized mechanical fasteners. These fasteners may be bolts, rivets, self-tapping screws or any adequate mechanical fasteners.

NOTE Even with the best fastening system, full edge fixity of a non-stiffened plate at its periphery can never be achieved. Plates are therefore considered at best as semi-fixed.

6.1.2.2 Plates made of glass

Metal to glass contact shall be avoided.

6.2 Fastening requirements

6.2.1 Fastening of plates and frames

Plates and frames can be fastened by mechanical means, glue or elastomer joints. All types of fastening shall ensure watertightness of the plate or frame, and resistance to loads due to normal operating pressure.

Every part of the mechanical elements connecting appliances to the rest of the craft shall be capable of withstanding, without breaking, twice the force induced by the pressure loads defined in clause 7. This requirement shall be verified for inwards opening appliances, where hinges, locks, or any other part of the link chain between the plate and the support shall be checked by calculation or testing in accordance with D.2.

6.2.2 Fastening of semi-fixed plates

Mechanical fasteners shall not induce parasitic stresses due to deflection or temperature changes, nor stress concentration or stress raising.

EXAMPLE Bolts in sharp angle counterbores and countersunk screw heads in conical bores shall not be used.

Additional stresses brought by cold forming shall be considered when determining the plate scantlings in clause 7 or 8.

6.2.3 Fastening of glued plates

Glued joints shall be resistant to (or protected against) sunlight (UV, heat, etc.) and all environmental effects or cleaning chemicals normally encountered in the manufacture and use of the craft.

Glued joints shall fulfil the requirements of one of the following items:

a) the inside pressure test (D.3.2);

b) the separation test (D.3.3);

c) the manufacturer's gluing procedure and conditions are followed and the bond strength checked by calculation to meet test pressure in D.3.2.2.

The above requirements shall be verified after any change in material or gluing procedure.

Plates, with or without framing, are considered glued if they are fastened with mechanical devices, such as bolts, rivets or screws, spaced more than 20 times t, where t is the nominal plate thickness defined in 7.2.

6.3 Special requirements

6.3.1 Appliances fitted in Area I

6.3.1.1 Height above waterline and maximum short side dimension

The lower edge of any opening appliance shall be placed at least 200 mm above the waterline, the boat being in the fully loaded ready-for-use condition and upright. These opening appliances shall in any case be located according to the relevant requirements of ISO 12217.

The small unsupported dimension b (or the equivalent of b) of any appliance (see annex C) placed in Area I shall not exceed 300 mm.

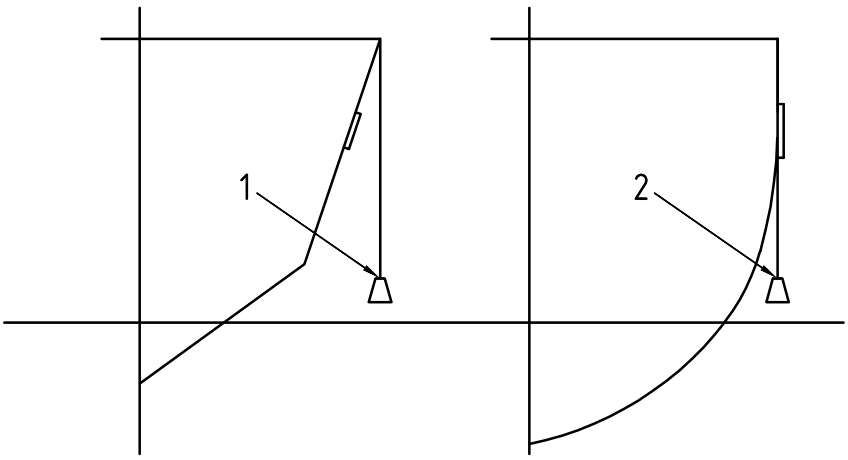
The above requirements do not apply to escape hatches of sailing multihulls, or designated escape hatches, when required by ISO 9094.

6.3.1.2 Opening side

All opening appliances shall open inwards, with the exception of multihull escape hatches or designated escape hatches, when required by ISO 9094.

6.3.1.3 Protection

On boats of design categories A and B, no part of the plate or its framing shall extend outside the local vertical tangent to the hull, deck, rubbing strake, fixed fender, or of a built-in fairing which is an integral part of the hull. Figure 2 explains this requirement.



Key

1 The local vertical tangent is outside the porthole: no problem

2 The local vertical tangent is inside the porthole: the porthole shall either be placed in a recess or protected by a built-in fairing

Figure 2 — Sketch explaining the requirement of 6.3.1.3

6.3.1.4 Use of glass

Glass shall not be used on sailing boats of all design categories and on motor boats of design categories A and B, unless the plate is made of high-impact-resistance glass, or if the appliance is equipped with a deadlight meeting the requirements of 6.3.6. High-impact-resistant glass types are listed in normative annex E.

6.3.2 Appliances fitted in Area II a

6.3.2.1 Use of glass

On motor boats, the usage of monolithic and laminated glass is accepted without restriction.

On sailing boats, neither monolithic nor laminated glass shall be used forward of the mast or foremast, unless the plate is made of high-impact-resistance glass, or if the appliance is equipped with a deadlight meeting the requirements of 6.3.6. High-impact-resistance glass types are listed in annex E.

This restriction need not be considered if the plate is protected against shocks by an adequate device.

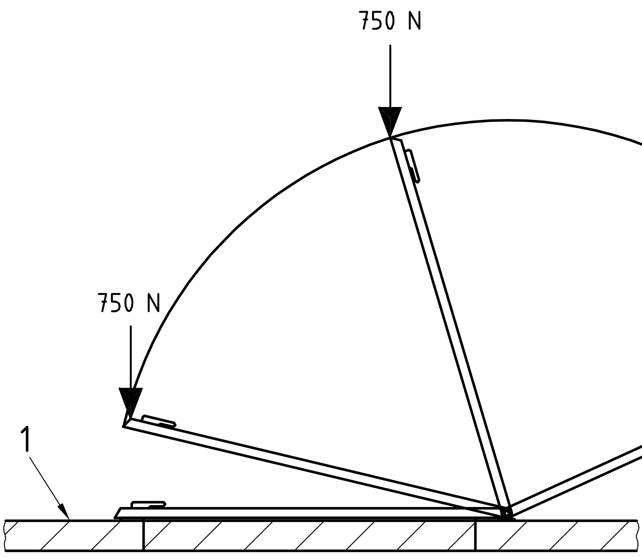
EXAMPLE Outside grid network, protection bars.

6.3.2.2 Tests on hinged deck hatches

6.3.2.2.1 Unintentional stepping test

The test is performed on a hinged deck hatch fixed to a rigid flat support of dimensions twice those of the hatch, as shown in Figure 3.

The hatch is open in any position, up to its maximum operating position, and shall be able to withstand a concentrated force of 750 N applied anywhere on the outside edge of the hatch, without permanent deformation or damage to the hatch, its framing or hinge. The hatch will normally close under the applied force, and the system that is used to maintain the hatch open may be damaged. The hatch is considered to fulfil the requirements of this test if the integrity of the hatch, and its closing and watertightness capabilities, are maintained.



Key

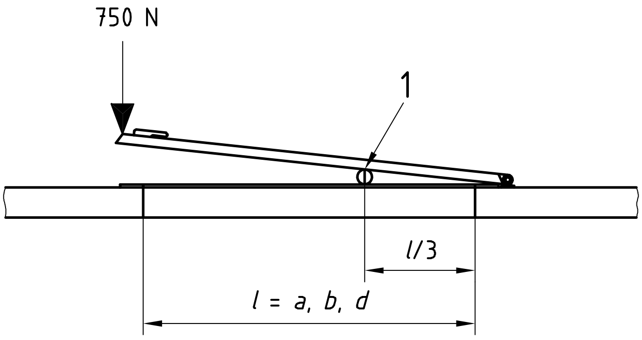
1 Flat plate (see 6.3.2.2.1)

Figure 3 — Unintentional stepping test

6.3.2.2.2 Rope jamming test

The test is performed on the same test device and loading as in 6.3.2.2.1, but with a 14 mm, three-strand polypropylene rope simultaneously jamming both sides, as shown in Figure 4.

The test is considered as passed if there is no permanent deformation or damage to the plate, its framing or hinges.



Key

1 Three-strands polypropylene rope of diameter 14 mm

Figure 4 — Rope jamming test

6.3.2.2.3 Hatch and hinge strength test

The test is performed on the same test device as in 6.3.2.2.1, with the hatch open at 90°, as shown in Figure 5.

Apply a twisting torque made by two parallel and opposite forces of 200 N, acting on the two outside corners (or horizontal diameter) of the opening part of the hatch.

The test is considered as passed if there is no permanent deformation or damage to the plate, its framing or hinges.

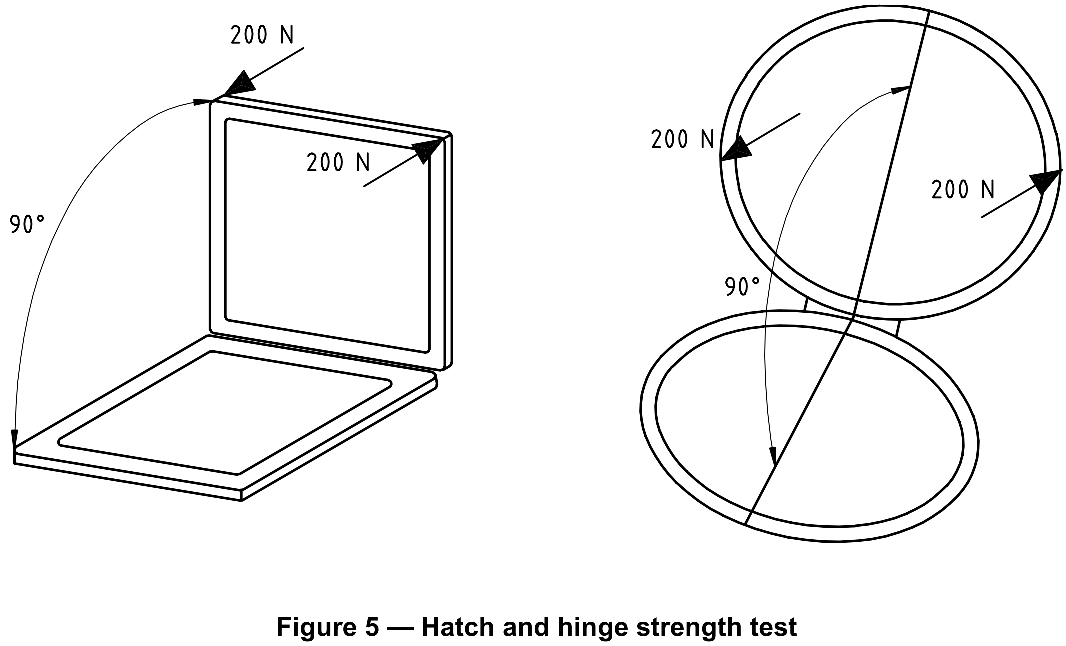


Figure 5 — Hatch and hinge strength test

6.3.3 Sliding appliances

6.3.3.1 Rabbet depth

The depth of the rabbet shall be sufficient to prevent any disengagement of the plate under the pressure loads defined in clause 7, taking into account the size of the appliance, the material of which it is made, and the rigidity of the structure it is fixed on. For unframed plates made of PMMA, PC, or materials with similar Modulus of elasticity, this depth shall be at least 12 mm.

6.3.3.2 Stops

The appliance shall be fitted with stops at each end of its stroke to prevent any disengagement of the sliding part of the frame.

6.3.4 Doors made with removable sections: washboards

Doors made with removable sections, usually called “washboards”, shall be

a) fitted with a device to keep them in position, when in use, and to be at least operable from inside, and

b) stored inside the craft in the vicinity of the door opening, and easily reached without the use of tools.

Craft of design category A shall be equipped with a device connecting the boards together when not in use.

EXAMPLE Lanyards.

6.3.5 Locking system

Any appliance shall have a locking device which maintains it in a closed position, operable at least from inside.

On doors, this system shall be operable from both sides.

In boats of design categories A and B, if the companionway door is used together with a companionway hatch, the locking device need only be efficient when both the door and the hatch are closed together. In this case, if the companionway door is made with washboards, the locking device may only act between the upper panel of the washboard and the hatch.

6.3.6 Deadlights

Any part of a deadlight shall meet the requirements of clause 4 and 6.2. Deadlights of windows fitted in Area I, if required, shall be permanently attached to the appliance, its framing, or the craft structure, and be operative even in the case of rupture of the opening part of the window.

6.3.7 Multihull escape hatches

6.3.7.1 Minimum dimensions

On boats with $L_H > 12$ m, the multihull escape hatches shall have the following minimum clearing characteristics:

— circular shape: diameter of at least 450 mm;

— any other shape: a minimum dimension of 380 mm and 0,18 m^2 minimum area. The hatch shall be big enough for a 380 mm diameter circle to be inscribed.

6.3.7.2 Material

Glass shall not be used, unless it is high-impact-resistance glass. High-impact-resistance glass types are listed in annex E.

6.3.7.3 Opening and hinge disposition

Multihull escape hatches shall be free to open from the inside and the outside when secured but unlocked.

The hinge or hinges of an escape hatch that opens outwards shall be such that the hatch cannot be torn out by the action of the sea if it is partially, or totally, opened.

6.3.8 Commercially available appliances

Commercially available appliances shall, at the time of purchase, have an information notice which indicates, for the benefit of the fitter and consumer, the upper design category, boat type and location area allowed. This notice may be a sticker glued on the appliance, a label on the appliance box, a leaflet or any other type of information device.

7 Scantling determination of non-stiffened plates

7.1 Monolithic plate thickness determination

The formulae given in 7.1.1 and 7.1.2 are valid for rectangular plates. For circular plates, replace b by d, which is the unsupported diameter.

For plates having unsupported shapes different from a rectangle or a circle, the approximations of annex C shall be used to determine "equivalent" unsupported dimensions.

7.1.1 Determination based on allowable stress criterion

$$t_\mathrm{r} = bk_\mathrm{c}\sqrt{\frac{k_\mathrm{r}\Psi p}{\sigma_\mathrm{a}}} \quad (1)$$

where

t_r is the basic plate thickness using allowable stress criterion, expressed in millimetres;

b is the unsupported short side of a rectangular plate or "equivalent short side" of a plate, in millimetres;

k_c is the curvature coefficient (non-dimensional) (see 7.6);

k_r is the plate-aspect ratio coefficient for stress calculation (see 7.3);

Ψ is the pressure reduction factor (non-dimensional) (see 7.5);

p is the basic design pressure, expressed in pascals (see 7.4);

σ_a is the allowable flexural stress of the material, expressed in pascals (see 7.7, 7.8, F.1 and F.2).

The same units shall be used for p and σ_a (both expressed in pascals, or kilopascals), as the term under the square root must be non-dimensional.

