Tasneef

هيئة الإمارات للتصنيف
Emirates Classification Society

Amendments to the "Rules for the Classification of Yachts Designed for Commercial Use"

RFS/008/AMN/02

Effective from 1/7/2021

Reasons of the amendments:

Part A – Classification and Surveys

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 2, [3.2.4] (deleted)	to allow the assignment of the mark ● HULL also to yachts in service for less than 6 years
Ch 1, Sec 2, [4.1.4] (new)	to add an example of classification notation that may be assigned to a passenger yacht
Ch 1, Sec 2, [6.1.3] (new)	to give the possibility to assign a yacht also with additional class notations taken from the Tasneef Rules for Classification of Ships
Ch 3, Sec 1, [1.10.1]	to clarify the requirements for Yacht Construction File

Part B – Hull and Stability

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 1, [5.6.5] Tab 2	to correct test load values that resulted to be too conservative
Ch 1, Sec 1, [5.12]	to include the technical considerations done during the development of ISO 11336-5
Ch 1, Sec 3, [2.1.2]	to delete, for EN more than 110, the possibility to reduce the mass of the two requested anchors, as this solution has never been applied
Ch 1, Sec 5, [5.5.1]	to improve clarity of design heads for decks
Ch 1, Sec 6, [6.1.1]	to align rudder stock bearings requirements to those in IACS UR S10 (Rev 6, 2019)
Ch 1, App 2, [2.3.1]	to clarify the deck design pressure for hatch testing
Ch 2, Sec 7, [1.1.2] Ch 3, Sec 7, [1.1.2] Ch 4, Sec 7, [1.1.2]	to add the current approach on damage stability of the REG Flags in case of vessel with no or unusual double bottom

Part C – Machinery, Electrical Installations, Automation and Fire Protection

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 6, [2.1.4], [2.5.1] d), Tab 3	to improve clarity on coupling bolts through an editorial correction and add one corrosion-resistant material for shafts
Ch 1, Sec 9, [13]	to include requirements on use on reductants in SCR systems in line with IACS UR M77 (Rev 1, Aug 2019)
Ch 1, App 1, [3.6.2]	to clarify shut-off valves fitting when plastic pipes pass through watertight bulkheads or decks
Ch 4, Sec 3, [4.1.2]	to clarify that materials other than steel, if duly insulated, may be acceptable for ventilation systems

www.tasneefmaritime.ae
+971 2 6922333 +971 2 4454333 info@tasneef.ae 111155, Abu Dhabi, UAE

SECTION 2 CLASSIFICATION NOTATIONS

1 General

1.1 Purpose of the classification notations

1.1.1 The classification notations give the scope according to which the class of the yacht has been based and refer to the specific Rule requirements which are to be complied with for their assignment. The classification notations are assigned according to the criteria which have been provided by the Interested Party, when applying for classification.

Tasneef may change the classification notations at any time, when the information available shows that the requested or already assigned notations are not suitable for the intended service, navigation and any other criteria taken into account for classification.

Note 1: Reference should be made to Sec 1, [1.3] on the limits of classification and its meaning.

1.1.2 The classification notations assigned to a yacht are indicated on the Certificate of Classification.

1.2 Types of notations assigned

1.2.1 The types of classification notations assigned to a yacht are the following:

a) main class symbol

b) construction marks

c) service notation

d) navigation notations

e) additional class notations.

1.2.2 Types of notations as per a) to d) of [1.2.1] are assigned to yachts designed and built in accordance with the requirements as stated in Part A to Part D. Notations relevant to item [1.2.1] e) are assigned to yachts designed and built in accordance with the requirements of Part E.

1.2.3 *(1/1/2019)*

As an example, the classification notations assigned to commercial yachts may be the following:

C ?HULL ?MACH Y_{ch}

Unrestricted Navigation

DMS, GREEN PLUS (Y)

where:

- **C ?HULL ?MACH**

  (main class symbol, construction marks)
- **Y_{ch}**

  (service notation)
- **Unrestricted navigation**

  (navigation notation)
- **DMS**

  (additional class notation related to damage stability).
- **GREEN PLUS (Y)**

  (additional class notation related to pollution prevention).

2 Main class symbol

2.1

2.1.1 The main class symbol expresses the degree of compliance of the yacht with the Rule requirements as regards its construction and maintenance. There is one main class symbol, which is compulsory for every classed yacht.

The symbol **C** with the 5-year class period is to be understood as being the highest class granted by Tasneef

2.1.2 *(1/1/2016)*

The main class symbol **C** may be accompanied by the notation "**E**" (Experimental) to be assigned to yachts designed and built according to criteria which are novel or unusual, either wholly or in part, though judged satisfactory by Tasneef on the basis of design plans, laboratory tests and tests in working conditions after construction. The notation implies a class period to be assigned which will be evaluated by Tasneef for each case.

3 Construction marks

3.1 General

3.1.1 The construction mark identifies the procedure under which the yacht and its main equipment or arrangements have been surveyed for initial assignment of the class. The procedures under which the yacht is assigned one of the construction marks are detailed in Ch 2, Sec 1.

3.1.2 *(1/1/2021)*

One of the construction marks defined below is assigned separately to the hull of the yacht and its appendages, to the machinery installation, and to some installations for which an additional classification notation (see [6] below) is assigned. The construction mark is placed before the symbol HULL for the hull, before the symbol MACH for the machinery installations, and before the additional class notation granted, when such a notation is eligible for a construction mark. When the same construction mark is assigned to both hull and machinery, the construction mark is assigned globally to the yacht without indication HULL and MACH after the main class symbol.

3.1.3 Construction marks refer to the original condition of the yacht. However, Tasneef may change the construction mark where the yacht is subjected to repairs, conversion or alterations.

3.2 List of construction marks

3.2.1 *(1/1/2021)*

a) Construction mark ✠ is assigned to the relevant part of the yacht when it has been surveyed by Tasneef during its construction in compliance with the new building procedure detailed in Ch 2, Sec 1, [2.1].

b) Construction mark ✠ is assigned to the hull when it was built under the survey of another Society.

c) Construction mark ● is assigned to the hull in all cases other than those defined in a) and b).

3.2.2 **(1/1/2021)**

The mark ✠ is assigned to the relevant part of the yacht, when the latter is classed after construction in compliance with the procedure detailed in Ch 2, Sec 1, [3.2] and it was built under the survey of a QSCS Classification Society and was assigned by this Society a class deemed equivalent to that described in the Rules.

This mark is assigned to yachts:

a) admitted to class in the course of construction surveyed by another QSCS Classification Society;

b) for which the procedure detailed in Ch 2, Sec 1, [3.2] does not apply, as it was disclassed from a QSCS Classification Society for a period longer than six months, but which was built according to the Rules and under the survey of a QSCS Classification Society. In this case, the admission to class survey is to confirm that the yacht has not undergone conversions or modifications or alterations, which were not approved by a QSCS Classification Society.

3.2.3 *(1/1/2021)*

The mark **?** is assigned to the relevant part of the yacht, where the procedure for the assignment of classification is other than those detailed in [3.2.1] and [3.2.2], but however deemed acceptable.

3.2.4 ~~*(1/1/2021)*~~

~~The mark **?** HULL may be assigned only to existing yachts in service for at least 6 years.~~

3.2.5 *(1/1/2021)*

For a new building yacht it is deemed acceptable for the assignment of the mark ? MACH at least what is required for mark X MACH with the exception of the testing activities.

3.2.6 *(1/1/2021)*

For an existing yacht it is deemed acceptable for the assignment of the mark ? MACH at least the approval of the design in accordance with Tasneef Rules.

4 Service notations

4.1 General

4.1.1 *(1/1/2021)*

The following service notations may be assigned

Y_{ch} or **Y_{ch} (mainly sailing)**

The service notation **Y_{ch}** is assigned to a yacht complying with Parts A to D, engaged in commercial use for sport or pleasure, not carrying cargo and not carrying more than 12 passengers.

The notation **Y_{ch} (mainly sailing)** is assigned to a sailing yacht of less than 500 GT complying with Parts A to D, engaged in commercial use for sport or pleasure, not carrying cargo and not carrying more than 36 passengers, so accepted by the Administration.

A vessel mainly propelled by sails is a vessel that has sails as main means of propulsion, which may also be propelled by internal combustion engines enabling the navigation of the vessel without sails if necessary, and that has a nominal sail area satisfying what is requested in [4.1.2].

The vessel may be propelled mechanically, by sail or by a combination of both.

4.1.2 *(1/1/2019)*

The service notations **Y_{ch}** may be completed by the additional service feature **(SAIL)** in case of yachts for which the value of the nominal sail area A_s, in m^2, as defined in the ISO Standard 8666, satisfy the following relation:

$A_s \geq 7 \, (D_{Max})^{2/3}$ where D_{Max} is the maximum displacement in metric tonn.

Example: **Y_{ch} (SAIL)**

4.1.3 *(1/1/2021)*

The service notation "passenger yacht" may be assigned to a yacht of more than 24m intended to carry from 13 to 36 passengers engaged in trade that does not carry cargo and that satisfy entirely Tasneef RULES for the Classification of Ships as applicable to passenger ships.

4.1.4 *(1/7/2021)*

In case of a "passenger yacht" as defined in [4.1.3] the classification notation will be for example C, ✠ HULL, ? MACH, passenger yacht, GREEN PLUS. Also for the assignement of additional class notation reference is to be the Rules for the Classification of Ships for passenger ships carrying up to 36 passengers.

5 Navigation notations

5.1

5.1.1 *(1/1/2019)*

The navigation notation **"unrestricted navigation"** is assigned to a yacht intended to operate in any area and any period of the year.

5.1.2 The navigation notation **"short range"** is assigned to a yacht having a service notation Y_{ch} of any gross tonnage, intended to operate in any period of the year within 60 miles from the shore or from a port of refuge or safe sheltered anchorage

5.1.3 The navigation notation **"special navigation"** is assigned to a yacht where the area and/or the period of navigation is different from those described above. The relevant description is to be indicated in brackets (e.g. **Special Navigation (sheltered area)**).

6 Additional class notations

6.1 General

6.1.1 An additional class notation expresses the classification of additional equipment or a specific arrangement, which has been requested by the Interested Party. The assignment of such additional class notation is subject to compliance with additional Rule requirements which are detailed in Part E.

6.1.2 The different additional class notations which may be assigned to a yacht are listed in [6.2] to [6.11], according to the category to which they belong.

6.1.3 *(1/7/2021)*

Other additional class notations may also be assigned among those listed in Pt A, Ch 1, Sec 2, [6] of the Tasneef Rules for Classification of Ships, subject to compliance with the additional specific requirements detailed in such Rules, as applicable.

6.2 Damage Stability (DMS)

6.2.1 The additional class notation **DMS** is assigned to yachts complying with the damage stability requirements of Pt E, Ch 2, Sec 1.

6.3 Automated machinery systems (AUT)

6.3.1

The notations dealt with under this heading are relevant to automated machinery systems installed on board yachts.

6.3.2 Unattended machinery space (AUT - UMS (Y))

The additional class notation **AUT-UMS (Y)** is assigned to yachts fitted with automated installations enabling machinery spaces to remain periodically unattended in all sailing conditions, including manoeuvring, and complying with the requirements of Pt E, Ch 3, Sec 1.

6.3.3 Centralised control station (AUT-CCS (Y))

The additional class notation **AUT-CCS (Y)** is assigned to yachts fitted with machinery installations operated and monitored from a centralised control station. The requirements for the assignment of this notation are given in Pt E, Ch 3, Sec 2.

6.4 Sea and air pollution prevention (GREEN PLUS(Y) / GREEN PLUS(Y) (GOLD) / GREEN PLUS(Y) (PLATINUM))

6.4.1

The additional class notations **GREEN PLUS(Y), (GREEN PLUS(Y) (GOLD)** or **GREEN PLUS(Y) (PLATINUM)** are assigned to yachts provided with construction and procedural means to prevent pollution of the sea and air and complying with the requirements of Pt E, Ch 4, Sec 1.

6.5 Comfort on Board

6.5.1 Comfort YACHT (Y)

The additional class notation **COMF (Y)** is assigned to yachts satisfying levels of noise and vibration measured on board during navigation and at berth and complying with the requirements of Pt E, Ch 5, Sec 1.

6.5.2 Comfort LARGE YACHT (COMF(LY)) *(1/1/2018)*

The additional class notation **COMF (LY)** is assigned to yachts with lengths equal to or greater than 65 m satisfying levels of noise and vibration measured on board during navigation and at berth according with the requirements of of Pt E, Ch 5, Sec 2.

6.6 In-water survey arrangements (INWATERSURVEY (Y))

6.6.1 The additional class notation **INWATERSURVEY (Y)** is assigned to yachts provided with suitable arrangements to facilitate the in-water survey and complying with the requirements of Pt E, Ch 6, Sec 1.

6.7 Monitoring system (MON-SHAFT (Y))

6.7.1 The additional class notation **MON-SHAFT (Y)** is assigned to yachts which are fitted with a temperature monitoring system for the tailshaft sterntube aft bearing and complying with the requirements of Pt E, Ch 7, Sec 1. The assignment of this notation allows the yacht to be granted a reduced scope for complete tailshaft survey.

6.8 Planned Maintenance System (PMS)

6.8.1 The additional class notation **PMS** is assigned to yachts of equal to or greater than 500 GT provided with a planned maintenance system and complying with the requirements of Pt E, Cap 1, App 2.

6.9 Secure yacht

6.9.1

The additional class notation **SECURE YACHT DESIGN** is assigned to yachts having security equipment according with the requirements of Part E, Ch 8, Sec 1.

6.10 Propulsion plant (HYBRID PROPULSION (…))

6.10.1

The additional class notation HYBRID PROPULSION (…) is assigned to yachts whose propulsion plant consists of two or more sources of power (i.e. electric motor and internal or external combustion engines) complying with the requirements of Pt E, Ch 9.

The notation is completed, in brackets, with the indication of the functional mode, i.e.:

- Parallel mode;
- Electric motor and shaft generator mode;
- Other modes, to be defined.

SECTION 1 SURVEY FOR NEW CONSTRUCTIONS

1 Hull

1.1 General

1.1.1 Scope *(1/1/2016)*

The scope of this Article [1] includes the following main activities:

a) Examination of the parts of the yacht covered by classification Rules and by applicable statutory regulations for hull construction, to obtain appropriate evidence that they have been built in compliance with the Rules and regulations, taking account of the relevant approved drawings.

b) Appraisal of the manufacturing, construction, control and qualification procedures, including welding consumables, weld procedures, weld connections and assemblies, with indication of relevant approval tests.

c) Witnessing inspections and tests as required in the classification Rules used for yacht construction including materials, welding and assembling, with specification of the items to be examined and/or tested, the methods (e.g. by hydrostatic, hose or leak testing, non-destructive examination, verification of geometry) and who is to carry out such inspections and tests.

Appraisal of materials and equipment used for yacht construction and their inspection at works is not included in this Article [1]. Details of requirements for hull and machinery steel forgings and castings and for normal and higher strength hull structural steel are given in Pt D, Ch 2, Sec 3, Pt D, Ch 2, Sec 4 and Pt D, Ch 2, Sec 1, [2] respectively.

Acceptance of these items is verified through the survey process carried out at the Manufacturer's works and the issuing of the appropriate certificates.

1.2 Definitions

1.2.1 Hull structure *(1/1/2016)*

The hull structure (see Note 1) is defined as follows:

a) hull envelope including all internal and external structures,

b) superstructures, deckhouses and casings,

c) welded foundations, e.g. main engine seatings,

d) hatch coamings, bulwarks,

e) all penetrations fitted and welded into bulkheads, decks and shell,

f) the fittings of all connections to decks, bulkheads and shell, such as air pipes and yacht side valves - all items of ILLC 1966, as amended, as recalled by the Statutory Requirements, if any,

g) welded attachments to shell, decks and primary members, e.g. crane pedestals, bitts and bollards, but only as regards their interaction on the hull structure.

Note 1: A glossary of hull terms and hull survey terms can be found in IACS Recommendation 82.

1.2.2 Hull structure *(1/1/2016)*

Reference to documents also includes electronic transmission or storage.

1.2.3 Survey methods *(1/1/2016)*

The survey methods which the Surveyor is directly involved in are as follows:

a) Patrol is defined as the act of checking on an independent and unscheduled basis that the applicable processes, activities and associated documentation of the shipbuilding functions identified in Tab 1 (See [1.3]) continue to conform to classification and statutory requirements.

b) Review is defined as the act of examining documents in order to determine traceability and identification, and to confirm that processes continue to conform to classification and statutory requirements.

c) Witness is defined as the attendance at scheduled inspections in accordance with the agreed Inspection and Test Plans or equivalent to the extent necessary to check compliance with the survey requirements.

1.3 Application

1.3.1 Classification items *(1/1/2016)*

This Article [1] covers the classification surveys of all new construction of yachts intended for international voyages.