7.1.2 Determination based on allowable deflection criterion

$$t_\mathrm{f} = 0{,}45\left(t_\mathrm{r} + bk_\mathrm{c}\sqrt[3]{\frac{k_\mathrm{f}\Psi p}{0{,}02E}}\right) \quad (2)$$

where

t_f is the basic plate thickness using the relative deflection criterion, expressed in millimetres;

k_f is the plate aspect-ratio coefficient for deflection calculation (non-dimensional) (see 7.3);

E is the elasticity modulus (Young's modulus), expressed in pascals (see 7.7, F.1 and F.2).

For explanation of the remaining symbols, see 7.1.1.

The calculation of t_r considers that a certain amount of membrane behaviour is taking place.

The same units shall be used for p and E (both expressed in pascals or kilopascals) as the term under the cubic root must be non-dimensional.

7.1.3 Applicability of 7.1.1 and 7.1.2

The formulae given above only apply to plates held at all points around their periphery.

Rectangular plates only held on two sides shall be calculated considering $a = 5\,b$, but plates held on three sides and/or on supports of unequal stiffness need special considerations, and shall be treated as specified in clause 8. This can be the case of companionway weatherboard and some sliding windows.

7.2 Selection of monolithic plate thickness

The value of the actual plate thickness, t_a, expressed in millimetres, to be used, shall be the greatest of the following:

— the monolithic plate thickness using the allowable stress criterion, t_r (see 7.1.1);

— the monolithic plate thickness using the allowable deflection criterion, t_f (see 7.1.2);

— the minimum plate thickness, t_m (see 7.8).

With commercially available plates, the nominal commercial thickness shall be at most 0,5 mm below the calculated thickness. The following examples illustrate this requirement.

EXAMPLE 1 If the calculation gives 6,5 mm, one may choose a commercially available thickness of 6 mm, in metric dimensions or 6,35 mm (1/4 in) in imperial dimensions.

EXAMPLE 2 If the calculation gives 6,51 mm, one may choose a commercially available thickness of 7 mm, in metric dimensions, or 8 mm if 7 is not available, or 6,35 mm (1/4 in) in imperial dimensions.

EXAMPLE 3 If the calculation gives 6,85 mm, in a country where only imperial dimensions are commercially available, one may use 6,35 mm (1/4 in) in imperial dimensions, but if the calculation gives 6,86, choose a plate thicker than 1/4 in: 5/16 in, for example

The precalculated thickness tables given in annex F for poly(methyl)methacrylate (PMMA) and tempered glass (TG) flat plates can be used instead of the above calculations.

7.3 Plate aspect-ratio coefficients, k_r and k_f

The plate aspect-ratio coefficient for stress calculation, k_r, and for deflection calculation, k_f, shall be chosen from Table 2 for rectangular plates and Table 3 for circular plates.

The aspect ratio is the ratio *a*/*b* of the unsupported dimensions: *a* and *b* are respectively the long and short unsupported dimensions (or their equivalent dimensions determined according to annex C) of a rectangular plate, expressed in millimetres.

Table 2 — Values of k_r and k_f for rectangular plates

SF Plates		Ratio	SS Plates	
k_r	k_f	a/b	k_r	k_f
0,298	0,029	1,0	0,287	0,044
0,34	0,035	1,1	0,333	0,053
0,38	0,04	1,2	0,376	0,062
0,415	0,045	1,3	0,416	0,07
0,446	0,05	1,4	0,454	0,077
0,472	0,054	1,5	0,487	0,084
0,494	0,058	1,6	0,518	0,091
0,513	0,061	1,7	0,545	0,096
0,529	0,064	1,8	0,569	0,102
0,542	0,067	1,9	0,591	0,106
0,554	0,069	2,0	0,61	0,111
0,563	0,071	2,1	0,627	0,114
0,572	0,073	2,2	0,642	0,118
0,578	0,074	2,3	0,655	0,121
0,584	0,076	2,4	0,667	0,123
0,59	0,077	2,5	0,677	0,126
0,594	0,078	2,6	0,687	0,128
0,598	0,079	2,7	0,695	0,129
0,601	0,08	2,8	0,702	0,131
0,604	0,080	2,9	0,708	0,131
0,607	0,081	3,0	0,713	0,134

SF Plates		Ratio	SS Plates	
k_r	k_f	a/b	k_r	k_f
0,607	0,081	3,0	0,713	0,134
0,609	0,082	3,1	0,718	0,135
0,611	0,082	3,2	0,723	0,136
0,613	0,082	3,3	0,726	0,136
0,614	0,083	3,4	0,73	0,137
0,616	0,083	3,5	0,733	0,138
0,617	0,083	3,6	0,735	0,138
0,618	0,084	3,7	0,737	0,139
0,619	0,084	3,8	0,739	0,139
0,62	0,084	3,9	0,741	0,14
0,62	0,084	4,0	0,743	0,14
0,621	0,084	4,1	0,744	0,14
0,622	0,084	4,2	0,745	0,141
0,622	0,085	4,3	0,746	0,141
0,623	0,085	4,4	0,747	0,141
0,623	0,085	4,5	0,748	0,141
0,624	0,085	4,6	0,748	0,141
0,624	0,085	4,7	0,749	0,141
0,624	0,085	4,8	0,749	0,141
0,625	0,085	4,9	0,75	0,142
0,625	0,085	5,0	0,75	0,142
NOTE For $a/b > 5$, k_r and k_f are constant.				

Table 3 — Values of k_r and k_f for SF and SS circular plates

SF circular plates		SS circular plates	
k_r	k_f	k_r	k_f
0,248	0,027	0,309	0,043

7.4 Basic design pressure

The basic design pressure for calculation of the plate thickness shall be selected from Table 4.

Table 4 — Basic design pressure p

Application location area	I	IIb	IIb	IIb	IIa	III	III	III	III	III	III	III	III	IV	IV
Boat type	Any	Any	Any	Any	Any	Sail	Sail	Motor	Motor	Motor	Motor	Motor	Motor	Sail	Motor
Design category	Any	A	B	C, D	Any	A, B	C, D	A	B	A	B	C	D	Any	Any
Particular (front, side, any)	Any	Any	Any	Any	Any	Any	Any	Front	Front	Side	Side	Any	Any	Any	Any
Pressure, p, kPa	70	70	50	28	28	18	12	12	9	9	6	6	6	12	6
To simplify the figures, the pressure in this table is expressed in kilopascals, but pascals shall be used in 7.1.1 and 7.1.2.															

7.5 Pressure reduction factor

The pressure reduction factor, Ψ, is introduced to take into account the fact that the pressure is lower on a large surface than on a small one (distribution of local impact loads).

For a rectangular plate, $\Psi = 1{,}102 - 0{,}0004b$.

For a circular plate, b is replaced by d.

Ψ shall be within the following limits: $0{,}33 \leqslant \Psi \leqslant 1{,}0$.

7.6 Curvature coefficient

The curvature coefficient, k_c, for a convex plate shall be determined from Figure 6 a) and the formula:

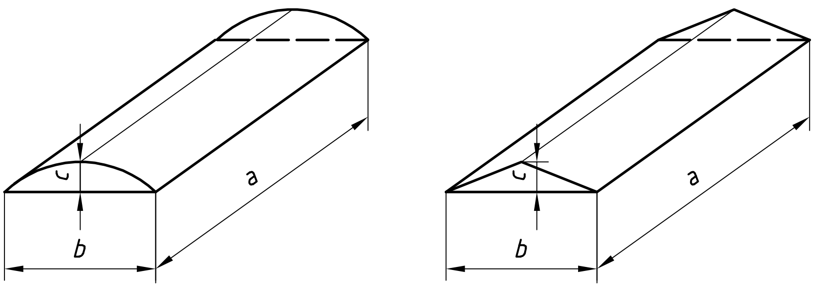
$$k_c = 1 - c/b \tag{3}$$

where

k_c is within the following limits: $0{,}33 \leqslant k_c \leqslant 1$;

c is the crown height of a curved plate, assessed in accordance with Figure 6 a), or the angle height of an angled plate assessed in accordance with Figure 6 b).

The formula is only applicable if the curvature or angle is in the b direction.



a) Curved plate

b) Angled plate

Figure 6 — Crown height and angle height

7.7 Flexural strength and modulus of elasticity

The values of ultimate flexural strength and modulus of elasticity (Young's modulus) of the plate material are the manufacturer's stated nominal (not minimal) values. In the absence of such data, the average values given in Tables F.1 and F.2 may be used.

7.8 Safety factor and minimum plate thickness

The allowable flexural stress of the material, σ_a, is determined from

$$\sigma_a = \sigma_u / \gamma$$

where γ is the value of the safety factor given in Table 5.

The safety factor, γ, used in this calculation of the allowable flexural stress (and minimum thickness values) takes into account the relative brittleness of the material and its ageing characteristics due to environmental conditions.

Safety factors and minimum thickness for materials other than those listed below shall be evaluated by comparing their impact energy at maximum force to that of glass-reinforced plastic (GRP) according to ISO 6603–1.

Table 5 — Safety factor and minimum thickness of monolithic plates

Dimensions in millimetres

Material	Acronym	Safety factor γ	Minimum thickness of monolithic plates, t_m			
			Design categories			
			Any		A and B	C and D
			Area I [a]	Area II	Areas III and IV	Areas III and IV
Poly(methyl)methacrylate	PMMA	3,5	$6 + 0,1\ (L_H - 4)$	6	5	4
Polycarbonate	PC	3,5	$6 + 0,1\ (L_H - 4)$	6	5	4
Monolithic tempered glass	TG	4,0	$5 + 0,1\ (L_H - 4)$ [b]	4	4	3
Laminated glass	LG	4,0	$5 + 0,1\ (L_H - 4)$ [b]	4	4	3
All mahogany plywood	AMPW	2,0	$8 + 0,1\ (L_H - 4)$	6	5	4
GRP mat 30 % glass	GRP M 30	2,0	$4 + 0,1\ (L_H - 4)$	3	3	2
GRP mat/roving 35 % glass	GRP MR 35	2,0	$4 + 0,1\ (L_H - 4)$	3	3	2
Aluminium alloy 5083-H111	—	2,0	$3 + 0,05\ (L_H - 4)$	3	3	2
Mild steel	MS	2,0	$2,5 + 0,025\ (L_H - 4)$	2,5	2,5	2

[a] The minimum thickness in Area I is related to L_H, in metres.

[b] Glass is only allowed in Area I if equipped with a deadlight, or if it is highly resistant to impact (see 6.3.1.4).

7.9 Laminated glass thickness

In order to calculate the thickness of laminated glass (3.21.5), the thickness, t_{eq}, of a monolithic plate made of the same type of glass material as the laminated glass plies, is calculated. Then:

a) if the difference in thickness between any two glass plies is less than or equal to 2 mm and the thickness of the plastic interlayer is less than, or equal to 0,76 mm:

— for 2 glass plies, the total thickness of the glass plies t_1 and t_2 shall be:

$$t_1 + t_2 \geqslant 1{,}2 t_{eq},$$

— for more than 2 glass plies, the total thickness of the glass plies, t_1, t_2, t_3, ..., t_n, shall be

$$t_1 + t_2 + t_3 + ... + t_n \geqslant 1{,}5 t_{eq};$$

b) if the conditions of a) above are not met, each ply shall be considered as stressed according to its section modulus and shall be analysed according to clause 8.

8 Sandwich plates, stiffened and/or supported plates

Sandwich plates have an inner core covered on each side by a working skin.

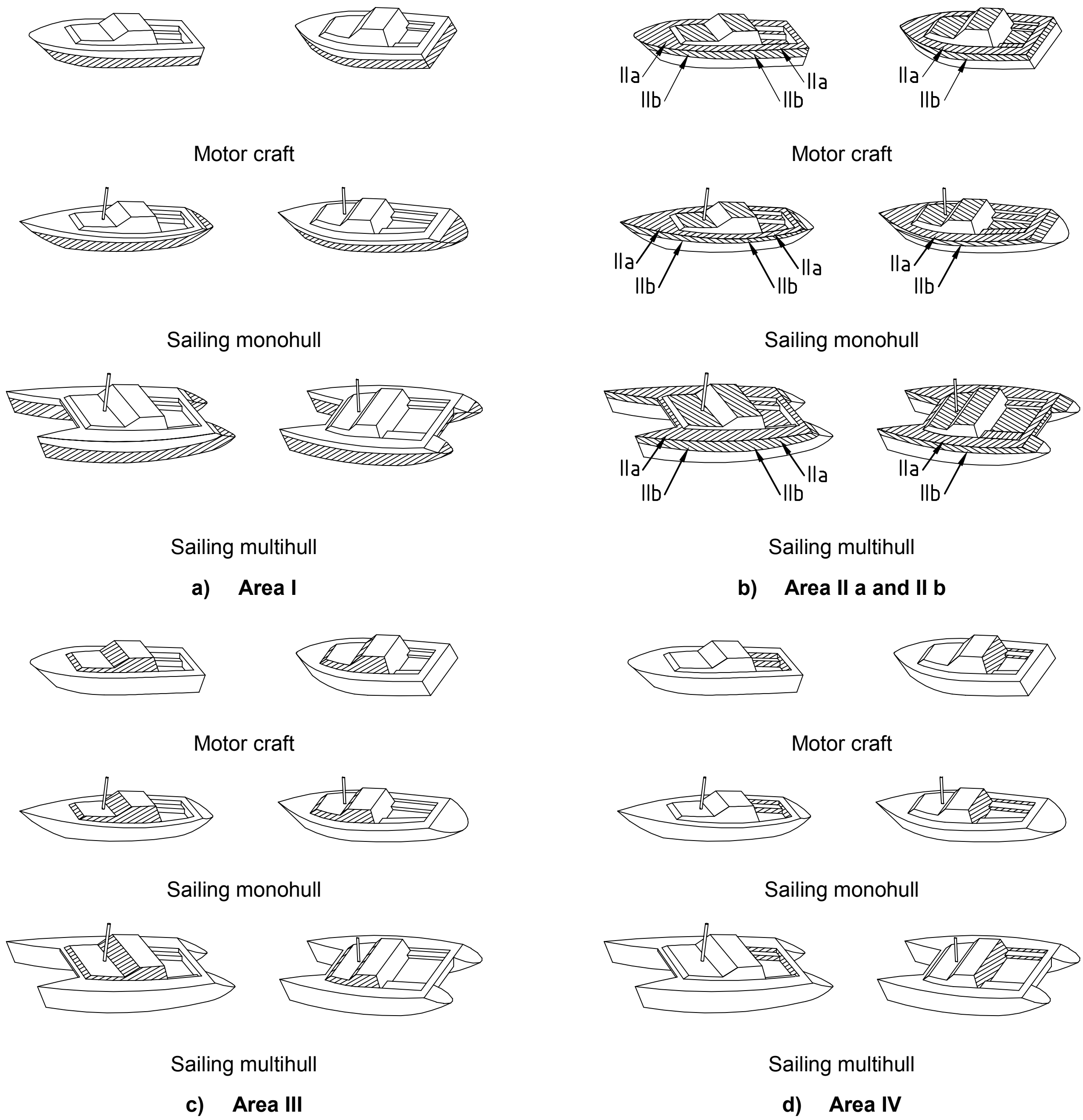
Stiffened and/or supported plates of appliances have internal or external stiffeners that either only stiffen the plate or carry the load to the frame or the support.