For yachts other than steel this procedure is to be applied as far as practicable and applicable. Tab 1 is reported in Pt A, Ch 3, Sec 1 of Tasneef Rules for the Classification of Ships and it has to be applied taking into consideration the hull material and the applicable Statutory requirements.

1.3.2 Statutory items *(1/1/2016)*

This Article [1] covers all delegated statutory items relevant to the hull structure and coating.

Classification of Ships as far as applicable itself can be used as the record with comments made in the appropriate column. If the Society has appointed a Surveyor for a specific newbuilding project then this Surveyor is to attend the kick-off meeting. The builder asked to should agree to undertake ad hoc investigations during construction where areas of concern arise and to keep the Society advised of the progress of any such investigation. Whenever an investigation is undertaken, the builder is to be requested, in principle, to agree to suspend relevant construction activities if warranted by the severity of the problem.

1.7.2 Delegated statutory requirements *(1/1/2016)*

The records are to take note of specific published Administration requirements and interpretations of delegated statutory requirements.

1.7.3 Construction progress records *(1/1/2016)*

The shipyard shall be requested to advise of any changes to the activities agreed at the kick-off meeting and these are to be documented. For instance, if the shipbuilder chooses to use or change subcontractors, or to incorporate any modifications necessitated by changes in production or inspection methods, rules and regulations, structural modifications, or in the event where increased inspection requirements are deemed necessary as a result of a substantial non-conformance or otherwise.

1.7.4 Fabrication quality standard *(1/1/2016)*

Shipbuilding quality standards for the hull structure during new construction are to be reviewed and agreed during the kick-off meeting. Structural fabrication is to be carried out in accordance with IACS Recommendation 47, "Shipbuilding and Repair Quality Standard", or a recognized fabrication standard which has been accepted by Tasneef prior to the commencement of fabrication/construction. The work is to be carried out in accordance with the Rules and under survey of Tasneef

1.7.5 Special cases of kick-off meeting *(1/1/2017)*

In the event of series yacht production, production (see Note 1), the requirement for a kick off meeting in [1.7.1] may be waived for the second and subsequent yachts provided that no changes to the specific activities agreed in the kick off meeting for the first yacht are introduced. If any changes are introduced, these are to be agreed in a new dedicated meeting and documented in a record of such meeting.

Note 1: Series Yacht Production: vessels in the series subsequent to the first one (prototype), i.e. sister yachts built in the same shipyard.

1.7.6 Other attendees at the kick-off meeting *(1/1/2016)*

In the event of series yacht production, consideration may be given to waiving the requirement for a kick-off meeting for the second and subsequent yachts provided any changes are documented as required in [1.7.1].

1.8 Examination and test plan for new building activities

1.8.1 Plans to be provided *(1/1/2016)*

The shipbuilder is to provide plans of the items which are intended to be examined and tested. These plans need not be submitted for approval and examination at the time of the kick-off meeting. They are to include:

a) proposals for the examination of completed steelwork - generally referred to as the block plan and including details of joining blocks together at the pre-erection and erection stages or at other relevant stages;

b) proposals for fit-up examinations where necessary;

c) proposals for testing of the structure (leak and hydrostatic) as well as for all watertight and weathertight closing appliances;

d) proposals for non-destructive examination;

e) any other proposals specific to the yacht type or to the statutory requirements.

1.8.2 Submittal of plans to the Surveyors *(1/1/2016)*

The plans and any modifications to them are to be submitted to the Surveyors in sufficient time to allow review before the relevant survey activity commences.

1.9 Proof of the consistency of surveys

1.9.1 Evidence for survey planning and activities *(1/1/2016)*

Inspection and test records, checklists etc are to be kept in order to provide evidence that Tasneef Surveyors have complied with the requirements of the new building survey planning and duly participated in the relevant activities shown in the shipbuilder's examination and test plans.

1.9.2 Recording of patrolling activities *(1/1/2017)*

In addition, the classification society is to maintain records of deficiencies found during the patrolling activities required in Table 1 and described in paragraph [2.3.1].

Records shall include the date when deficiency was found, description of the deficiency and the date the deficiency was cleared.

1.10 Yacht Construction File

1.10.1 Document provider *(1/7/2021)*

The shipbuilder is to deliver documents for the Yacht Construction File. In the event that items have been provided by another Party such as the Shipowner, and where separate arrangements have been made for document delivery excluding the shipbuilder, that Party has the responsibility. The Yacht Construction File is to be reviewed for content in accordance with the requirements of [1.10.2].

Note 1: When the info required in [1.10.2] are at the disposal of the Interested parties in a different form than the Yacht Construction File it may be accepted by Tasneef

1.10.2 Contents of the Yacht Construction File *(1/1/2017)*

It is recognized that the purpose of documents held in the Yacht Construction File on board the yacht is to facilitate surveys and repairs and maintenance, and, therefore, in addition to those listed in Tab 1 of Pt A, Ch 3, Sec 1 of Rules for the Classification of Ships as far as it's practicable and applicable, such documents are to include, but not be limited to, the following:

a) as-built structural drawings including scantling details, material details and, as applicable, wastage allowances,

SECTION 1 GENERAL REQUIREMENTS

1 Rule application

1.1

1.1.1 Part B consists of six Chapters and applies to hulls of length L_{OA}, defined in [4.2], of 24 m and over of yachts of normal type, monohull craft or catamarans, which are to be classed by Tasneef

Chapter 1 applies in general to all yachts, irrespective of the material used for the construction of the hull.

Chapter 2 contains requirements relevant to the scantlings of hull structures of steel yachts.

Chapter 3 contains requirements relevant to the scantlings of hull structures of aluminium alloy yachts.

Chapter 4 contains requirements relevant to the scantlings of hull structures of yachts constructed of composite materials.

Chapter 5 contains requirements relevant to the scantlings of hull structures of wooden yachts.

Chapter 6 contains requirements relevant to the intact stability of commercial vessels.

Yachts of unusual form, speed or proportions or of types other than those considered in Part B will be given special consideration by Tasneef also on the basis of equivalence criterion.

Yachts built using a combination of the foregoing materials are subject to the applicable requirements of the relevant chapters. Connections between different materials will be the subject of special consideration by Tasneef

2 Equivalents

2.1

2.1.1 In examining constructional plans, Tasneef may take into account material distribution and scantlings which are different from those obtained by applying these requirements, provided that longitudinal, transversal and local strength are equivalent to those of the relevant Rule structure and that such scantlings are found satisfactory by Tasneef also on the basis of direct calculations of the structural strength.

In particular, the structures of yachts similar in performance to high speed craft (HSC) may have scantlings in accordance with Tasneef "Rules for the Classification of High Speed Craft".

In such case, the Master is to be provided with a yacht operating manual indicating the appropriate speed for each sea state.

The use of Tasneef "Rules for the Classification of High Speed Craft" for the scantlings of the structures of the afore mentioned yachts is to be agreed between the yard and Tasneef before the submittance of the drawings for approval and the commencement of the hull.

Special structures not provided for in these Rules, such as decks intended for the carriage of vehicles, side and stern doors and helicopter decks, may have scantlings in accordance with the "Rules for the Classification of Ships".

3 Direct calculations for monohull and twin hull yacht

3.1 Direct calculations for monohull yachts

3.1.1 General

Direct calculations are generally required to be carried out, at the discretion of Tasneef to check the primary structures of yachts which have unusual shapes and/or characteristics.

In addition, direct calculations are to be performed to check the scantlings of primary structures of yachts whenever, in the opinion of Tasneef hull shapes and structural dimensions are such that the scantling formulae used in these Rules are no longer deemed to be effective.

By way of example, this may be the case in the following situations:

- elements of the primary transverse ring (beam, web and floor) have very different cross-sectional inertia, so that the boundary conditions for each are not well defined;
- marked V-shapes, so that floor and web tend to degenerate into a single element;
- complex, non-conventional geometry;
- presence of significant racking effects (yachts with many tiers of superstructure);
- structures contributing to longitudinal strength with large openings.

3.1.2 Loads

In general, the following load conditions specified in a) to d) are to be considered.

The condition in d) is to be checked in yacht for which, in the opinion of Tasneef significant racking effects are anticipated (yachts with many tiers of superstructure).

In relation to special structure or loading configurations, should some load conditions turn out to be less significant than others, the former may be ignored at the discretion of Tasneef By the same token, it may be necessary to consider further load conditions specified by Tasneef in individual cases.

The vertical and transverse accelerations and the impact pressure p_2 are to be calculated as stipulated in Sec 5.

For each primary supporting member, the coefficient F_a, which appears in the formula for impact pressure, is to be calculated as a function of the area supported by the member.

In three dimensional analyses, special attention is to be paid to the distribution of weights and buoyancy and to the dynamic equilibrium of the yacht.

In the case of three dimensional analyses, the longitudinal distribution of impact pressure is considered individually in each with a drop or ballast keel, the lower side of the keel is intended to mean the intersection of the longitudinal plane of symmetry with the continuation of the external surface of the hull.

T_1 : Draught T, in metres, measured to the lower side - theoretically extended, if necessary, to the middle of length L - of the fixed ballast keel, where fitted, or the drop keel.

Δ : Displacement, in t, of the yacht at draught T.

V : Maximum design speed, in knots, of the yacht at displacement Δ.

s : Spacing of ordinary stiffeners, in metres.

S : Web frame spacing, in metres.

4.3 Definitions

4.3.1 Rule frame spacing

The Rule frame spacing, s_R, in m, of ordinary stiffeners is obtained as follows:

$$s_R = 0,350 + 0,005L$$

In general, spacing of transversal or longitudinal stiffeners is not to exceed 1,2 times the Rule frame spacing.

4.3.2 Superstructure

The superstructure is a decked structure located above the weather deck, extending from side to side of the hull or with the side plating not inboard of the shell plating more than 4% of the local breadth.

Superstructures may be complete, where deck and sides extend for the whole length of the yacht, or partial, where sides extend for a length smaller than that of the yacht, even where the deck extends for the whole length of the yacht.

Superstructures may be of different tiers in relation to their position in respect of the weather deck.

A 1^{st} tier superstructure is one fitted on the weather deck, a 2^{nd} tier superstructure is one fitted on the 1st tier superstructure, and so on.

4.3.3 Bulkhead deck

The bulkhead deck is normally the uppermost complete deck exposed to the weather and sea, which has permanent means of closing all openings in the weather part thereof, and below which all openings in the sides of the ship are fitted with permanent means of watertight closing. In a ship having a discontinuous bulkhead deck, the lowest line of the exposed deck and the continuation of that line parallel to the upper part of the deck is taken as the bulkhead deck.

4.3.4 Watertight bulkhead

Watertight bulkheads are bulkheads extended watertight till the freeboard deck, whose scantlings comply with [5.1.4].

4.3.5 Weather deck

The weather deck is the uppermost complete weathertight deck fitted as an integral part of the vessel's structure and which is exposed to the sea and the weather.

4.3.6 Virtual freeboard deck

Where the actual freeboard from the full load waterline to the weather deck exceeds that required by ILLC '66 by at least 1,8 m for yachts having $L_{LL} < 75$ m, or at least 1,80 + 0,01 (L_{LL} - 75) for 75 < L_{LL} < 125, or at least 2,30 m for L_{LL} > 125 m, a virtual freeboard deck may be defined (hypotetically drawn below and parallel to the weather deck) and, for the determination of the superstructure tier, the superstructure above the weather deck may be considered as a second tier and the second tier in respect to the weather deck may be considered as a third tier and so on. All the fitting above the weather deck, abaft the forward quarter, may be considered in the same way".

The vertical distance as above defined between the assumed freeboard deck corresponding to the relevant watertight weather deck and the minimum freeboard as calculated in accordance with the Load Line Requirements may be used to reduce the requirements for closing appliances for openings in the hull, superstructure, deckhouses, relevant sills above deck and the height of air pipes and ventilators above deck, if not otherwise stated by the flag Administration.

4.3.7 Deckhouse

The deckhouse is a decked structure fitted on the weather deck, a superstructure deck or another deckhouse, having limited length and a spacing between the external longitudinal bulkheads less than 92% of the local breadth of the yacht.

4.3.8 Weathertight

A closing appliance is considered weathertight if it is designed to prevent the passage of water into the yacht in any sea condition.

4.3.9 Watertight

A closing appliance is considered watertight if it is designed to prevent the passage of water in either direction under a head of water for which the surrounding structure is designed.

4.3.10 Cofferdam *(1/1/2020)*

A cofferdam means an empty space arranged so that compartments on each side have no common boundary; a cofferdam may be located vertically or horizontally. As a rule, a cofferdam is to be properly ventilated and of sufficient size to allow for inspection.

5 Subdivision, integrity of hull and superstructure

5.1 Number of watertight bulkheads

5.1.1 All Yachts are to have at least the following transverse watertight bulkheads:

- One collision bulkhead
- Two bulkheads forming the boundaries of the machinery spaces;as an alternative, the transom may be accepted as aft transverse bulkhead.

Additional bulkheads may be required for yachts required to comply with subdivision or damage stability criteria.

5.1.2 Openings in watertight bulkheads and decks

The number of openings in watertight subdivisions is to be limited to a minimum compatible with the proper working of the yacht. Pipes and electrical cable may be carried through watertight subdivisions provided that both the watertightness and structural integrity of the bulkhead are ensured by devices suita-

5.6.3 Materials *(1/1/2020)*

The following materials may be used:

- thermally strengthened monolithic or laminated glass,
- chemically strengthened laminated glass,
- polymetilmetacrylate and
- polycarbonate.

Other materials will be considered on a case by case base.

Only thermally or chemically strengthened glass shall be used as pane material or as plies material for laminated constructions.

Thermally strengthened glass used both in monolithic or laminated construction shall meet the requirements of EN 12150-1.

For laminated construction the glazing shall meet the requirements outlined in ISO 12543-1.

Ordinary not strengthened (thermally or chemically) glass is not acceptable.

Chemically strengthened glass shall meet the requirements outlined in EN 12337-1.

When chemically strengthened safety glass is used, windows are to be of laminated type. The minimum depth of chemical strengthening is to be 30 microns on exposed surfaces and the surface is to be subject to regular inspections.

The characteristic of superficial compression (S_c x N/mm^2) and of depth of compression layer l_{CD} (μm) have to be declared by the Manufacturer of the glass.

For monolithic construction only rigid plastic panes with a minimum characteristic failure strength of 90 MPa shall be used.

Plastic panes (monolithic) or plies (laminated) shall be used according to indications of material manufacturers both in terms of chemical compatibility with other materials (adhesives, sealants, gaskets) and application conditions (with special attention to exposure to outdoor environment).

Metallic materials used for frame and other parts of the windows have to be tested by Tasneef

Only laminate with plies of the same material are considered.

Glazing made of multiple panes, either monolithic or laminated, separated by sealed gaps filled with gas (air, argon, etc.) (IGU) have to be verified as follows.

In stepped IGU one of the panes is fixed to the framing while the other pane is not supported by the framing structure. In this case the framed pane of the IGU (either monolithic or laminated) shall be selected according to [5.6.8], [5.6.9] and [5.6.13] if monolithic and [5.6.11], [5.6.12] and [5.6.13] if laminated . The other pane is to have thickness of minimum 4mm.

In unstepped IGU both panes are supported by the framing structure. In this case both the panes of the IGU (either monolithic or laminated) shall be selected according to [5.6.8], [5.6.9] and [5.6.13] if monolithic and [5.6.11], [5.6.12] and [5.6.13] if laminated.

Otherwise the IGU may be tested hydraulically (3 samples) in accordance with [5.6.16].

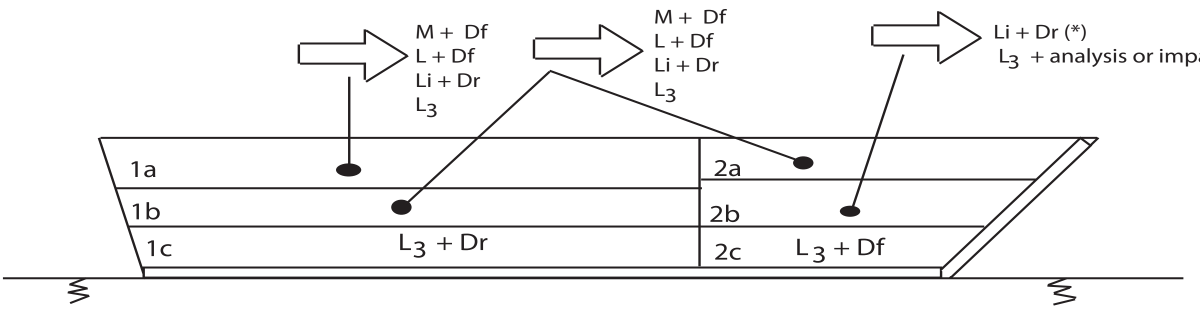
5.6.4 Deadlights and storm covers *(1/1/2020)*

Below the deck and in the superstructures contributing to the buoyancy, a deadlight for each window is to be provided. The position of such deadlights is to satisfy what follows:

- Deadlights in general are to be provided fixed in place.
- Deadlights may be removable when the glass is laminated and its load carrying capability is increased of 30%.
- Deadlights may be avoided for glazing made of laminated with an interlayer of 3mm polycarbonate or equivalent material if located in Zone 1a or 1b or 2a.
- In Zone 2b when laminated glass with an interlayer of 3mm polycarbonate or equivalent material is used a removable deadlight is to be provided.