All elements of these types of plate (including stiffeners, frames, fasteners, etc.) shall be designed in accordance with 7.1 to 7.8.

Annex A
(normative)

Appliance location areas

Examples of the appliance location areas (3.17.1, 3.17.2, 3.17.3, 3.17.4) are shown in Figure A.1 as hatched areas.

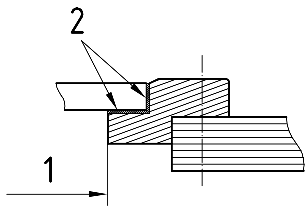


NOTE The sketches summarize the different location areas. For dubious cases, the definitions of clause 3 prevail.

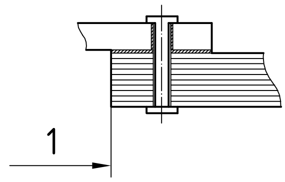
Figure A.1 — Sketches of Areas I to IV

Annex B
(normative)

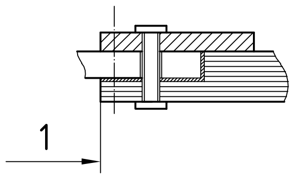
Types of plate edge connection



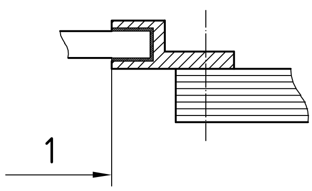
a) Glued on a frame



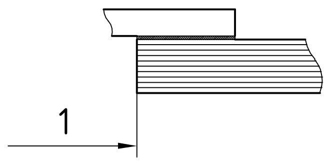
b) Bolted and jointing compound



c) Bolted with counter frame and jointing compound



d) Glued or elastomer in a frame



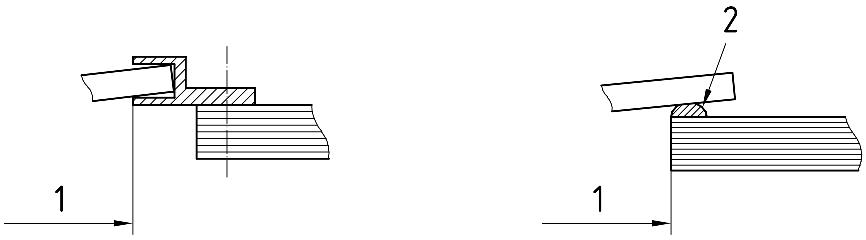
e) Glued

Key

1 Unsupported dimensions

2 Glued on side and/or face

Figure B.1 — Typical semi-fixed connections



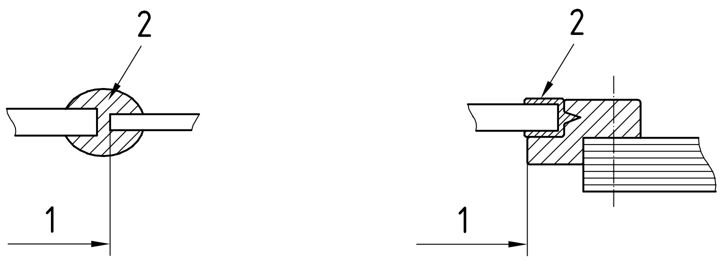
a) Sliding in a frame or a rabbet **b) Supported connection**

Key

1 Unsupported dimensions

2 Elastomer

Figure B.2 — Typical simply supported connections



a) Car windscreen joint **b) Flexible connection**

Key

1 Unsupported dimensions

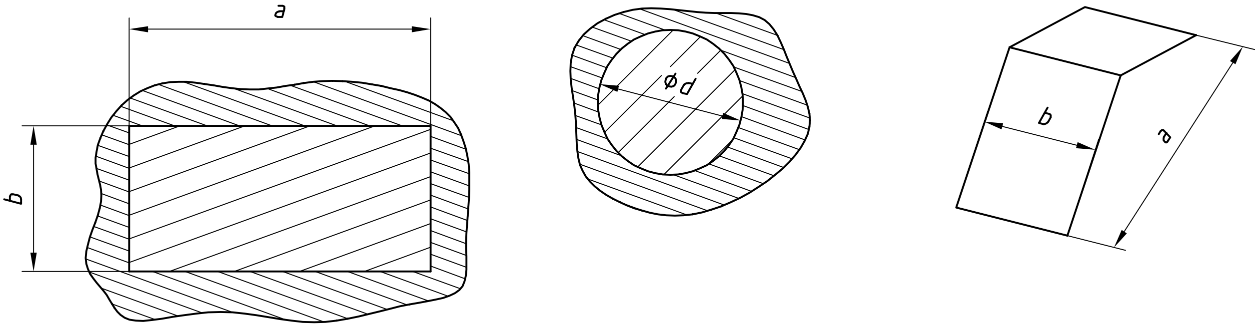
2 Elastomer

Figure B.3 — Typical flexible connections

Annex C
(normative)

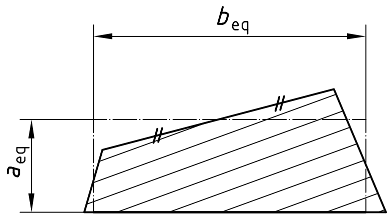
Unsupported plate dimensions

For a rectangular plate, the small and large unsupported dimensions are b and a respectively, as shown in Figure C.1 a). For a folded plate, the small and large unsupported dimensions are b and a respectively, as shown in Figure C.1 c). For a circular plate, the unsupported diameter is d, as shown in Figure C.1 b). For non-rectangular or non-circular plate shapes, use “equivalent” dimensions of a rectangular or circular plate having an area equal to that of the plate being considered (see Figure C.2).



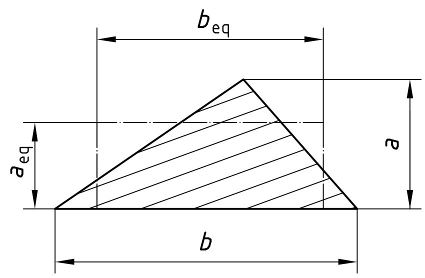
a) Rectangular plate **b) Circular plate** **c) Folded plate**

Figure C.1 — Unsupported plate dimensions



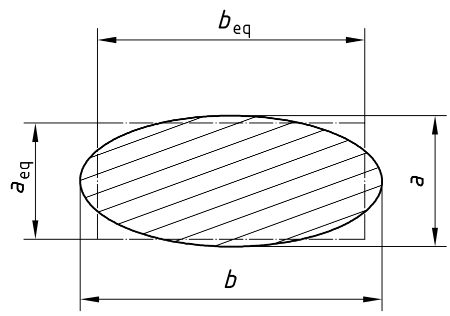
The rectangle has the same area

1) Quadrangle



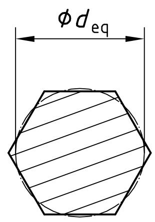
$a_{eq} = 2a/3$ $b_{eq} = 3b/4$

2) Triangle



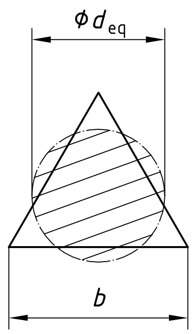
$a_{eq} = 0{,}87a$ $b_{eq} = 0{,}87b$

3) Flat ellipse



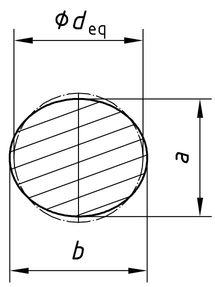
The circle has the same area

4) Polygon



$d_{eq} = 3b/4$

5) Equilateral triangle



$d_{eq} = \sqrt{ab}$

6) Round ellipse

Figure C.2 — Equivalent dimensions

Annex D
(normative)

Methods of test

D.1 Pressure and watertightness tests

D.1.1 Pressure test for prefabricated appliances

This test shall be performed on each type of prefabricated appliance before its installation on the craft.

A sample of each type of prefabricated appliance shall be tested in a suitable pressure jig for at least 3 min with an outside water pressure of at least:

- 35 kPa for appliances to be placed in Area I;
- 14 kPa for appliances to be placed in Area II;
- 0,5 $p\Psi$ for appliances to be placed in Area III, (D.1)

where

p is the basic design pressure specified in Table 4 (see 7.4);

Ψ is the pressure reduction factor (see 7.5).

No leak, nor permanent deformation of any part of the appliance shall be observed during the test.

Appliances having already performed successfully in one test do not need to be subjected to the test at lower pressure values.

The above tests may not be applied on sliding appliances, but in that case the tests of D.1.2 shall be applied on at least one test sample.

The above tests are not necessary for:

- appliances constituted by a single plate fitted on the craft;
- companion-way hatches,

which are both covered by D.1.2.

The above test shall only be performed on a test sample made with the same process as the actual appliance, or on a sample taken from the production line. These tests shall be repeated if any significant change is made to the manufacturing process or materials. For curved appliances, this test may be performed on samples of flat appliances made with the same material and process.

If the appliance has ventilation devices which are either built-in, or fitted by the appliance manufacturer before commercialization, these ventilation devices may be made inoperative, e.g. sealed with jointing compound, to perform the tests defined in D.1.

After performance of these tests, the appliance, with its ventilation device made operative, shall have its watertightness degree required by Table 1 tested by the appliance manufacturer before commercialization, using the test methods defined in D.1.2.

If the ventilation device is equipped with a system intended to limit or shut the rate of air passage, it may be used when applying the latter test.

D.1.2 Watertightness tests

D.1.2.1 General

These tests shall be performed on appliances after their installation on the craft.

D.1.2.2 Determination of degrees of watertightness 2 and 3

The appliance shall be tested with a water jet positioned outside of the craft, and in accordance with Figure D.1 for horizontal appliances or up to 45° against the horizontal, or in accordance with Figure D.2 for vertical appliances or oriented up to 45° against the vertical.

The water jet shall be a dense thin water jet delivering a flow of at least 10 l/min, aiming everywhere in an area located within 0,05 m each side of the periphery of the appliance (see Figures D.1 and D.2).

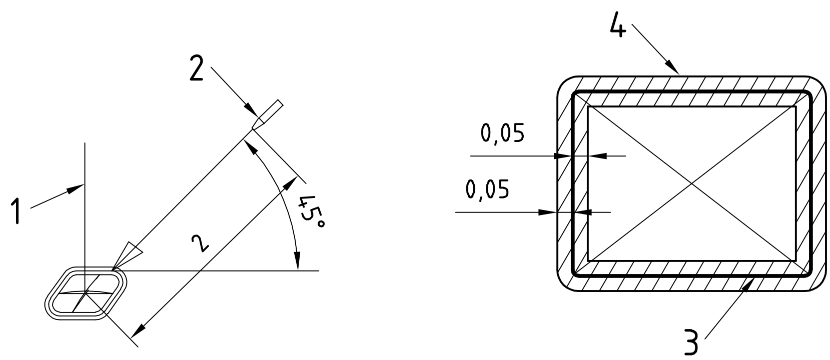
NOTE This jet is normally attained when connecting a garden hose with an adjustable nozzle to a tap, the static pressure of which, when the tap is closed, is 200 kPa.

Spraying shall continue for at least 3 min. After this duration, the ingress of water shall not exceed:

— 0,05 l for appliances that conform to degree of watertightness 2;

— 0,5 l for appliances that conform to degree of watertightness 3.

Dimensions in metres



Key

1 Perpendicular

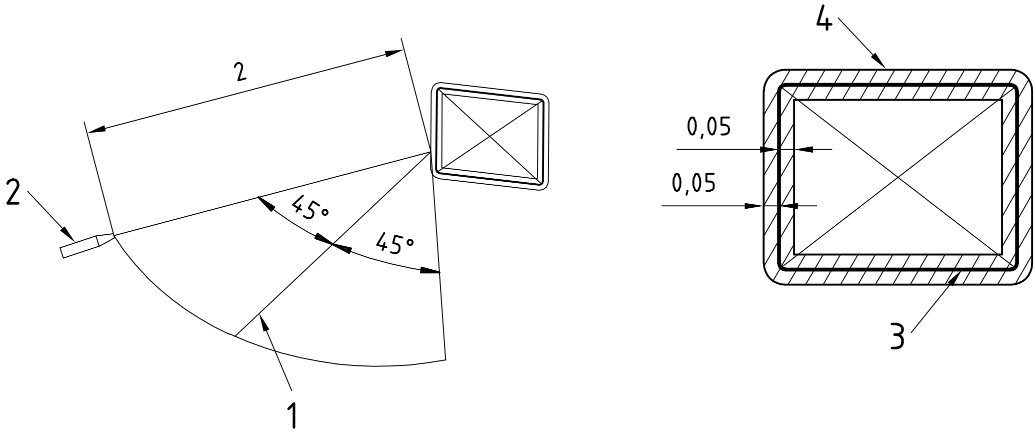
2 Nozzle

3 Periphery of the appliance

4 Jet to be aimed around the periphery of the appliance within the hatched area

Figure D.1 — Test arrangement for horizontal appliances or up to 45° against the horizontal

Dimensions in metres



Key

1 Perpendicular

2 Nozzle

3 Periphery of the appliance

4 Jet to be aimed around the periphery of the appliance within the hatched area

Figure D.2 — Test arrangement for vertical appliances or up to 45° against the vertical

D.1.2.3 Determination of degree of watertightness 4

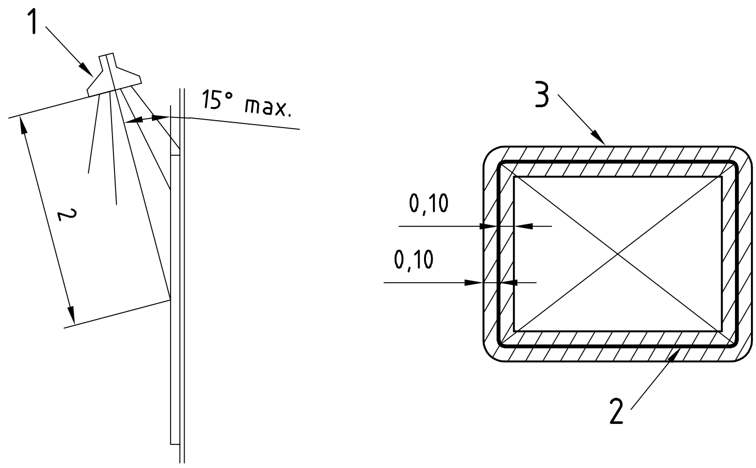
Unless already tested in accordance with D.1.2.2, the appliance shall be tested with a spray nozzle positioned outside of the craft, and in accordance with Figure D.3.

This spray nozzle shall be able to simulate heavy rain. No water pressure is specified.

The water spray shall be aimed everywhere in an area located within 0,10 m each side of the periphery of the appliance (see Figure D.3).

Spraying shall continue for at least 3 min. After this duration, the ingress of water shall not exceed 0,5 litres.

Dimensions in metres



Key

1 Nozzle

2 Periphery of the appliance

3 Jet to be aimed around the periphery of the appliance within the hatched area

Figure D.3 — Test arrangement for the determination of degree of watertightness 4

D.2 Test or calculation for mechanical links

This test or calculation is only required for appliances opening inwards, or when there is a doubt as to the resistance of some elements of the mechanical links (see Figure D.4).