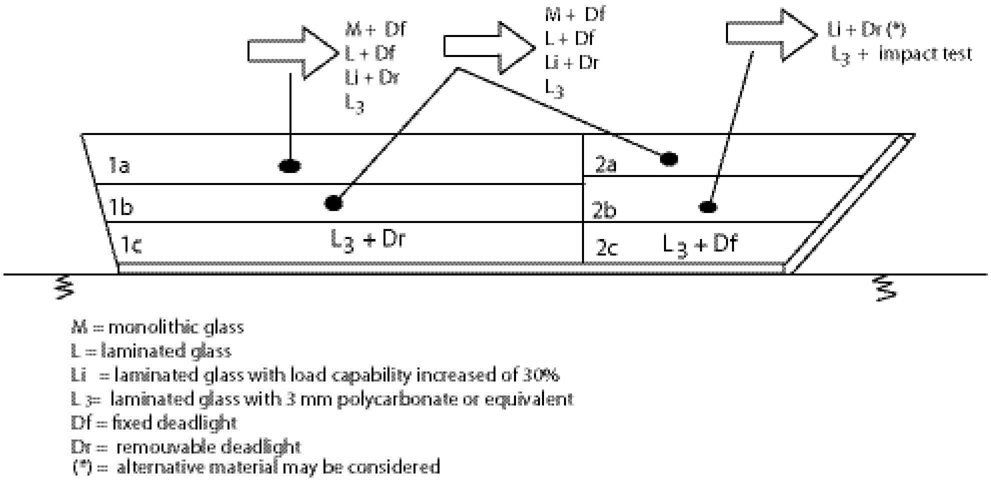
  The possibility to avoid such deadlight will be evaluated if an impact test on the laminated glass with the external ply fractured is carried out (see [5.6.17]).
- In Zone 1c a fixed or removable deadlight is to be in any case foreseen.
- In Zone 2c a fixed deadlight is to be in any case foreseen.

Figure 8 : ~~Deadlights (1/1/2017)~~



M = monolithic glass
L = laminated glass
Li = laminated glass with load capability increased of 30%
L 3= laminated glass with 3 mm polycarbonate or equivalent
Df = fixed deadlight
Dr = remouvable deadlight
(*) = alternative material may be considered

Figure 9 : Deadlights *(1/7/2021)*



Where portable deadlights are allowed they shall be stored in an easily accessible location and readily and safely mounted in any sea condition.

For fixed glazing glued without frame to the hull/superstructure the connection to the hull of the deadlight is to be found suitable taking into account the material of the hull and of the deadlight taking into account the test required in [5.6.18].

Materials shall be either in accordance with ISO 1751, marine grade aluminium alloy, or composite material as used for hull construction. Cast aluminium alloy shall be of a ductile type with elongation to breakage not less than 6%.

Deadlights shall be dimensioned such that when loaded by the design pressure the yield deformation stress is not exceeded. The deadlight shall be designed considering the same design pressure as required for the glazing. Subject to this pressure the stress in deadlight and all load carrying fittings is not to exceed the yield strength.

When equivalent strength is not shown by calculations, the deadlights in the mounted position shall be tested according to [5.6.18].

Guidance shall be available on board on the sea state at which deadlights shall be fitted and on maintenance and inspection and their means of securing.

In the superstructures not contributing to the buoyancy, normally deadlights need not to be provided except for windows located in the superstructures not contributing to the buoyancy if they are the prosecution of the shell (wide body yachts) when they are located below 0,08L and forward of 0,25L. One blanking plate with the same dimension of the largest window to be foreseen on board.

When due the navigation of the yacht storm covers on windows fitted somewhere in a superstructure not contributing to the buoyancy are required by the Administration the storm cover has to satisfy what follows.

Storm shutters shall be dimensioned such that when loaded by the design pressure the yield deformation stress is not exceeded. The storm shutter shall be designed considering the same design pressure as required for the glazing. Subject to this pressure the stress in storm shutter and all load carrying fittings is not to exceed the yield strength.

When equivalent strength is not shown by calculations, the Storm shutter in the mounted position shall be hydraulically tested at a pressure of at least 4 p_D (the test may be carried out only on the largest storm shutter).

As an alternative a factor of 1,5 over the design pressure together with the use of laminated glass is considered acceptable in lieu of the storm cover.

As another alternative to storm covers also one of the arrangement in Fig 9 may be acceptable.

Table 1 : Pressure to be used for the hydrostatic test *(1/1/2017)*

Thickness of glass pane (mm)	Pressure (N/mm^2) for a glass pane net diameter (mm) of:					
	200	250	300	350	400	450
4	0,33	0,21	-	-	-	-
5	0,33	0,21	-	-	-	-
6	0,33	0,21	-	-	-	-
8	0,58	0,37	0,26	0,19	-	-
10	0,92	0,58	0,41	0,30	0,23	0,18
12	1,32	0,84	0,59	0,43	0,33	0,26
15	-	1,32	0,92	0,67	0,51	0,41
19	-	-	1,47	1,08	0,83	0,65

Table 2 : Punch test load *(1/7/2021)*

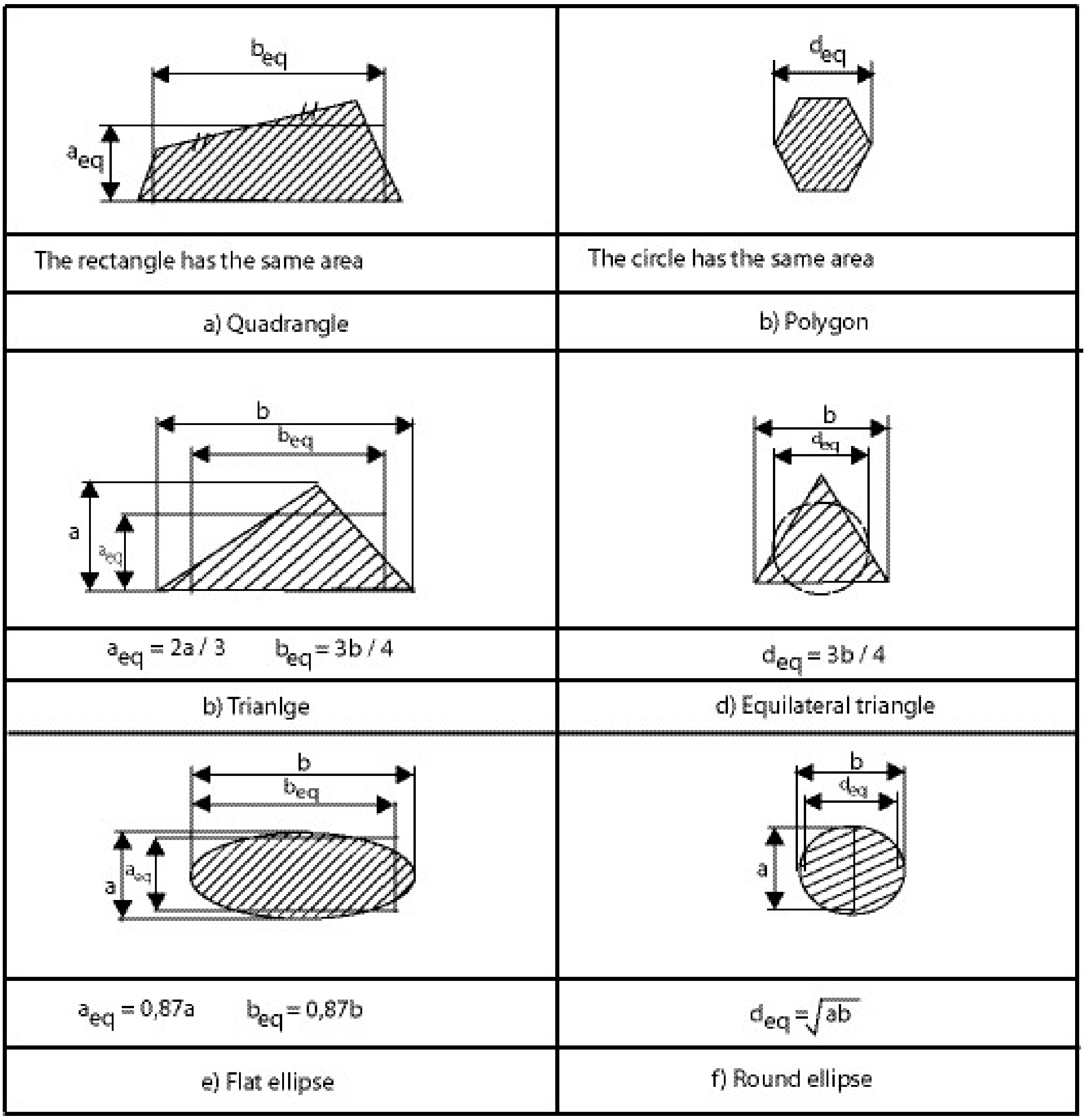
Thickness of glass pane (mm) (tolerance: 0 + 2)	Test loads (N) for a hole diameter in support plate of:	
	200 mm	150 mm
4	~~2300~~1500	~~2400~~1600
5	~~2600~~2400	~~2700~~2600
6	3400	3500
8	6500	6700
10	10200	11000
12	15500	16500
15	24000	25500
19	33400	36800

The witness of the Surveyor to the above mentioned test for glass fitted in superstructure not contributing to buoyancy may be replaced by a Declaration from the Manufacturer together with the production quality system certification issued by an accredited Body.

5.6.6 Glazing with non conventional shapes *(1/1/2020)*

The first step of this scantling procedure foresees that glazing made of non traditional shapes -such trapezoidal or polygonal and all those different from rectangular or circular - are to be transformed in traditional ones using the following criteria to calculate the equivalent dimension a_{eq} and b_{eq} or d_{eq}.

Figure 11 *(1/1/2017)*



5.6.7 Calculation of the pressure to be used for the scantling of the glazing *(1/1/2021)*

For the windows fitted in the hull and in the superstructure contributing to the buoyancy the pressure acting on the glass, P_D in kN/m², that will be used for the calculation of the minimum thickness required, is to be taken as the highest among the following 3 values p1, p2 and p3.

For the windows fitted in the superstructure not contributing to the buoyancy among the following 2 values p1 and p4:

a) In Zone 1a P~~1~~ ref is to be taken from the following Table 3.

Table 3 *(1/1/2017)*

L m	Motor yachts kN/m²	Cruising sailing yachts kN/m²
24	70	70
30	70	70
40	70	70
50	70	83
60	76	96
70	84	109
80	91	121
90	98	133

For motor yachts of more than 90 meters in length the value of f can be taken using the following formula:

p_{ref} = 0,71 L + 34

For cruising sailing yachts of more than 90 meters in length the value of f can be taken using the following formula

p_{ref} = 1,263 L + 19,9

For other zones for glasses of more than 0,85m2 P1 ref is to be taken:

In Zone 1b not less than 1,1 times the value given in the above Table for Zone 1a

In Zone 2a not less than 1,25 times the value given in the above Table for Zone 1a

In Zone 2b not less than 1,35 times the value given in the above Table for Zone 1a

For the following zones $P_{1\ ref}$ is to be taken:

In Zone 1c not less than 1,6 times the value given in the above Table for Zone 1a

In Zone 2c not less than 1,7 times the value given in the above Table for Zone 1a

P_1 is to be calculated using the following formula:

P1 = 10,05 * θ * (b*f-h) (kN/m^2)

Where:

θ = 5 for windows in the hull or in superstructure contributing to the buoyancy.

For glazing of less than 0,85m^2 p_1 no need to be taken more than $p_{1\ ref}$

For windows located in superstructures not contributing to the buoyancy the coefficient "θ" is to be taken as follows.

Value of "θ" for lateral (in the wide body) and frontal (unprotected) windows:

- Superstructure or deckhouse at more than 0,02 L (m) above design waterline:

  2 + (L/120)

- Superstructure or deckhouse at more than 0,02 L + h_{std} (m) above design waterline:

  1 + (L/120)

- Superstructure or deckhouse at more than 0,02 L + 2 h_{std} (m) above design waterline:

  0,5 + (L/120) (this may be used also for protected frontal windows)

Value of "θ" for lateral (not in the wide body) windows:

0,5 + (L/120)

The value "θ" for lateral windows fitted in superstructure or deckhouses not contributing to buoyancy may be multiplied for value k_s that may be taken as follows:

k_s =0.85 for glazing fitted in the superstructure not contributing to buoyancy for unrestricted navigation

k_s =0.85 for glazing fitted in the superstructure not contributing to buoyancy for short range navigation for sailing yacht

k_s =0.64 for glazing fitted in the superstructure not contributing to buoyancy for short range navigation for motor yacht

Value of "θ" for aft end windows located of an height above the design waterline of more than 0,02 L + h_{std} :

- x/L ≤ 0,5

$$0,7 + \frac{L}{1000} - 0,8\frac{x}{L}$$

- x/L > 0,5

$$0,5 + \frac{L}{1000} - 0,4\frac{x}{L}$$

Value of "θ" for aft end windows located of an height above the design waterline of less than 0,02 L + h_{std} :

The value obtained for windows located at an height above the design waterline more than 0,02 L + h_{std} multiplied by 1,5.

In the table above x is the longitudinal position of the ~~aft~~fore end.

h_{std} is the superstructure height in m for vessels up to 75 m load line length: height to be taken as 1,8 m; for vessels over 125 m load line length to be taken as 2,3 m; for vessels of intermediate lengths: height to be obtained by linear interpolation.

b is given below depending on the longitudinal position

- x/L ≤ 0,45

$$1 + \left(\frac{\frac{x}{L} - 0,45}{C_B + 0,2}\right)^2$$

- x/L > 0,45

$$1 + 1,5\left(\frac{\frac{x}{L} - 0,45}{C_B + 0,2}\right)^2$$

C_B is block coefficient, with 0,6 ≤ C_B ≤ 0,8

f is the value given in the following table

Table 4 *(1/1/2017)*

As a general rule, closing appliances are to be permanently attached to the ventilation ducts coaming.

Ventilation ducts are to be fitted with a suitable means of preventing ingress of water and spray when open and have a suitable drainage arrangements leading overboard.

5.11 Air pipes

5.11.1 General

Air pipes serving fuel and other tanks is to be of efficient construction and provided with permanently attached means of weathertight closure. Means of closure may be omitted if it can be shown that the open and of an air pipe is afforded adequate protection by other structures which will prevent the ingress of water.

In addition, air and sounding pipes are to comply with the requirements of Pt C, Ch 1, Sec 9, [7].

5.11.2 Height of air pipes

Where located on the weather deck, air pipes are to be kept as far inboard as practicable and be fitted with a coming of sufficient height to prevent inadvertent flooding. Generally, air pipes to tanks are to have a minimum coming height as indicated in Tab 13.

Table 12

Location	Coming height (mm) Short range navigation	Coming height (mm) Unrestricted navigation
On weather deck	380	760
Elsewhere	225	450

5.12 Bulwarks and guardrails or guardline

5.12.1 General *(1/7/2021)*

Bulwarks or railings are to be arranged on exposed decks.

Where this is not practicable, handrails or stays are to be provided.

Bulwarks are to be of strong construction and adequately supported.

The height of bulwarks or rails, or a combination of both, is to be not less than 1000 mm.

The maximum clearance below the lowest course of the guardline is to be 230 mm. The other courses of guardline are to be not more than 380 mm.

The stanchions are to be spaced at not more than 2,2 m.

The scantling of a solid bulwark is to be equivalent of that of the adjacent structures of the side shell.

External glass balustrades are to provide water freeing areas in accordance with [5.13]. Openings for water freeing are to be not more than 230 mm.

Stanchions and top rail are to be able to withstand the a load of at least 1 kN in the most critical point. The scantling of the top rail and the stanchions to be carried out in accordance with [5.12.2].

If the scantling of the top rail and the stanchions is not in accordance with [5.12.2], direct calculation with 1 kN as concentrated load are to sent.

Notwithstanding of the application of [5.12.2] or the alternative calculation a practical test in accordance with ISO 15085 using 1 kN instead of the value proposed by the a.m. ISO standard is required. No permanent deformation has to occur. If the top rail yield strength more than 315N/mm^2, has minimum section modulus of at least 17cm^3 and the stanchions has yield strength more than 315 N/mm^2, minimum section modulus of 20 cm^3 if spaced up to 1,5m and 40 cm^3 if spaced up to 2,2 m the a.m. test is not required.

The material used for the construction of the stanchions and the top rail is to have minimum yield strength of at least 235 N/mm^2.