NOTE Appliance opening outwards, such as folding doors made of several panels connected by hinges, may require this test as the hinges take a large part of the pressure force.

By means of testing or calculation, determine whether the hinges and locks, or any part of the mechanical devices, can support, without breaking, the force.

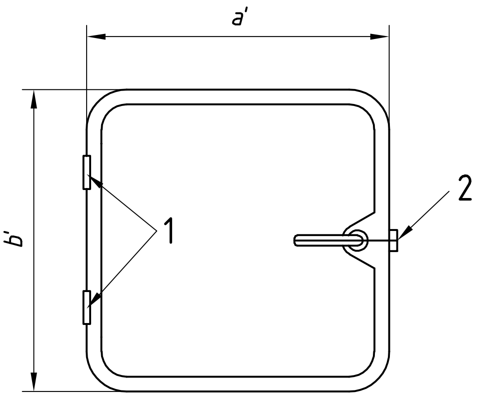
$$F = 2\,a'\,b'\,\Psi\,p \qquad \text{(D.2)}$$

where

a' and b' are the unsupported dimensions of the appliance, expressed in metres;

Ψ is the pressure reduction factor (7.5);

p is the basic design pressure, expressed in pascals (7.4).



Key

1 Hinges

2 Lock

Figure D.4 — Example of an appliance which opens inwards

D.3 Gluing tests

D.3.1 General

Plates retained by a non-glued outside framing, such as those shown in Figure B.1 d), need not be subjected to the test.

D.3.2 Inside pressure test

D.3.2.1 Sample

The sample shall consist of a flat plate with an unsupported area between 0,02 m^2 and 0,16 m^2, made with the same jointing procedure, plate and support material as used by the manufacturer of the appliance (see Figure D.5).

The test sample gluing area, A_{sg}, expressed in square metres, is determined from

$$A_{sg} = l_p (a_f + a_s) \quad \text{(D.3)}$$

where

l_p is the plate perimeter, expressed in metres;

a_f is the face gluing dimension, expressed in metres;

a_s is the side gluing dimension, expressed in metres.

Figure D.5 shows the position of the dimensions a_f and a_s.

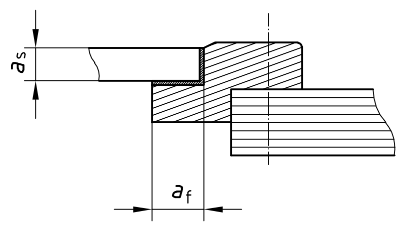


Figure D.5 — Glued joint dimensions sketch

D.3.2.2 Test procedure

Use a suitable jig to apply an inside water pressure of at least 625 A_{sg}, expressed in kilopascals, tending to push the plate out of its support.

The test pressure shall be maintained for at least 3 min.

D.3.2.3 Test result

The test is passed if there is no apparent damage to the glue joint and no sign of leakage.

D.3.3 Separation test

D.3.3.1 Sample

Two test blades, 300 mm by 25 mm, shall be made from the same materials as the plate and structure to be glued together. The thicknesses of the blades shall be the same as those of the actual plate and structure.

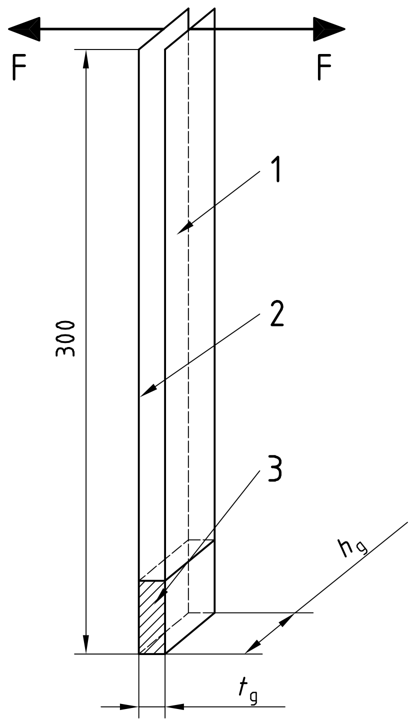
The test blades shall be glued together with the same glue joint dimensions (thickness, t_g, and height, h_g) and gluing procedure as used on the craft, as shown in Figure D.6.

D.3.3.2 Test procedure

Apply two equal and opposite forces, F, to the sample as shown in Figure D.6.

F is applied up to the point of breaking or permanent deformation of one element of the blades of the sample. The separation forces may be induced manually.

Dimensions in millimetres



Key

1 Plate blade

2 Structure blade

3 Glued joint

Figure D.6 — Arrangement for the separation test

D.3.3.3 Test result

The test is passed if one of the three following conditions is met:

— one of the test blades yields or breaks before any visible yielding or breaking of the glue joint during the test;

— no permanent deformation nor break is shown inside the glue joint after the test;

— the glue joint disconnects from one of the test blades, and some part of the blade (delamination, wood breaking, etc.) has been torn away.

Annex E
(normative)

High-impact-resistance glass

A list of high-impact-resistance glass in given in Table E.1 together with additional requirements for each type.

Table E.1 — High-impact-resistance glass types

Glass type	Additional requirements
Laminated glass (faces AG, TG or CG)	Minimum thickness of faces 4 mm, minimum interlayer thickness 2,3 mm
Bullet-resistant glass	Class FB2 to FB7 tested in accordance with EN 1063
Impact-resistant glass	Class 4 tested in accordance with EN 356
NOTE AG = Annealed glass, TG = Tempered glass, CG = Chemically tempered glass.	

Other glass types can be accepted if a 400 mm × 400 mm flat plate can bear an impact energy of 300 J yielded by the fall of a hard object (steel dart or ball) and have a degree of watertightness 1, 2 or 3, when tested in accordance with D.1.2.

Annex F
(informative)

Precalculated tables

F.1 Mechanical properties of typical materials

See Table F.1.

Table F.1 — Average mechanical properties of typical materials

Material	Abbreviation	Ultimate flexural strength σ_u MPa	Modulus of elasticity E MPa
Polymethylmethacrylate	PMMA	110	3 000
Polycarbonate	PC	90	2 400
Tempered glass	TG	200	72 600
Chemically reinforced glass	CG	300[a]	72 600
Annealed glass	AG	40	72 600
All mahogany plywood	AMPW	50	7 000
GRP all mat 30 % glass	GRP M 30	140	7 500
GRP mat/roving 35 % glass	GRP MR 35	175	10 000
Aluminium alloy 5083-H111	—	280	70 000
Mild steel	MS	400	200 000
Stainless steel AISI 316 L[b]	AISI 316L	510	200 000

NOTE To simplify the figures, σ_u and E are expressed in megapascals, but pascals shall be used in 7.1.1 and 7.1.2.

a This value corresponds to a case depth (chemical reinforcement depth) of 30 µm.

b Steel 20 according to ISO/TR 15510.

F.2 Use of precalculated tables

As a complementary instrument to solve the complexity of the formulae given in clause 7, the attached precalculated Tables F.6 to F.29 for PMMA and TG displaying plate thickness can be used.

Table F.2 lists these tables, which give the plate thickness, calculated with the specifications of Table 4.

In order to help builders or designers to obtain the thickness they wish, adjusting unsupported dimensions, the plate thicknesses are given with one digit after the commas, but after that shall be rounded as indicated.

Table F.2 — Design specifications

Calcul-ation specific-ation	Material	Basic design pressure kPa	Appliance location area	Boat type	Design category	Modulus of elasticity E Mpa	Ultimate flexural strength σ_u Mpa	Factor of safety γ	Allowable flexural strength σ_a Mpa	Table No. for plate type SF	 SS
P 70	PMMA	70	I any	Any	Any	3 000	110	3,5	31,4	F.6	F.18
//	PMMA	70	IIb any	Any	A	//	//	//	//	//	//
P 28	PMMA	28	IIb any	Any	C, D	//	//	//	//	F.7	F.19
//	PMMA	28	IIa any	Any	Any	//	//	//	//	//	//
P 18	PMMA	18	III any	Sailboat	A, B	//	//	//	//	F.8	F.20
P 12	PMMA	12	III any	Sailboat	C, D	//	//	//	//	F.10	F.21
//	PMMA	12	III front	Motorboat	A	//	//	//	//	//	//
//	PMMA	12	IV any	Sailboat	Any	//	//	//	//	//	//
P 9	PMMA	9	III front	Motorboat	B	//	//	//	//	F.10	F.22
//	PMMA	9	III side	Motorboat	A	//	//	//	//	//	//
P 6	PMMA	6	III any	Motorboat	C, D	//	//	//	//	F.11	F.23
//	PMMA	6	IV any	Motorboat	Any	//	//	//	//	//	//
T 70	TG	70	I any	Any	Any	72 600	200	4	50	F.12	F.24
//	TG	70	IIb any	Any	A	//	//	//	//	//	//
T 28	TG	28	IIb any	Any	C, D	//	//	//	//	F.13	F.25
//	TG	28	IIa any	Any	Any	//	//	//	//	//	//
T 18	TG	18	III any	Sailboat	A, B	//	//	//	//	F.14	F.26
T 12	TG	12	III any	Sailboat	C, D	//	//	//	//	F.15	F.27
//	TG	12	III front	Motorboat	A	//	//	//	//	//	//
//	TG	12	IV any	Sailboat	Any	//	//	//	//	//	//
T 9	TG	9	III front	Motorboat	B	//	//	//	//	F.16	F.28
//	TG	9	III side	Motorboat	A	//	//	//	//	//	//
T 6	TG	6	III any	Motorboat	C, D	//	//	//	//	F.17	F.29
//	TG	6	IV any	Motorboat	Any	//	//	//	//	//	//

Table F.3 — Values of t_{min} for PMMA in Area I

L_H, m	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
t_{min}, mm	6,2	6,3	6,4	6,5	6,6	6,7	6,8	6,9	7,0	7,1	7,2	7,3	7,4	7,5	7,6	7,7	7,8	7,9	8,0

Table F.4 — Values of t_{min} for TG in Area I

L_H, m	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
t_{min}, mm	5,2	5,3	5,4	5,5	5,6	5,7	5,8	5,9	6,0	6,1	6,2	6,3	6,4	6,5	6,6	6,7	6,8	6,9	7,0

Table F.5 — Values of the pressure reduction factor, Ψ, for all design specifications

b or d mm	⩽ 250	300	320	350	370	400	450	500	550	600	620	700	720	800	900	1 000	1 100	1 200
Ψ	1,0	0,98	0,97	0,96	0,95	0,94	0,92	0,90	0,88	0,86	0,85	0,82	0,81	0,78	0,74	0,70	0,66	0,62

Table F.6 — Thickness of semi-fixed plates for calculation specification P 70 (PMMA and p = 70 kPa)

Rectangular flat plate

a mm	**Values of b (lesser dimension),** mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250			6,0	6,5	6,8														
300			6,5	7,3	7,8														
350			6,8	7,9	8,6														
400			7,0	8,3	9,2														
450			7,2	8,6	9,7														
500			7,3	8,8	10,0														
550			7,4	9,0	10,3														
600			7,4	9,1	10,5														
650			7,4	9,2	10,6														
700	$t = t_{min}$ 6 mm to 8 mm (see Table F.3)		7,5	9,2	10,8	In Area I, b shall not be greater than 300 mm													
750			7,5	9,3	10,9														
800			7,5	9,3	10,9														
900			7,5	9,3	11,0														
1 000			7,5	9,4	11,1														
1 100			7,5	9,4	11,1														
1 200			7,5	9,4	11,2														
1 300			7,5	9,4	11,2														
1 400			7,5	9,4	11,2														
1 500			7,5	9,4	11,2														
1 600			7,5	9,4	11,2														
1 800			7,5	9,4	11,2														
2 000			7,5	9,4	11,2														

Circular flat plate

Values of d, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$			6,2	7,4	8,5	9,7	10,8	11,9	13,0	14,0	15,0	16,0	17,0	18,0	19,8	21,5	23,1	24,6

NOTE 1 Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

NOTE 2 See 6.3.1 for appliances fitted in Area I.

Table F.7 — Thickness of semi-fixed plates for calculation specification P 28 (PMMA and p = 28 kPa)

	Rectangular flat plate																		
a	Values of b (lesser dimension), mm																		
mm	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350					5,9	6,2													
400					6,4	6,8	7,0												
450					6,7	7,2	7,6	7,9											
500				6,1	6,9	7,6	8,1	8,4	8,7										
550				6,2	7,1	7,9	8,5	8,9	9,2	9,4									
600				6,3	7,2	8,1	8,8	9,3	9,7	10,0	10,2								
650				6,3	7,3	8,2	9,0	9,6	10,1	10,5	10,8	11,0							
700				6,4	7,4	8,4	9,2	9,9	10,5	10,9	11,3	11,5	11,7						
750	$t = t_{min}$ = 6 mm			6,4	7,5	8,5	9,4	10,1	10,8	11,3	11,7	12,0	12,2	12,4					
800	(see Table F.3)			6,4	7,5	8,6	9,5	10,3	11,0	11,6	12,1	12,4	12,7	12,9	13,1				
900				6,4	7,6	8,7	9,7	10,6	11,4	12,1	12,7	13,2	13,6	13,9	14,1	14,4			
1 000				6,5	7,7	8,8	9,8	10,8	11,7	12,5	13,1	13,7	14,2	14,7	15,0	15,4	15,7		
1 100				6,5	7,7	8,8	9,9	10,9	11,9	12,7	13,5	14,2	14,8	15,3	15,7	16,3	16,7	16,8	
1 200				6,5	7,7	8,9	10,0	11,0	12,0	12,9	13,7	14,5	15,2	15,8	16,3	17,0	17,6	17,8	17,9
1 300				6,5	7,7	8,9	10,0	11,1	12,1	13,1	13,9	14,8	15,5	16,1	16,7	17,6	18,3	18,7	18,9
1 400				6,5	7,7	8,9	10,1	11,2	12,2	13,2	14,1	15,0	15,7	16,4	17,1	18,1	18,9	19,5	19,8
1 500				6,5	7,7	8,9	10,1	11,2	12,3	13,3	14,2	15,1	15,9	16,7	17,4	18,6	19,5	20,1	20,5
1 600				6,5	7,7	8,9	10,1	11,3	12,3	13,3	14,3	15,2	16,1	16,9	17,6	18,9	19,9	20,7	21,2
1 800				6,5	7,7	8,9	10,1	11,3	12,4	13,4	14,5	15,4	16,3	17,2	18,0	19,4	20,6	21,6	22,3
2 000				6,5	7,7	8,9	10,1	11,3	12,4	13,5	14,5	15,5	16,5	17,4	18,2	19,8	21,1	22,2	23,1

Circular flat plate																		
Values of d, mm																		
100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
$t = t_{min}$						6,7	7,5	8,2	9,0	9,7	10,4	11,1	11,8	12,4	13,7	14,9	16,0	17,1

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.8 — Thickness of semi-fixed plates for calculation specification P 18 (PMMA and p = 18 kPa)

a mm	Rectangular flat plate — Values of b (lesser dimension) mm: 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
350					5,0	5,2													
400					5,3	5,7	5,9												
450				5,0	5,6	6,1	6,4	6,6											
500				5,1	5,8	6,4	6,8	7,1	7,3										
550				5,2	6,0	6,6	7,1	7,5	7,7	7,9									
600				5,2	6,1	6,8	7,3	7,8	8,1	8,4	8,6								
650				5,3	6,2	6,9	7,5	8,1	8,5	8,8	9,0	9,2							
700				5,3	6,2	7,0	7,7	8,3	8,8	9,1	9,4	9,6	9,8						
750	$t = t_{min}$ = 5 mm			5,4	6,3	7,1	7,8	8,5	9,0	9,5	9,8	10,1	10,3	10,4					
800	(see Table F.3)			5,4	6,3	7,2	8,0	8,6	9,2	9,7	10,1	10,4	10,7	10,9	11,0				
900				5,4	6,4	7,3	8,1	8,9	9,5	10,1	10,6	11,0	11,4	11,6	11,8	12,1			
1 000				5,4	6,4	7,4	8,2	9,0	9,8	10,4	11,0	11,5	11,9	12,3	12,6	13,0	13,1		
1 100				5,4	6,4	7,4	8,3	9,2	9,9	10,7	11,3	11,9	12,4	12,8	13,2	13,7	14,0	14,1	
1 200				5,4	6,5	7,4	8,4	9,2	10,1	10,8	11,5	12,2	12,7	13,2	13,6	14,3	14,7	15,0	15,0
1 300				5,4	6,5	7,5	8,4	9,3	10,2	11,0	11,7	12,4	13,0	13,5	14,0	14,8	15,4	15,7	15,9
1 400				5,4	6,5	7,5	8,4	9,4	10,2	11,1	11,8	12,5	13,2	13,8	14,3	15,2	15,9	16,3	16,6
1 500				5,4	6,5	7,5	8,5	9,4	10,3	11,1	11,9	12,7	13,4	14,0	14,6	15,6	16,3	16,9	17,2
1 600				5,4	6,5	7,5	8,5	9,4	10,3	11,2	12,0	12,8	13,5	14,2	14,8	15,9	16,7	17,3	17,8
1 800				5,4	6,5	7,5	8,5	9,4	10,4	11,3	12,1	12,9	13,7	14,4	15,1	16,3	17,3	18,1	18,7
2 000				5,4	6,5	7,5	8,5	9,5	10,4	11,3	12,2	13,0	13,8	14,6	15,3	16,6	17,7	18,6	19,4
	Circular flat plate — Values of d, mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
	$t = t_{min}$					5,0	5,6	6,3	6,9	7,5	8,1	8,7	9,3	9,9	10,5	11,5	12,5	13,5	14,3

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.9 — Thickness of semi-fixed plates for calculation specification P 12 (PMMA and p = 12 kPa)

	Rectangular flat plate																		
a	Values of b (lesser dimension), mm																		
mm	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400							5,0												
450						5,2	5,4	5,6											
500						5,4	5,8	6,0	6,2										
550					5,1	5,6	6,0	6,4	6,6	6,7									
600					5,2	5,8	6,2	6,6	6,9	7,1	7,3								
650					5,2	5,9	6,4	6,9	7,2	7,5	7,7	7,8							
700					5,3	6,0	6,6	7,1	7,5	7,8	8,0	8,2	8,3						
750	$t = t_{min}$ = 5 mm				5,3	6,1	6,7	7,2	7,7	8,0	8,3	8,6	8,7	8,9					
800	(see Table F.3)				5,4	6,1	6,8	7,4	7,9	8,3	8,6	8,9	9,1	9,2	9,4				
900					5,4	6,2	6,9	7,6	8,1	8,6	9,0	9,4	9,7	9,9	10,1	10,3			
1 000					5,5	6,3	7,0	7,7	8,3	8,9	9,4	9,8	10,2	10,5	10,7	11,0	11,2		
1 100					5,5	6,3	7,1	7,8	8,5	9,1	9,6	10,1	10,5	10,9	11,2	11,7	11,9	12,0	
1 200					5,5	6,3	7,1	7,9	8,6	9,2	9,8	10,3	10,8	11,2	11,6	12,2	12,5	12,8	12,8
1 300					5,5	6,3	7,2	7,9	8,6	9,3	10,0	10,5	11,1	11,5	11,9	12,6	13,1	13,4	13,5
1 400					5,5	6,4	7,2	8,0	8,7	9,4	10,1	10,7	11,2	11,7	11,9	13,0	13,5	13,9	14,1
1 500					5,5	6,4	7,2	8,0	8,8	9,5	10,2	10,8	11,4	11,9	12,2	13,3	13,9	14,4	14,7
1 600					5,5	6,4	7,2	8,0	8,8	9,5	10,2	10,9	11,5	12,1	12,6	13,5	14,2	14,8	15,1
1 800					5,5	6,4	7,2	8,0	8,8	9,6	10,3	11,0	11,7	12,3	12,8	13,9	14,7	15,4	15,9
2 000					5,5	6,4	7,2	8,1	8,9	9,6	10,4	11,1	11,8	12,4	13,0	14,1	15,1	15,9	16,5
	Circular flat plate																		
	Values of d, mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	900	1 000	1 100	**1 200**
	$t = t_{min}$ (5 mm)							5,3	5,9	6,4	6,9	7,5	8,0	8,4	8,9	9,8	10,7	11,5	12,2

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.10 — Thickness of semi-fixed plates for calculation specification P 9 (PMMA and p = 9 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450								5,0											
500							5,1	5,4	5,5										
550						5,0	5,4	5,7	5,9	6,0									
600						5,1	5,6	5,9	6,2	6,4	6,5								
650						5,2	5,7	6,1	6,4	6,7	6,9	7,0							
700						5,4	5,9	6,3	6,7	7,0	7,2	7,3	7,5						
750	$t = t_{min}$ = 5 mm (see Table F.3)					5,5	6,0	6,4	6,9	7,2	7,4	7,7	7,8	7,9					
800						5,5	6,0	6,6	7,0	7,4	7,7	7,9	8,1	8,3	8,4				
900						5,6	6,2	6,7	7,3	7,7	8,1	8,4	8,7	8,9	9,0	9,2			
1 000						5,6	6,3	6,9	7,4	7,9	8,4	8,8	9,1	9,3	9,6	9,9	10,0		
1 100						5,7	6,3	7,0	7,6	8,1	8,6	9,0	9,4	9,7	10,0	10,4	10,7	10,8	
1 200						5,7	6,4	7,0	7,7	8,2	8,8	9,2	9,7	10,0	10,4	10,9	11,2	11,4	11,5
1 300						5,7	6,4	7,1	7,7	8,3	8,9	9,4	9,9	10,3	10,7	11,3	11,7	11,9	12,1
1 400						5,7	6,4	7,1	7,8	8,4	9,0	9,5	10,0	10,5	10,9	11,6	12,1	12,4	12,6
1 500						5,7	6,4	7,1	7,8	8,5	9,1	9,6	10,2	10,6	11,1	11,8	12,4	12,8	13,1
1 600						5,7	6,4	7,2	7,8	8,5	9,1	9,7	10,3	10,8	11,2	12,1	12,7	13,2	13,5
1 800						5,7	6,5	7,2	7,9	8,6	9,2	9,8	10,4	11,0	11,5	12,4	13,2	13,8	14,2
2 000						5,7	6,5	7,2	7,9	8,6	9,3	9,9	10,5	11,1	11,6	12,6	13,5	14,2	14,7

Circular flat plate

Values of d, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$								5,3	5,7	6,2	6,7	7,1	7,5	8,0	8,8	9,6	10,3	10,9

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.11 — Thickness of semi-fixed plates for calculation specification P 6 (PMMA and p = 6 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450																			
500																			
550									5,0	5,1									
600								5,1	5,3	5,4	5,6								
650								5,2	5,5	5,7	5,9	6,0							
700							5,0	5,4	5,7	5,9	6,1	6,3	6,4						
750	$t = t_{min}$ = 5 mm (see Table F.3)						5,1	5,5	5,8	6,1	6,4	6,5	6,7	6,8					
800							5,2	5,6	6,0	6,3	6,6	6,8	6,9	7,0	7,1				
900							5,3	5,8	6,2	6,6	6,9	7,2	7,4	7,6	7,7	7,9			
1 000							5,3	5,9	6,3	6,8	7,1	7,5	7,7	8,0	8,2	8,4	8,5		
1 100							5,4	5,9	6,4	6,9	7,3	7,7	8,0	8,3	8,5	8,9	9,1	9,2	
1 200							5,4	6,0	6,5	7,0	7,5	7,9	8,2	8,6	8,8	9,3	9,6	9,7	9,8
1 300							5,4	6,0	6,6	7,1	7,6	8,0	8,4	8,8	9,1	9,6	10,0	10,2	10,3
1 400							5,5	6,1	6,6	7,2	7,7	8,1	8,6	8,9	9,3	9,9	10,3	10,6	10,8
1 500							5,5	6,1	6,7	7,2	7,7	8,2	8,7	9,1	9,5	10,1	10,6	11,0	11,2
1 600							5,5	6,1	6,7	7,3	7,8	8,3	8,8	9,2	9,6	10,3	10,8	11,3	11,6
1 800							5,5	6,1	6,7	7,3	7,9	8,4	8,9	9,4	9,8	10,6	11,2	11,7	12,1
2 000							5,5	6,1	6,7	7,3	7,9	8,4	9,0	9,5	9,9	10,8	11,5	12,1	12,6

Circular flat plate

Values of d, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$										5,3	5,7	6,1	6,4	6,8	7,5	8,2	8,8	9,3

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.12 — Thickness of semi-fixed plates for calculation specification T 70 (TG and p = 70 kPa)

Rectangular flat plate

a mm	Values of *b* (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250				5,1															
300			5,1	5,8	6,1														
350			5,4	6,2	6,7	7,0			Only permitted above a certain height above waterline										
400			5,6	6,6	7,3	7,7	7,9												
450			5,7	6,8	7,6	8,2	8,6	8,8											
500			5,7	7,0	7,9	8,7	9,2	9,5	9,7										
550			5,8	7,1	8,1	9,0	9,6	10,1	10,4	10,5									
600			5,8	7,2	8,3	9,2	10,0	10,5	10,9	11,2	11,4								
650			5,9	7,2	8,4	9,4	10,3	10,9	11,4	11,8	12,0	12,2							
700	$t = t_{min}$ = 5 mm to 7 mm (see Table F.4)		5,9	7,3	8,5	9,6	10,5	11,3	11,9	12,3	12,6	12,8	13,0						
750			5,9	7,3	8,5	9,7	10,7	11,5	12,2	12,7	13,1	13,4	13,6	13,7					
800			5,9	7,3	8,6	9,8	10,8	11,7	12,5	13,1	13,6	14,0	14,2	14,4	14,4				
900			5,9	7,3	8,7	9,9	11,0	12,0	12,9	13,7	14,3	14,8	15,2	15,5	15,7	15,8			
1 000			5,9	7,4	8,7	10,0	11,2	12,2	13,2	14,1	14,8	15,5	16,0	16,4	16,7	17,0	17,1		
1 100			5,9	7,4	8,7	10,0	11,2	12,4	13,4	14,4	15,2	16,0	16,6	17,1	17,5	18,1	18,3	18,3	
1 200			5,9	7,4	8,8	10,1	11,3	12,5	13,6	14,6	15,5	16,3	17,1	17,7	18,2	18,9	19,3	19,4	19,3
1 300			5,9	7,4	8,8	10,1	11,4	12,6	13,7	14,7	15,7	16,6	17,4	18,1	18,7	19,6	20,2	20,4	20,4
1 400			5,9	7,4	8,8	10,1	11,4	12,6	13,8	14,9	15,9	16,8	17,7	18,4	19,1	20,2	20,9	21,3	21,5
1 500			5,9	7,4	8,8	10,1	11,4	12,7	13,8	15,0	16,0	17,0	17,9	18,7	19,4	20,7	21,5	22,1	22,3
1 600			5,9	7,4	8,8	10,1	11,4	12,7	13,9	15,0	16,1	17,1	18,0	18,9	19,7	21,0	22,0	22,7	23,1
1 800			5,9	7,4	8,8	10,2	11,5	12,7	14,0	15,1	16,2	17,3	18,3	19,2	20,1	21,6	22,8	23,7	24,3
2 000			5,9	7,4	8,8	10,2	11,5	12,8	14,0	15,2	16,3	17,4	18,4	19,4	20,3	22,0	23,3	24,4	25,2

Circular flat plate

Values of *d*, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$				5,5	6,4	7,2	8,1	8,8	9,6	10,4	11,1	11,8	12,5	13,2	14,4	15,6	16,7	17,6

NOTE 1 Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

NOTE 2 See 6.3.1 for appliances fitted in Area I.