For yachts of less than 500 GT. The minimum section modulus of the top rail is to be in any case more than 3cm^3 for stanchions spaced up to 1,5m and 5 cm^3 for stanchions spaced up to 2,2 m if the top rail is connected to the glazing. If the top rail is not connected to the glazing the minimum section modulus may be reduced to 2 cm^3 if the stanchions are spaced up to 1,5m and 3 cm^3 if the stanchions are spaced up to 2,2m. The minimum section modulus of the stanchions is to be in any case more than 3cm^3 (2 cm^3 are acceptable for stanchions height up to 500 mm).

For yachts of more than 500 GT the minimum section modulus of the top rail is to be at least 17cm^3. The minimum section modulus of the stanchions is to be at least 20cm^3 for stanchions spaced up to 1,5m and 40cm^3 for stanchions spaced up to 2,2m.

The maximum admissible stress have to be assumed as the 80% of the minimum yield strength of the material.

The top rail is to have ergonomic shape.

The stanchions shall be rigidly fixed at their lower ends to resist rotational displacements.

The stanchions are to be structurally connected to the hull and in case of different material bimetallic joints have to be used.

Where the rails are substituted by glazing materials what follow applies. Normally stanchions and handrails have to be provided the glazing may be substitute the other transversal rails.

What follows is not applicable to small glazing panel that does not substitute rails. They have to be considered on a case by case base.

Glazing substituting the rails should not be situated in areas deemed essential for the operation of the ship. Such areas include mooring decks, lifeboat decks, external muster stations and in the vicinity of davits. Where external glass balustrades are not to be used, more traditional bulwarks or guard rails are to be fitted.

Where the glazing substitutes rails the scantling of the stanchions and of the top rails have to take into account in addition to the personnel load also the load due to the weather.

The scantling of the top rail and the stanchions have to be carried out according to [5.12.2] adding the weather load to personnel load. As an alternative to the application of [5.12.2] fem or direct calculation considering personnel and weather loads have to be sent for examination.

When the scantling of top rails and stanchions are not in accordance with [5.12.2] but are validated with fem or direct calculation the test a.m. required in accordance with ISO 15085 is to be performed with personnel and weather load. The impact test required below in accordance with EN 13094 if carried out also on the stanchions and top rail may be considered as alternative.

The weather load is to be taken not less than:

- 1st tier deck (main deck): p_1 calculated as for a windows in the first tier of superstructure or 12,5 kN/m^2 for lateral and aft glazing and 30 kN/m^2 for front glazing whichever is higher
- 2nd tier deck (upper deck): p_1 calculated as for a windows in the second tier of superstructure or 6 kN/m^2 for lateral and aft glazing and 10 kN/m^2 for front glazing whichever is higher
- 3rd tier deck (sun deck): p_1 calculated as for a windows in the third tier of superstructure or 2.5 kN/m^2 for lateral and aft glazing and 7.5 kN/m^2 for front glazing whichever is higher.

For restricted navigations (e.g. short range yacht where the yacht is intended to sail with wind condition of maximum Beaufort scale 4) the weather loads for 2nd and 3rd deck may be reduced of 50%.

Provision are to be available to fit adequately spaced rails in case of failure of the glazing.

Glass or other glazing materials such as polycarbonate may be used.

If glass is used it is to be thermally or chemically strengthened glass of laminated type.

The relevant scantling is to be calculated with the above mentioned weather loads and personnel load (1 kN/m^2 considered additional to weather load) as it is supported on four sides.

In Tab 13 are reported the thickness required for different locations and different interlayer material.

If the arrangement on board foresees less than 4 supporting sides a fem calculation is to be send to demonstrate that the acceptability of the thickness proposed in Tab 13 also in case of less than 4 supporting sides. The scantling calculated with 4 sides supported is to be in any case granted.

In Tab 13 are reported the required composition of the glazing for 4 different area, 2 different characteristic strength, 2 different type of interlayer and different deck levels for unrestricted navigation.

The direct calculation above required may be omitted if the thickness of the glazing supported on less than 4 sides is increased up to the value reported in Tab 14.

The safety factors for the glass and for the polycarbonate are the same as for windows located in the superstructure.

If the glazing is made of glass, laminated glass is to be used, the minimum composition is to be 4+ 1,52+4.

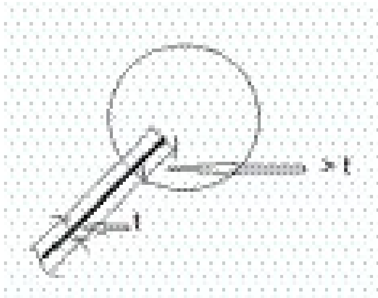
Connection between glazing and stanchions and top rail:

The vertical sides of the glazing are to be connected to the stanchions with continuous line - double side - support filled with structural gluing.

The glazing weight to be mechanically supported.

The thickness of the double side support is to be at least equal to the thickness of the glazing. See Fig 33.

Figure 34 : *(1/1/2020)*



The horizontal side of the glazing may or not be connected with the top rail or to the deck or a solid bulwark and the scantling of the rop rail, of the stanchions and the glazing to be calculated accordingly. If the glazing has one or 2 free edges these have to be suitably protected (edge protection or finishes).

Bulwark with rails made with glazing material are to be subject to a prototype pendulum impact test in accordance with EN 13049:2003 Windows - Soft and heavy body impact - Test method, safety requirements and classification or an equivalent National or International Standard (e.g. EN 12600) without permanent deformation utilizing a drop height of not less than 1,5m as an alternative the height may be reduced to 1,2m but in this case the test is to be repeated 3 times. If after this test the glazing has not enough residual stregth (e.g. when thermally toughened glass is used and after the test all the plies are broken) suitable means are to be provided to prevent falling in case of failure of the glazing (e.g. tensionable rails or wires connected to the stanchions).

Note 1: "Without permanent deformation" is to be intended that after the impact test the glazing is not to exit from the continuous support and the permanent deflection is to be less than about 100mm.

The test specimens including the retaining arrangements should be the same as the finished installation.

If the bulwark has glazing with different dimensions (but of the same thickness) the test may be carried out on the larger glazing (maximum height and maximum length).

The a.m. test is not required if:

a) the interlayer is at least 3mm of a structural material that passed the impact test to avoid deadlight for glazing fitted in the hull

b) the glazing has at least 2 sides with continuous line -double side- support (for bulwark with rails made of glazing material).

c) the top rail is made of a material with yield strength of at least 315 N/mm^2 and has section modulus of at least 20 cm^3 if the stanchions are spaced up to 1,5m and 40cm^3 if the stanchions are spaced up to 2,2,m

d) the stanchions are made of a material with yield strength of at least 315 N/mm^2 and have minimum section modulus of 30 cm^3 if spaced up to 1,5m and 40 cm^3 if spaced up to 2,2 m

e) the weather load calculated according to what above is less than 30 kN/m^2

f) the glass is chemically streghtened

Different considerations may be done if the deck can not be accessed during navigation.

Solutions different from what above will be considered on a case by case base.

SECTION 3 EQUIPMENT

1 General

1.1

1.1.1 The anchoring equipment required in [6] is intended for temporary mooring of a yacht within or near a harbour, or in a sheltered area.
The equipment is therefore not designed to hold a yacht off fully exposed coasts in rough weather or to stop a yacht which is moving or drifting. In such conditions the loads on the anchoring equipment increase to such a degree that its components may be damaged or lost owing to the high energy forces generated.
The anchoring equipment required in [6] is deemed suitable to hold a yacht in good holding ground where the conditions are such as to avoid dragging of the anchor. ~~-~~In poor holding ground the holding power of the anchors will be significantly reduced.
It is assumed that under normal circumstances a yacht will use one anchor only.

2 Anchors

2.1

2.1.1 Anchors are to be manufactured in accordance with Pt D, Ch 4, Sec 1.

2.1.2 *(1/7/2021)*
The mass, per anchor, given in Table 1 applies to "high holding power" anchors. When use is made of normal type anchors, the mass shown in the table is to be multiplied by 1,33.

When "very high holding power" anchors are used, the mass of the anchors may be equal to 70% of that shown in Table 1 for stockless anchors.
The actual mass of each anchor may vary by + or - 7% with respect to that shown in Table 1, provided that the total mass of the two anchors is at least equal to the sum of the masses given in the table.
When 2 anchors are required:

The second anchor is intended as a spare and it is not necessary to carry it as a bower anchor provided that, in the event of the loss of the first anchor, the spare anchor can be readily removed from its position and arranged as a bower anchor.

In this case, the first anchor is to be equipped with at least 70% of the length of chain indicated in table, and the spare anchor with at least 70% of the required length.