Table F.13 — Thickness of semi-fixed plates for calculation specification T 28 (TG and p = 28 kPa)

a	**Rectangular flat plate**																		
	Values of *b* (lesser dimension), mm																		
mm	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350					4,3	4,4													
400				4,2	4,6	4,9	5,0												
450				4,3	4,8	5,2	5,4	5,6											
500				4,4	5,0	5,5	5,8	6,0	6,1										
550				4,5	5,1	5,7	6,1	6,4	6,6	6,7									
600				4,5	5,2	5,8	6,3	6,7	6,9	7,1	7,2								
650				4,6	5,3	6,0	6,5	6,9	7,2	7,5	7,6	7,7							
700				4,6	5,4	6,0	6,6	7,1	7,5	7,8	8,0	8,1	8,2						
750	$t = t_{min}$ = 4 mm			4,6	5,4	6,1	6,7	7,3	7,7	8,1	8,3	8,5	8,6	8,7					
800	(see Table F.4)			4,6	5,4	6,2	6,8	7,4	7,9	8,3	8,6	8,8	9,0	9,1	9,1				
900				4,6	5,5	6,3	7,0	7,6	8,2	8,7	9,1	9,4	9,6	9,8	9,9	10,0			
1 000				4,7	5,5	6,3	7,1	7,7	8,4	8,9	9,4	9,8	10,1	10,4	10,6	10,8	10,8		
1 100				4,7	5,5	6,3	7,1	7,8	8,5	9,1	9,6	10,1	10,5	10,8	11,1	11,4	11,6	11,6	
1 200				4,7	5,5	6,4	7,2	7,9	8,6	9,2	9,8	10,3	10,8	11,2	11,5	12,0	12,2	12,3	12,2
1 300				4,7	5,6	6,4	7,2	7,9	8,7	9,3	9,9	10,5	11,0	11,4	11,8	12,4	12,8	12,9	12,9
1 400				4,7	5,6	6,4	7,2	8,0	8,7	9,4	10,0	10,6	11,2	11,7	12,1	12,8	13,2	13,5	13,6
1 500				4,7	5,6	6,4	7,2	8,0	8,8	9,5	10,1	10,7	11,3	11,8	12,3	13,1	13,6	14,0	14,1
1 600				4,7	5,6	6,4	7,2	8,0	8,8	9,5	10,2	10,8	11,4	12,0	12,5	13,3	13,9	14,4	14,6
1 800				4,7	5,6	6,4	7,3	8,1	8,8	9,6	10,3	10,9	11,6	12,2	12,7	13,7	14,4	15,0	15,4
2 000				4,7	5,6	6,4	7,3	8,1	8,9	9,6	10,3	11,0	11,7	12,3	12,9	13,9	14,8	15,4	16,0
	Circular flat plate																		
	Values of *d*, mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
	$t = t_{min}$					4,0	4,6	5,1	5,6	6,1	6,6	7,0	7,5	7,9	8,3	9,1	9,9	10,5	11,2

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.14 — Thickness of semi-fixed plates for calculation specification T 18 (TG and p = 18 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400							4,0												
450						4,2	4,4	4,5											
500					4,0	4,4	4,6	4,8	4,9										
550					4,1	4,6	4,9	5,1	5,3	5,3									
600					4,2	4,7	5,1	5,3	5,6	5,7	5,8								
650					4,3	4,8	5,2	5,5	5,8	6,0	6,1	6,2							
700					4,3	4,8	5,3	5,7	6,0	6,2	6,4	6,5	6,6						
750	$t = t_{min}$ = 4 mm				4,3	4,9	5,4	5,8	6,2	6,5	6,7	6,8	6,9	7,0					
800	(see Table F.4)				4,4	5,0	5,5	5,9	6,3	6,7	6,9	7,1	7,2	7,3	7,3				
900					4,4	5,0	5,6	6,1	6,6	6,9	7,3	7,5	7,7	7,9	7,9	8,0			
1 000					4,4	5,1	5,7	6,2	6,7	7,1	7,5	7,8	8,1	8,3	8,5	8,6	8,7		
1 100					4,4	5,1	5,7	6,3	6,8	7,3	7,7	8,1	8,4	8,7	8,9	9,2	9,3	9,3	
1 200					4,4	5,1	5,7	6,3	6,9	7,4	7,9	8,3	8,6	9,0	9,2	9,6	9,8	9,8	9,8
1 300					4,5	5,1	5,8	6,4	6,9	7,5	8,0	8,4	8,8	9,2	9,5	10,0	10,2	10,4	10,4
1 400					4,5	5,1	5,8	6,4	7,0	7,5	8,1	8,5	9,0	9,3	9,7	10,2	10,6	10,8	10,9
1 500					4,5	5,1	5,8	6,4	7,0	7,6	8,1	8,6	9,1	9,5	9,9	10,5	10,9	11,2	11,3
1 600					4,5	5,1	5,8	6,4	7,0	7,6	8,2	8,7	9,2	9,6	10,0	10,7	11,2	11,5	11,7
1 800					4,5	5,1	5,8	6,5	7,1	7,7	8,2	8,8	9,3	9,7	10,2	10,9	11,6	12,0	12,3
2 000					4,5	5,1	5,8	6,5	7,1	7,7	8,3	8,8	9,4	9,8	10,3	11,1	11,8	12,4	12,8

Circular flat plate

Values of d, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$							4,1	4,5	4,9	5,3	5,6	6,0	6,3	6,7	7,3	7,9	8,5	8,9

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.15 — Thickness of semi-fixed plates for calculation specification T 12 (TG and p = 12 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450																			
500									4,0										
550							4,0	4,2	4,3	4,4									
600							4,1	4,4	4,5	4,6	4,7								
650							4,3	4,5	4,7	4,9	5,0	5,0							
700						4,0	4,3	4,7	4,9	5,1	5,2	5,3	5,4						
750	$t = t_{min}$ = 4 mm					4,0	4,4	4,8	5,1	5,3	5,4	5,6	5,6	5,7					
800	(see Table F.4)					4,0	4,5	4,9	5,2	5,4	5,6	5,8	5,9	5,9	6,0				
900						4,1	4,6	5,0	5,4	5,7	5,9	6,1	6,3	6,4	6,5	6,6			
1 000						4,1	4,6	5,1	5,5	5,8	6,1	6,4	6,6	6,8	6,9	7,1	7,1		
1 100						4,2	4,7	5,1	5,6	6,0	6,3	6,6	6,9	7,1	7,3	7,5	7,6	7,6	
1 200						4,2	4,7	5,2	5,6	6,0	6,4	6,8	7,1	7,3	7,5	7,8	8,0	8,0	8,0
1 300						4,2	4,7	5,2	5,7	6,1	6,5	6,9	7,2	7,5	7,7	8,1	8,4	8,5	8,5
1 400						4,2	4,7	5,2	5,7	6,2	6,6	7,0	7,3	7,6	7,9	8,4	8,7	8,8	8,9
1 500						4,2	4,7	5,2	5,7	6,2	6,6	7,0	7,4	7,7	8,0	8,6	8,9	9,1	9,2
1 600						4,2	4,7	5,3	5,7	6,2	6,7	7,1	7,5	7,8	8,2	8,7	9,1	9,4	9,6
1 800						4,2	4,7	5,3	5,8	6,3	6,7	7,2	7,6	8,0	8,3	8,9	9,4	9,8	10,1
2 000						4,2	4,8	5,3	5,8	6,3	6,8	7,2	7,6	8,0	8,4	9,1	9,7	10,1	10,4

Circular flat plate

Values of d, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$									4,0	4,3	4,6	4,9	5,2	5,5	6,0	6,5	6,9	7,3

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.16 — Thickness of semi-fixed plates for calculation specification T 9 (TG and p = 9 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350																			
400																			
450																			
500																			
550																			
600										4,0	4,1								
650									4,1	4,2	4,3	4,4							
700								4,0	4,3	4,4	4,5	4,6	4,6						
750				$t = t_{min}$ = 4 mm				4,1	4,4	4,6	4,7	4,8	4,9	4,9					
800				(see Table F.4)				4,2	4,5	4,7	4,9	5,0	5,1	5,1	5,2				
900							4,0	4,3	4,6	4,9	5,1	5,3	5,5	5,6	5,6	5,7			
1 000							4,0	4,4	4,7	5,1	5,3	5,6	5,7	5,9	6,0	6,1	6,1		
1 100							4,0	4,4	4,8	5,2	5,5	5,7	6,0	6,1	6,3	6,5	6,6	6,6	
1 200							4,1	4,5	4,9	5,2	5,6	5,9	6,1	6,3	6,5	6,8	6,9	7,0	6,9
1 300							4,1	4,5	4,9	5,3	5,6	6,0	6,2	6,5	6,7	7,0	7,2	7,3	7,3
1 400							4,1	4,5	4,9	5,3	5,7	6,0	6,3	6,6	6,9	7,2	7,5	7,6	7,7
1 500							4,1	4,5	5,0	5,4	5,7	6,1	6,4	6,7	7,0	7,4	7,7	7,9	8,0
1 600							4,1	4,6	5,0	5,4	5,8	6,1	6,5	6,8	7,1	7,5	7,9	8,1	8,3
1 800							4,1	4,6	5,0	5,4	5,8	6,2	6,6	6,9	7,2	7,7	8,2	8,5	8,7
2 000							4,1	4,6	5,0	5,4	5,9	6,2	6,6	7,0	7,3	7,9	8,4	8,8	9,0

Circular flat plate

Values of d, mm 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
$t = t_{min}$											4,0	4,2	4,5	4,7	5,2	5,6	6,0	6,3

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.17 — Thickness of semi-fixed plates for calculation specification T 6 (TG and p = 6 kPa)

Rectangular flat plate

a mm	Values of *b* (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450																			
500																			
550																			
600																			
650																			
700																			
750					$t = t_{min}$ = 4 mm								4,0	4,0					
800					(see Table F.4)						4,0	4,1	4,2	4,2	4,2				
900										4,0	4,2	4,3	4,5	4,5	4,6	4,6			
1 000										4,1	4,3	4,5	4,7	4,8	4,9	5,0	5,0		
1 100										4,2	4,5	4,7	4,9	5,0	5,1	5,3	5,4	5,3	
1 200									4,0	4,3	4,5	4,8	5,0	5,2	5,3	5,5	5,7	5,7	5,7
1 300									4,0	4,3	4,6	4,9	5,1	5,3	5,5	5,7	5,9	6,0	6,0
1 400									4,0	4,4	4,6	4,9	5,2	5,4	5,6	5,9	6,1	6,2	6,3
1 500									4,1	4,4	4,7	5,0	5,2	5,5	5,7	6,0	6,3	6,5	6,5
1 600									4,1	4,4	4,7	5,0	5,3	5,5	5,8	6,2	6,5	6,7	6,8
1 800									4,1	4,4	4,8	5,1	5,4	5,6	5,9	6,3	6,7	6,9	7,1
2 000									4,1	4,4	4,8	5,1	5,4	5,7	6,0	6,4	6,8	7,1	7,4

Circular flat plate

Values of *d*, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$															4,2	4,6	4,9	5,2

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.18 — Thickness of simply supported plates for calculation specification P 70 (PMMA and p =70 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
200																			
250			6,50	7,0															
300	$t = t_{min}$ =		7,1	7,9	8,4														
350	6 mm	6,1	7,6	8,6	9,3	9,7			Only permitted above a certain height above waterline										
400	to	6,2	7,9	9,1	10,0	10,6	11,0												
450	8 mm	6,3	8,1	9,5	10,6	11,4	11,9	12,3											
500	(see Table	6,4	8,2	9,8	11,1	12,0	12,7	13,2	13,5										
550	F.3)	6,4	8,4	10,1	11,4	12,5	13,3	14,0	14,4	14,7									
600		6,4	8,4	10,2	11,7	12,9	13,9	14,7	15,2	15,6	15,9								
650		6,4	8,5	10,4	11,9	13,3	14,4	15,2	15,9	16,4	16,8	17,1							
700		6,5	8,5	10,5	12,1	13,6	14,8	15,7	16,5	17,2	17,6	18,0	18,2						
750		6,5	8,6	10,5	12,3	13,8	15,1	16,2	17,1	17,8	18,4	18,8	19,1	19,3					
800		6,5	8,6	10,6	12,4	14,0	15,4	16,5	17,5	18,4	19,0	19,5	19,9	20,2	20,4				
900		6,5	8,6	10,7	12,6	14,3	15,8	17,1	18,3	19,3	20,1	20,8	21,4	21,8	22,1	22,5			
1 000		6,5	8,6	10,7	12,7	14,5	16,1	17,6	18,9	20,0	21,0	21,8	22,5	23,1	23,6	24,2	24,4		
1 100		6,5	8,6	10,8	12,7	14,6	16,3	17,9	19,3	20,6	21,7	22,6	23,5	24,2	24,8	25,6	26,1	26,3	
1 200		6,5	8,6	10,8	12,8	14,7	16,5	18,1	19,6	21,0	22,2	23,3	24,3	25,1	25,8	26,9	27,5	27,9	27,9
1 300		6,5	8,6	10,8	12,8	14,7	16,6	18,3	19,9	21,3	22,7	23,9	24,9	25,8	26,7	27,9	28,8	29,3	29,5
1 400		6,5	8,6	10,8	12,8	14,8	16,7	18,4	20,1	21,6	23,0	24,3	25,4	26,5	27,4	28,9	29,9	30,6	31,0
1 500		6,5	8,6	10,8	12,8	14,8	16,7	18,5	20,2	21,8	23,3	24,6	25,9	27,0	28,0	29,6	30,9	31,7	32,2
1 600		6,5	8,6	10,8	12,8	14,8	16,8	18,6	20,3	22,0	23,5	24,9	26,2	27,4	28,5	30,3	31,7	32,7	33,4
1 800		6,5	8,6	10,8	12,8	14,9	16,8	18,7	20,5	22,2	23,8	25,3	26,8	28,1	29,3	31,4	33,1	34,4	35,3
2 000		6,5	8,6	10,8	12,8	14,9	16,8	18,7	20,6	22,3	24,0	25,6	27,1	28,5	29,8	32,2	34,1	35,7	36,8

Circular flat plate

Values of d, mm 120	150	200	250	300	320	350	370	400	450	500	550	600	620	700	720	800	900	1 000
$t = t_{min}$			7,1	8,5	8,9	9,7	10,2	10,9	12,2	13,4	14,6	15,8	16,1	18,0	18,1	19,7	21,7	23,5

NOTE 1 Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

NOTE 2 See 6.3.1 for appliances fitted in Area I.

Table F.19 — Thickness of simply supported plates for calculation specification P 28 (PMMA and p = 28 kPa)

a	Rectangular flat plate																		
	Values of b (lesser dimension), mm																		
mm	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350				6,0	6,5	6,7													
400				6,3	7,0	7,4	7,6												
450				6,6	7,3	7,9	8,3	8,5											
500				6,8	7,7	8,3	8,8	9,2	9,4										
550				7,0	7,9	8,7	9,3	9,7	10,0	10,2									
600				7,1	8,1	9,0	9,6	10,2	10,6	10,9	11,1								
650				7,2	8,3	9,2	10,0	10,6	11,1	11,4	11,7	11,9							
700				7,2	8,4	9,4	10,2	10,9	11,5	11,9	12,3	12,5	12,7						
750	$t = t_{min}$ = 6 mm			7,3	8,5	9,5	10,5	11,2	11,8	12,4	12,8	13,1	13,3	13,4					
800	(see Table F.3)			7,3	8,6	9,7	10,6	11,5	12,2	12,7	13,2	13,6	13,9	14,1	14,2				
900			6,0	7,4	8,7	9,9	10,9	11,9	12,7	13,4	14,0	14,4	14,8	15,1	15,4	15,6			
1 000			6,0	7,4	8,8	10,0	11,1	12,2	13,1	13,9	14,6	15,1	15,6	16,0	16,4	16,8	17,0		
1 100			6,0	7,4	8,8	10,1	11,3	12,4	13,4	14,3	15,0	15,7	16,3	16,8	17,2	17,8	18,2	18,3	
1 200			6,0	7,5	8,8	10,2	11,4	12,5	13,6	14,6	15,4	16,2	16,8	17,4	17,9	18,7	19,2	19,4	19,5
1 300			6,0	7,5	8,9	10,2	11,5	12,7	13,8	14,8	15,7	16,5	17,3	17,9	18,5	19,4	20,0	20,4	20,6
1 400			6,0	7,5	8,9	10,2	11,5	12,8	13,9	15,0	15,9	16,8	17,6	18,4	19,0	20,0	20,8	21,3	21,6
1 500			6,0	7,5	8,9	10,3	11,6	12,8	14,0	15,1	16,1	17,1	17,9	18,7	19,4	20,6	21,5	22,1	22,4
1 600			6,0	7,5	8,9	10,3	11,6	12,9	14,1	15,2	16,3	17,3	18,2	19,0	19,8	21,0	22,0	22,7	23,2
1 800			6,0	7,5	8,9	10,3	11,6	12,9	14,2	15,4	16,5	17,6	18,6	19,5	20,3	21,8	23,0	23,9	24,5
2 000			6,0	7,5	8,9	10,3	11,7	13,0	14,3	15,5	16,7	17,8	18,8	19,8	20,7	22,3	23,7	24,8	25,6
	Circular flat plate																		
	Values of d, mm																		
	120	**150**	**200**	**250**	**300**	**320**	**350**	**370**	**400**	**450**	**500**	**550**	**600**	**620**	**700**	**720**	**800**	**900**	**1 000**
	$t = t_{min}$					6,2	6,7	7,1	7,6	8,4	9,3	10,1	10,9	11,2	12,5	12,6	13,7	15,1	16,3

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.20 — Thickness of simply supported plates for calculation specification P 18 (PMMA and p = 18 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350				5,0	5,4	5,7													
400				5,3	5,8	6,2	6,4												
450				5,5	6,2	6,6	7,0	7,2											
500				5,7	6,4	7,0	7,4	7,7	7,9										
550				5,8	6,6	7,3	7,8	8,2	8,4	8,6									
600	$t = t_{min}$ = 5 mm			5,9	6,8	7,5	8,1	8,5	8,9	9,1	9,3								
650	(see Table F.3)			6,0	6,9	7,7	8,4	8,9	9,3	9,6	9,8	10,0							
700			5,0	6,1	7,0	7,9	8,6	9,2	9,6	10,0	10,3	10,5	10,7						
750			5,0	6,1	7,1	8,0	8,8	9,4	9,9	10,4	10,7	11,0	11,2	11,3					
800			5,0	6,2	7,2	8,1	8,9	9,6	10,2	10,7	11,1	11,4	11,6	11,8	11,9				
900			5,0	6,2	7,3	8,3	9,2	10,0	10,7	11,2	11,7	12,1	12,5	12,7	12,9	13,2			
1 000			5,0	6,2	7,4	8,4	9,4	10,2	11,0	11,7	12,2	12,7	13,1	13,5	13,8	14,1	14,3		
1 100			5,0	6,2	7,4	8,5	9,5	10,4	11,2	12,0	12,6	13,2	13,7	14,1	14,5	15,0	15,3	15,4	
1 200			5,0	6,3	7,4	8,6	9,6	10,5	11,4	12,2	12,9	13,6	14,1	14,6	15,1	15,7	16,1	16,3	16,4
1 300			5,0	6,3	7,4	8,6	9,6	10,6	11,6	12,4	13,2	13,9	14,5	15,1	15,5	16,3	16,8	17,2	17,3
1 400			5,0	6,3	7,4	8,6	9,7	10,7	11,7	12,6	13,4	14,1	14,8	15,4	16,0	16,8	17,5	17,9	18,1
1 500			5,0	6,3	7,5	8,6	9,7	10,8	11,8	12,7	13,6	14,3	15,1	15,7	16,3	17,3	18,0	18,6	18,9
1 600			5,0	6,3	7,5	8,6	9,7	10,8	11,8	12,8	13,7	14,5	15,3	16,0	16,6	17,7	18,5	19,1	19,5
1 800			5,0	6,3	7,5	8,6	9,8	10,9	11,9	12,9	13,9	14,8	15,6	16,4	17,1	18,3	19,3	20,1	20,6
2 000			5,0	6,3	7,5	8,6	9,8	10,9	12,0	13,0	14,0	14,9	15,8	16,6	17,4	18,8	19,9	20,8	21,5

Circular flat plate

Values of d, mm																		
100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
$t = t_{min}$						6,5	7,2	7,9	8,7	9,4	10,0	10,7	11,4	12,0	13,2	14,4	15,5	16,5

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.21 — Thickness of simply supported plates for calculation specification P 12 (PMMA and p = 12 kPa)

a mm	Rectangular flat plate — Values of *b* (lesser dimension), mm: 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350																			
400							5,5												
450						5,7	5,9	6,1											
500					5,5	6,0	6,3	6,6	6,7										
550				5,0	5,7	6,2	6,6	7,0	7,2	7,3									
600				5,1	5,8	6,4	6,9	7,3	7,6	7,8	7,9								
650				5,1	5,9	6,6	7,1	7,6	7,9	8,2	8,4	8,5							
700				5,2	6,0	6,7	7,3	7,8	8,2	8,5	8,8	9,0	9,1						
750	$t = t_{min}$ = 5 mm			5,2	6,1	6,8	7,5	8,0	8,5	8,9	9,1	9,4	9,5	9,7					
800	(see Table F.3)			5,2	6,1	6,9	7,6	8,2	8,7	9,1	9,5	9,7	9,9	10,1	10,2				
900				5,3	6,2	7,1	7,8	8,5	9,1	9,6	10,0	10,4	10,6	10,9	11,0	11,2			
1 000				5,3	6,3	7,2	8,0	8,7	9,4	9,9	10,4	10,9	11,2	11,5	11,7	12,1	12,2		
1 100				5,3	6,3	7,2	8,1	8,9	9,6	10,2	10,8	11,3	11,7	12,0	12,3	12,8	13,0	13,1	
1 200				5,3	6,3	7,3	8,2	9,0	9,7	10,4	11,0	11,6	12,1	12,5	12,8	13,4	13,8	13,9	14,0
1 300				5,3	6,3	7,3	8,2	9,1	9,9	10,6	11,3	11,9	12,4	12,9	13,3	13,9	14,4	14,7	14,8
1 400				5,3	6,3	7,3	8,3	9,1	10,0	10,7	11,4	12,1	12,6	13,2	13,6	14,4	14,9	15,3	15,5
1 500				5,3	6,4	7,3	8,3	9,2	10,0	10,8	11,6	12,2	12,9	13,4	13,9	14,8	15,4	15,8	16,1
1 600				5,3	6,4	7,3	8,3	9,2	10,1	10,9	11,7	12,4	13,0	13,6	14,2	15,1	15,8	16,3	16,7
1 800				5,3	6,4	7,4	8,3	9,3	10,2	11,0	11,8	12,6	13,3	13,9	14,6	15,6	16,5	17,1	17,6
2 000				5,3	6,4	7,4	8,3	9,3	10,2	11,1	11,9	12,7	13,5	14,2	14,8	16,0	17,0	17,8	18,4
	Circular flat plate — Values of *d*, mm: 100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
	$t = t_{min}$						5,5	6,2	6,8	7,4	8,0	8,6	9,1	9,7	10,3	11,3	12,3	13,2	14,1

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.22 — Thickness of simply supported plates for calculation specification P 9 (PMMA and p = 9 kPa)

a mm	Rectangular flat plate — Values of b (lesser dimension), mm: 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350																			
400																			
450						5,1	5,3	5,5											
500						5,3	5,6	5,9	6,0										
550					5,1	5,6	5,9	6,2	6,4	6,6									
600					5,2	5,7	6,2	6,5	6,8	7,0	7,1								
650	$t = t_{min}$ = 5 mm				5,3	5,9	6,4	6,8	7,1	7,3	7,5	7,6							
700	(see Table F.3)				5,4	6,0	6,5	7,0	7,4	7,6	7,9	8,0	8,1						
750					5,4	6,1	6,7	7,2	7,6	7,9	8,2	8,4	8,5	8,6					
800					5,5	6,2	6,8	7,3	7,8	8,2	8,5	8,7	8,9	9,0	9,1				
900					5,6	6,3	7,0	7,6	8,1	8,6	8,9	9,3	9,5	9,7	9,9	10,1			
1 000					5,6	6,4	7,1	7,8	8,4	8,9	9,3	9,7	10,0	10,3	10,5	10,8	10,9		
1 100					5,6	6,5	7,2	7,9	8,6	9,1	9,6	10,1	10,4	10,8	11,0	11,4	11,7	11,8	
1 200					5,7	6,5	7,3	8,0	8,7	9,3	9,9	10,4	10,8	11,2	11,5	12,0	12,3	12,5	12,5
1 300					5,7	6,5	7,3	8,1	8,8	9,5	10,1	10,6	11,1	11,5	11,9	12,5	12,9	13,1	13,2
1 400					5,7	6,5	7,4	8,2	8,9	9,6	10,2	10,8	11,3	11,8	12,2	12,9	13,3	13,7	13,9
1 500					5,7	6,6	7,4	8,2	9,0	9,7	10,3	10,9	11,5	12,0	12,4	13,2	13,8	14,2	14,4
1 600					5,7	6,6	7,4	8,2	9,0	9,7	10,4	11,1	11,6	12,2	12,7	13,5	14,1	14,6	14,9
1 800					5,7	6,6	7,4	8,3	9,1	9,8	10,6	11,2	11,9	12,5	13,0	14,0	14,7	15,3	15,8
2 000					5,7	6,6	7,5	8,3	9,1	9,9	10,7	11,4	12,0	12,7	13,3	14,3	15,2	15,9	16,4

Circular flat plate — Values of d, mm: 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
$t = t_{min}$							5,5	6,1	6,6	7,1	7,7	8,2	8,7	9,2	10,1	11,0	11,8	12,6

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.23 — Thickness of simply supported plates for calculation specification P 6 (PMMA and p = 6 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350																			
400																			
450																			
500								5,0	5,2										
550							5,1	5,3	5,5	5,6									
600							5,3	5,6	5,8	6,0	6,1								
650						5,0	5,4	5,8	6,1	6,3	6,4	6,5							
700						5,1	5,6	6,0	6,3	6,5	6,7	6,9	7,0						
750			$t = t_{min}$ = 5 mm			5,2	5,7	6,1	6,5	6,8	7,0	7,2	7,3	7,4					
800			(see Table F.3)			5,3	5,8	6,2	6,7	7,0	7,2	7,4	7,6	7,7	7,8				
900						5,4	6,0	6,3	6,9	7,3	7,6	7,9	8,1	8,3	8,4	8,6			
1 000						5,5	6,1	6,5	7,1	7,6	8,0	8,3	8,6	8,8	9,0	9,2	9,4		
1 100						5,5	6,2	6,6	7,3	7,8	8,2	8,6	8,9	9,2	9,4	9,8	10,0	10,1	
1 200						5,5	6,2	6,8	7,4	8,0	8,4	8,9	9,2	9,5	9,8	10,2	10,5	10,7	10,7
1 300						5,6	6,3	6,9	7,5	8,1	8,6	9,1	9,5	9,8	10,1	10,6	11,0	11,2	11,3
1 400						5,6	6,3	7,0	7,6	8,2	8,7	9,2	9,7	10,1	10,4	11,0	11,4	11,7	11,9
1 500						5,6	6,3	7,0	7,7	8,3	8,8	9,3	9,8	10,2	10,6	11,3	11,8	12,1	12,3
1 600						5,6	6,3	7,0	7,7	8,3	8,9	9,4	9,9	10,4	10,8	11,5	12,1	12,5	12,8
1 800						5,6	6,4	7,1	7,8	8,4	9,0	9,6	10,1	10,7	11,1	11,9	12,6	13,1	13,5
2 000						5,6	6,4	7,1	7,8	8,5	9,1	9,7	10,3	10,8	11,3	12,2	13,0	13,6	14,1

Circular flat plate

Values of d, mm	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
$t = t_{min}$									5,2	5,6	6,1	6,6	7,0	7,4	7,8	8,6	9,4	10,1	10,8

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.24 — Thickness of simply supported plates for calculation specification T 70 (TG and p = 70 kPa)

Rectangular flat plate

a mm	Values of *b* (lesser dimension), mm: 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250	$t = t_{min}$ 5 mm to 7 mm (see Table F.4)			5,0															
300			5,2	5,7	6,0														
350			5,6	6,3	6,7	6,9				Only permitted above a certain height above waterline									
400			5,8	6,7	7,3	7,6	7,8												
450			6,0	7,1	7,8	8,2	8,5	8,7											
500			6,2	7,3	8,1	8,7	9,1	9,4	9,5										
550			6,3	7,5	8,4	9,2	9,7	10,0	10,3	10,4									
600			6,3	7,6	8,7	9,5	10,1	10,0	10,9	11,1	11,2								
650			6,4	7,8	8,9	9,8	10,5	10,6	11,5	11,7	11,9	12,0							
700			6,4	7,8	9,0	10,0	10,8	11,1	12,0	12,3	12,5	12,7	12,7						
750			6,4	7,9	9,2	10,2	11,1	11,8	12,4	12,3	13,1	13,3	13,4	13,5					
800			6,4	8,0	9,3	10,4	11,3	12,1	12,8	12,8	13,7	13,9	14,1	14,2	14,2				
900			6,5	8,0	9,4	10,6	11,7	12,6	13,4	13,3	14,5	14,9	15,2	15,4	15,5	15,6			
1 000			6,5	8,1	9,5	10,8	12,0	13,0	13,9	14,0	15,3	15,8	16,2	16,5	16,7	16,9	16,8		
1 100			6,5	8,1	9,5	10,9	12,1	13,3	14,2	14,6	15,8	16,4	16,9	17,3	17,6	18,0	18,1	18,0	
1 200			6,5	8,1	9,6	11,0	12,3	13,4	14,5	15,1	16,3	17,0	17,6	18,1	18,5	19,0	19,2	19,2	19,0
1 300			6,5	8,1	9,6	11,0	12,4	13,6	14,7	15,5	16,6	17,4	18,1	18,7	19,2	19,9	20,2	20,3	20,2
1 400			6,5	8,1	9,6	11,1	12,4	13,7	14,9	15,7	16,9	17,8	18,5	19,2	19,8	20,6	21,1	21,3	21,3
1 500			6,5	8,1	9,6	11,1	12,5	13,8	15,0	16,0	17,2	18,1	18,9	19,6	20,3	21,2	21,9	22,2	22,3
1 600			6,5	8,1	9,6	11,1	12,5	13,9	15,1	16,1	17,3	18,3	19,2	20,0	20,7	21,8	22,6	23,0	23,2
1 800			6,5	8,1	9,6	11,1	12,6	13,9	15,2	16,3	17,6	18,7	19,6	10,5	21,3	22,7	23,7	24,3	24,7
2 000			6,5	8,1	9,6	11,1	12,6	14,0	15,3	16,6	17,8	18,9	19,9	20,9	21,8	23,3	24,5	25,4	25,9

Circular flat plate

Values of *d*, mm: 120	150	200	250	300	320	350	370	400	450	500	550	600	620	700	720	800	900	1 000
$t = t_{min}$			5,2	6,2	6,5	7,1	7,4	7,9	8,8	9,7	10,5	11,3	11,5	12,9	12,9	13,9	15,2	16,4

NOTE 1 Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

NOTE 2 See 6.1.1.1 for the use of SS plates in Area I and 6.3.1 for appliances fitted in Area I.

Table F.25 — Thickness of simply supported plates for calculation specification T 28 (TG and p = 28 kPa)

Rectangular flat plate

a mm	Values of *b* (lesser dimension), mm: 100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
250																			
300																			
350				4,0	4,2	4,4													
400				4,3	4,6	4,8	4,9												
450				4,5	4,9	5,2	5,4	5,5											
500				4,6	5,2	5,5	5,8	5,9	6,0										
550			4,0	4,7	5,3	5,8	6,1	6,3	6,5	6,6									
600			4,0	4,8	5,5	6,0	6,4	6,7	6,9	7,0	7,1								
650			4,0	4,9	5,6	6,2	6,7	7,0	7,3	7,4	7,5	7,6							
700			4,1	5,0	5,7	6,3	6,9	7,3	7,6	7,8	7,9	8,0	8,1						
750	$t = t_{min}$ = 4 mm (see Table F.4)		4,1	5,0	5,8	6,5	7,0	7,5	7,8	8,1	8,3	8,4	8,5	8,5					
800			4,1	5,0	5,9	6,6	7,2	7,7	8,1	8,4	8,6	8,8	8,9	9,0	9,0				
900			4,1	5,1	6,0	6,7	7,4	8,0	8,5	8,9	9,2	9,4	9,6	9,7	9,8	9,8			
1 000			4,1	5,1	6,1	6,8	7,6	8,2	8,8	9,3	9,7	10,0	10,2	10,4	10,5	10,7	10,6		
1 100			4,1	5,1	6,1	6,9	7,7	8,4	9,0	9,5	10,0	10,4	10,7	11,0	11,2	11,4	11,4	11,4	
1 200			4,1	5,1	6,1	6,9	7,8	8,5	9,2	9,8	10,3	10,7	11,1	11,4	11,7	12,0	12,2	12,1	12,0
1 300			4,1	5,1	6,1	7,0	7,8	8,6	9,3	10,0	10,5	11,0	11,5	11,8	12,1	12,6	12,8	12,9	12,8
1 400			4,1	5,1	6,1	7,0	7,9	8,7	9,4	10,1	10,7	11,3	11,7	12,1	12,5	13,0	13,4	13,5	13,5
1 500			4,1	5,1	6,1	7,0	7,9	8,7	9,5	10,2	10,9	11,4	12,0	12,4	12,8	13,4	13,8	14,1	14,1
1 600			4,1	5,1	6,1	7,0	7,9	8,8	9,6	10,3	11,0	11,6	12,1	12,6	13,1	13,8	14,3	14,6	14,7
1 800			4,1	5,1	6,1	7,0	7,9	8,8	9,6	10,4	11,1	11,8	12,4	13,0	13,5	14,3	15,0	15,4	15,6
2 000			4,1	5,1	6,1	7,0	8,0	8,8	9,7	10,5	11,2	12,0	12,6	13,2	13,8	14,7	15,5	16,0	16,4

Circular flat plate

Values of *d*, mm: 120	150	200	250	300	320	350	370	400	450	500	550	600	620	700	720	800	900	1 000
$t = t_{min}$					4,1	4,5	4,7	5,0	5,6	6,1	6,6	7,2	7,3	8,1	8,2	8,8	9,6	10,4

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.26 — Thickness of simply supported plates for calculation specification T 18 (TG and p = 18 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400						3,9	3,9												
450					3,9	4,2	4,3	4,4											
500					4,1	4,4	4,6	4,8	4,8										
550				3,8	4,3	4,6	4,9	5,1	5,2	5,3									
600				3,9	4,4	4,8	5,1	5,4	5,5	5,6	5,7								
650				3,9	4,5	5,0	5,3	5,6	5,8	5,9	6,0	6,1							
700				4,0	4,6	5,1	5,5	5,8	6,1	6,2	6,4	6,4	6,5						
750		$t = t_{min}$ = 4 mm		4,0	4,6	5,2	5,6	6,0	6,3	6,5	6,7	6,8	6,8	6,8					
800		(see Table F.4)		4,0	4,7	5,3	5,8	6,2	6,5	6,7	6,9	7,1	7,1	7,2	7,2				
900				4,1	4,8	5,4	5,9	6,4	6,8	7,1	7,4	7,6	7,7	7,8	7,9	7,9			
1 000				4,1	4,8	5,5	6,1	6,6	7,0	7,4	7,7	8,0	8,2	8,3	8,5	8,6	8,5		
1 100				4,1	4,8	5,5	6,2	6,7	7,2	7,7	8,0	8,3	8,6	8,8	8,9	9,1	9,2	9,1	
1 200				4,1	4,9	5,6	6,2	6,8	7,4	7,8	8,3	8,6	8,9	9,2	9,4	9,6	9,8	9,7	9,6
1 300				4,1	4,9	5,6	6,3	6,9	7,5	8,0	8,4	8,8	9,2	9,5	9,7	10,1	10,3	10,3	10,2
1 400				4,1	4,9	5,6	6,3	7,0	7,5	8,1	8,6	9,0	9,4	9,7	10,0	10,4	10,7	10,8	10,8
1 500				4,1	4,9	5,6	6,3	7,0	7,6	8,2	8,7	9,2	9,6	10,0	10,3	10,8	11,1	11,3	11,3
1 600				4,1	4,9	5,6	6,3	7,0	7,7	8,2	8,8	9,3	9,7	10,1	10,5	11,0	11,4	11,7	11,8
1 800				4,1	4,9	5,6	6,4	7,1	7,7	8,3	8,9	9,5	10,0	10,4	10,8	11,5	12,0	12,3	12,5
2 000				4,1	4,9	5,6	6,4	7,1	7,8	8,4	9,0	9,6	10,1	10,6	11,0	11,8	12,4	12,9	13,1

Circular flat plate

Values of d, mm																		
100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
$t = t_{min}$						4,1	4,6	5,0	5,4	5,9	6,3	6,7	7,1	7,5	8,2	8,8	9,4	10,0

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.27 — Thickness of simply supported plates for calculation specification T 12 (TG and p = 12 kPa)

	Rectangular flat plate																		
a	Values of b (lesser dimension), mm																		
mm	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450																			
500																			
550							4,0	4,2	4,2										
600							4,2	4,4	4,5	4,6									
650						4,1	4,4	4,6	4,7	4,9	5,0								
700						4,2	4,5	4,8	5,0	5,1	5,2	5,3							
750	$t = t_{min}$ = 4 mm					4,2	4,6	4,9	5,1	5,3	5,5	5,6	5,6						
800	(see Table F.4)					4,3	4,7	5,0	5,3	5,5	5,8	5,8	5,9	5,9					
900						4,4	4,8	5,2	5,6	5,8	6,2	6,3	6,4	6,4	6,4				
1 000						4,5	5,0	5,4	5,7	6,1	6,5	6,7	6,8	6,9	7,0	7,0			
1 100					4,0	4,5	5,0	5,5	5,9	6,3	6,8	7,0	7,2	7,3	7,5	7,5	7,4		
1 200					4,0	4,5	5,1	5,6	6,0	6,4	7,0	7,3	7,5	7,7	7,9	8,0	8,0	7,9	
1 300					4,0	4,6	5,1	5,6	6,1	6,5	7,2	7,5	7,7	7,9	8,2	8,4	8,4	8,4	
1 400					4,0	4,6	5,1	5,7	6,2	6,6	7,4	7,7	8,0	8,2	8,5	8,7	8,8	8,8	
1 500					4,0	4,6	5,2	5,7	6,2	6,7	7,5	7,8	8,1	8,4	8,8	9,1	9,2	9,2	
1 600					4,0	4,6	5,2	5,7	6,3	6,7	7,6	7,9	8,3	8,6	9,0	9,3	9,5	9,6	
1 800					4,0	4,6	5,2	5,8	6,3	6,8	7,7	8,1	8,5	8,8	9,4	9,8	10,1	10,2	
2 000					4,0	4,6	5,2	5,8	6,3	6,9	7,8	8,3	8,7	9,0	9,6	10,1	10,5	10,7	

	Circular flat plate																		
	Values of d, mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
	$t = t_{min}$								4,1	4,4	4,8	5,1	5,5	5,8	6,1	6,7	7,2	7,7	8,2

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.28 — Thickness of simply supported plates for calculation specification T 9 (TG and p = 9 kPa)

a mm	Rectangular flat plate — Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450																			
500																			
550																			
600											4,0	4,0							
650								4,0	4,0	4,1	4,2	4,3	4,3						
700								4,1	4,1	4,3	4,4	4,5	4,5	4,6					
750		$t = t_{min}$ = 4 mm (see Table F.4)					4,0	4,2	4,2	4,4	4,6	4,7	4,8	4,8	4,8				
800							4,1	4,3	4,4	4,6	4,8	4,9	5,0	5,1	5,1	5,1			
900							4,2	4,4	4,5	4,8	5,0	5,2	5,4	5,5	5,5	5,6	5,6		
1 000							4,3	4,4	4,7	5,0	5,2	5,5	5,7	5,8	5,9	6,0	6,0		
1 100							4,4	4,4	4,8	5,1	5,4	5,7	5,9	6,1	6,2	6,3	6,5	6,4	
1 200							4,4	4,5	4,8	5,2	5,5	5,8	6,1	6,3	6,5	6,6	6,8	6,9	6,8
1 300						4,0	4,4	4,5	4,9	5,3	5,6	6,0	6,3	6,5	6,7	6,9	7,1	7,3	7,2
1 400						4,0	4,5	4,5	4,9	5,3	5,7	6,1	6,4	6,7	6,9	7,1	7,4	7,6	7,6
1 500						4,0	4,5	4,5	4,9	5,4	5,8	6,2	6,5	6,8	7,0	7,3	7,6	8,0	8,0
1 600						4,0	4,5	4,5	5,0	5,4	5,8	6,2	6,6	6,9	7,2	7,4	7,8	8,3	8,3
1 800						4,0	4,5	4,5	5,0	5,5	5,9	6,3	6,7	7,0	7,4	7,6	8,1	8,7	8,9
2 000						4,0	4,5	4,5	5,0	5,5	5,9	6,4	6,8	7,2	7,5	7,8	8,4	9,1	9,3
	Circular flat plate — Values of d, mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
	$t = t_{min}$										4,2	4,4	4,7	5,0	5,3	5,8	6,2	6,7	7,1

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Table F.29 — Thickness of simply supported plates for calculation specification T 6 (TG and p = 6 kPa)

Rectangular flat plate

a mm	Values of b (lesser dimension), mm																		
	100	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**750**	**800**	**900**	**1 000**	**1 100**	**1 200**
250																			
300																			
350																			
400																			
450																			
500																			
550																			
600																			
650																			
700																			
750	$t = t_{min}$ = 4 mm																		
800	(see Table F.4)										4,0	4,1	4,1	4,1	4,2				
900										4,1	4,3	4,4	4,5	4,5	4,5	4,6			
1 000									4,1	4,3	4,5	4,6	4,7	4,8	4,9	4,9	4,9		
1 100									4,2	4,4	4,6	4,8	5,0	5,1	5,2	5,3	5,3	5,3	
1 200									4,2	4,5	4,8	5,0	5,1	5,3	5,4	5,6	5,6	5,6	5,6
1 300								4,0	4,3	4,6	4,9	5,1	5,3	5,5	5,6	5,8	5,9	6,0	5,9
1 400								4,0	4,4	4,7	5,0	5,2	5,4	5,6	5,8	6,0	6,2	6,2	6,2
1 500								4,0	4,4	4,7	5,0	5,3	5,5	5,7	5,9	6,2	6,4	6,5	6,5
1 600								4,1	4,4	4,8	5,1	5,4	5,6	5,9	6,1	6,4	6,6	6,7	6,8
1 800								4,1	4,5	4,8	5,2	5,5	5,8	6,0	6,2	6,6	6,9	7,1	7,2
2 000								4,1	4,5	4,9	5,2	5,5	5,8	6,1	6,4	6,8	7,2	7,4	7,6

Circular flat plate

Values of d, mm																		
100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000	1 100	1 200
$t = t_{min}$													4,1	4,3	4,7	5,1	5,4	5,8

NOTE Round to the nearest millimetre; for example 5,4 is rounded to 5 and 5,6 to 6.

Annex G
(informative)

Background information

G.1 Hypothesis of calculation

The formulae giving stress and centre deflection are the ones for flat plates that are generally accepted, and correspond, among others, to the works and publications of S. Timoshenko and al. [4].

According to the theory of strength of materials, a simply supported plate can swivel at its supports (no flexural moment at the end of the plate), whereas a fixed-ends plate (clamped) has the deflection slope equal to zero at its supports. As it is very difficult to obtain this nil slope at the periphery of a panel held by a simple bearing surface, the plates will be considered as semi-fixed, i.e. the clamping moment value is midway between zero and the “fixed-ends” value.

The coefficients k_r and k_f for a semi-fixed plate are taken as the mean value between the ones for fixed and simply supported plates. It should be noted however, that the deflection of the plates studied in this International Standard is often greater than the one corresponding to the limit of validity of Timoshenko's normal range of application, which is equal to the thickness of the plate, whereas the 2 % of b value considered is usually much greater.

From Timoshenko, beyond a deflection equal to the thickness, the plate begins to behave both like a plate and a membrane. Regarding the plate as fully working as a membrane would lead to overly complicated calculations and thicknesses too small s that are. Some membrane effect is however considered in t_f defined in 7.1.2, which is not only calculated from the deflection criterion using the coefficient k_f but, after some practical assessments, taken a little lower than midway between the thickness values calculated from theoretical stress and theoretical deflection respectively.

The mechanical properties of the materials given in Table F.1 are average values and not minimum values. In this International Standard dealing with different materials, it could be unrealistic in some cases to use minimal values.

The pressures and the corresponding factor of safety are coherent with the IOR/ABS rules [6]; these pressure values are higher than the actual pressure which explains the moderate safety factor values. The variation of safety factor with materials takes into account the ductility or brittleness of each material. The impact value energy of 300 J specified in annex E corresponds to the one developed during the fall of the spinnaker pole of a 24 m sloop.

G.2 Formulae for k_r and k_f for flat rectangular plates

The values of thickness given in the Tables F.6 to F.29 have been calculated using the values of k_r and k_f given in the formulae below. These formulae are only valid for values of a/b less than and equal to 5. For values of a/b greater than 5, k_r and k_f are equal to the values of k_r and k_f respectively, for a/b equal to 5.

a) for semi-fixed (SF) plates:

$$k_r = \frac{0{,}621\,65\left(\frac{a}{b}\right)^2 - 0{,}647\,3\left(\frac{a}{b}\right) + 0{,}264\,81}{\left(\frac{a}{b}\right)^2 - 1{,}173\left(\frac{a}{b}\right) + 0{,}976\,71} \qquad k_f = \frac{0{,}080\,52\left(\frac{a}{b}\right)^2 - 0{,}027\,2\left(\frac{a}{b}\right) + 0{,}001\,9}{\left(\frac{a}{b}\right)^2 - 0{,}927\,5\left(\frac{a}{b}\right) + 1{,}700\,18} \qquad \text{(G.1)}$$

b) for simply supported (SS) plates

$$k_r = \frac{0{,}699\,52\left(\frac{a}{b}\right)^2 + 0{,}026\,62\left(\frac{a}{b}\right) - 0{,}073\,5}{\left(\frac{a}{b}\right)^2 - 0{,}718\,5\left(\frac{a}{b}\right) + 1{,}989\,25} \quad k_f = \frac{0{,}129\,15\left(\frac{a}{b}\right)^2 + 0{,}008\,68\left(\frac{a}{b}\right) - 0{,}029\,3}{\left(\frac{a}{b}\right)^2 - 0{,}887\left(\frac{a}{b}\right) + 2{,}337\,2} \qquad \text{(G.2)}$$

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