When only 1 anchor is required (EN less than 110) and a second is foreseen as a spare, this spare anchor has to have a mass of at least 70% of the main anchor; in this case the chain length is to be at least 65% for EN < 70 and 70% for EN < 110 of the required chain length for the main anchor and also of the spare anchor.

For EN < 280 a maximum of a 90% of the chain length fitted on the spare anchor may be replaced by wire or fiber rope.

The ~~Possibility of~~ replacement of ~~a mass required for 1~~one anchor fit in place with ~~2~~two anchors both ~~fixed~~fit in place and used simultaneously is acceptable only in case of EN less than 110~~:~~.

a) ~~When 2 Anchors are required (EN more than 110)~~

~~Each anchor is to have a mass equal at least 60% of the of the requested mass of each anchor and the length of each chain line shall not be less than 75% of the total length indicated in the table.~~

~~In this case the spare anchor may have a mass equal at least 60% of the of the requested mass of each anchor and the length of each chain line shall not be less than 75% of the total length indicated in the table.~~

~~A maximum of 90% of the chain length fitted on the spare anchor may be replaced by wire or fiber rope.~~

b) ~~When only 1 anchor is required (EN less than 110)~~

~~The mass required for each anchor can be replaced with two anchors having a total mass not less than the mass of the anchor required. In this case the two anchors are to be in place, to be used simultaneously. Where the requested mass for each anchor is divided in two anchors, each one having a mass equal to least 60% of the requested mass,~~

The anchor required may be replaced by two anchors having each a mass of at least 60% of the mass of the required anchor; the length of each chain line shall not be less than 65% for EN < 70 and 70% for EN < 110 of the total length indicated in the table.

2.1.3 *(1/1/2020)*
The diameters refer to Grade Q1 steel chain cables; where Grade Q2 or Q3 steel studless chain cables are used, the diameters may be reduced guaranteeing the same breaking load as the chain cable corresponding to Grade Q1. (see Pt D, Ch 4, Sec 1, Tab 9); where Grade Q2 or Q3 steel with stud chain cables are used, the diameters may be reduced guaranteeing as per Tab 1.

For HHP and VHHP anchors, grade Q1 chain cables are not allowed and Grade Q2 or Q3 chain cables are to be used; in this case the reduction of chain diameter for VHHP may be possible only for chain with stud as per Tab 1.

For yacht of more than 500GT studless chain cables are not allowed.

SECTION 5 LOADS

1 General

1.1

1.1.1 The static and dynamic design loads defined in this Section are to be adopted in the formulae for scantlings of hull and deck structures stipulated in Chapters 2, 3 and 4 of Part B.

For yachts of speed exceeding 10 $L^{0,5}$ knots or yachts of unusual shape, additional information may be required in the form of basin test results on prototypes.

Alternative methods for the determination of acceleration and loads may be taken into consideration by Tasneef also on the basis of model tests or experimental values measured on similar yachts, or generally accepted theories.

In such case a report is to be submitted giving details of the methods used and/or tests performed.

Pressures on panels and stiffeners may be considered as uniform and equal to the value assumed in the point of reference pdr as defined in [2.3].

2 Definitions and symbols

2.1 General

2.1.1 The definitions of the following symbols are valid for all of Part B. The meanings of those symbols which have specific validity are specified in the relevant Chapters or Sections.

2.2 Definitions

2.2.1 Displacement yacht

A yacht whose weight is fully supported by the hydrostatic forces.

In general, for the purposes of this Section, a displacement yacht is a craft having $V / L^{0,5} \le 4$.

2.2.2 Semi-planing yacht

A yacht that is supported partially by the buoyancy of the water it displaces and partially by the dynamic pressure generated by the bottom surface running over the water.

2.2.3 Planing yacht

A yacht in which the dynamic lift generated by the bottom surface running over the water supports the total weight of the yacht.

2.2.4 Chine

In hulls without a clearly visible chine, this is the point of the hull in which the tangent to the hull has an angle of 50° on the horizontal axis.

2.2.5 Bottom

The bottom is that part of the hull between the keel and the chines.

2.2.6 Side Shell

The side shell is that part of the hull between the chine and the highest continuous deck.

2.3 Symbols

2.3.1

β_x : Deadrise of the transverse section under consideration.

In hulls without a clearly visible deadrise, this is the angle formed by the horizontal axis and the straight line joining keel and chine.

Pp_{AV} : Forward perpendicular: perpendicular at the intersection of the full load waterline plane (with the yacht stationary in still water) and the fore side of the stem.

Pp_{AD} : Aft perpendicular: perpendicular at the intersection of the full load waterline plane (with the yacht stationary in still water) and the aft side of the sternpost or transom.

pdc : Design deck, intended as the first deck above the full load waterline, extending for at least 0,6 L and constituting an effective support for side structures.

pdr : Point of reference, intended as the lower edge of the plating panel or the centre of the area supported by the stiffener, depending on the case under consideration.

Δ : Displacement, in t, of the yacht at full load draught T. Where unknown, to be assumed equal to 0,42 · L · B · T.

C_B : Block coefficient, given by the relationship:

$$C_B = \frac{\Delta}{1,025 L \cdot B \cdot T}$$

C_S : Support contour of the yacht, in m, defined as the transverse distance, measured along the hull, from the chines to 0,5 L. For twin hull yachts, C_S is twice the distance measured along the single hull.

g : Acceleration of gravity = 9,81 m/s².

LCG : Longitudinal centre of gravity of the yacht; where unknown, to be taken as located in the section at 0,6 L from the Pp_{AV}.

a_{CG} : Maximum design value of vertical acceleration at LCG, in g, provided by the Designer based on an assessment of the service conditions (speed, significant wave height) envisaged in the design.

V : Maximum service speed, in knots.

- For x / L < 0,6

$q_{si} = q_{bi} = g_i \cdot a_{vi}$

where:

a_{vi} : total dimensionless vertical acceleration at the interval considered, calculated by the following formula:

$$a_{vi} = a_h + a_p \cdot (x_i - 0{,}5\ L)$$

a_h : acceleration due to heaving motion

a_p : acceleration due to pitching motion

a_h e a_p : are relative to g

a_h : $\frac{F_{SL}}{G} \cdot \left[\frac{r_0^2 - x_{SL} \cdot x_W}{r_0^2 - x_W^2}\right]$

a_p : $\frac{F_{SL}}{G} \cdot \left[\frac{x_{SL} - x_W}{r_0^2 - x_W^2}\right]$, in m^{-1}

- For x / L ≥ 0,6

$q_{si} = q_{bi} - q_{SLi}$

e) The impact induced sagging bending moment and shear force are to be obtained by integration of the load distribution q_{si} along the hull. They are to be added to the respective values calculated according to a) and b) in order to obtain the total bending moment and shear due to still water loads, wave induced loads and impact loads.

4.3 Design total vertical bending moment

4.3.1 The design total vertical bending moment Mt, in kNxm, is to be taken equal to the greater of the values indicated in [4.2.2] a) and b), for planing or semi-planing yachts. For displacement yachts, the value of MT is to be taken equal to the greater of those given in [4.2.2] (b).

4.4 Transverse loads for twin hull yachts

4.4.1 General

For catamarans, the hull connecting structures are to be checked for the load conditions specified in [4.4.2] and [4.4.3] below. These load conditions are to be considered as acting separately.

The design moments and forces given in the following paragraphs are to be used unless other values are verified by model tests, full-scale measurements or any other information provided by the Designer.

For yacht of length L > 65 m or speed V > 45 knots, or for yachts with structural arrangements that do not permit a realistic assessment of stress conditions based on simple models, the transverse loads are to be evaluated by means of direct calculations carried out in accordance with criteria specified in the individual Chapters or other criteria considered equivalent by Tasneef

4.4.2 Transverse bending moment and shear force

The transverse bending moment M_{bt} in kN.m, and shear force T_{bt}, in kN, are given by:

$$M_{bt} = \frac{\Delta \cdot b \cdot a_{CG} \cdot g}{5}$$

$$T_{bt} = \frac{\Delta \cdot a_{CG} \cdot g}{4}$$

where:

b : transverse distance, in m, between the centres of the two hulls;

a_{CG} : vertical acceleration at L_{CG}, defined in [3.1].

4.4.3 Transverse torsional connecting moment

The catamaran transverse torsional connecting moment, in kN.m, is given by:

$$M_{tt} = 0{,}125 \cdot \Delta \cdot L \cdot a_{CG} \cdot g$$

where a_{CG} is the vertical acceleration at L_{CG}, defined in [3.1], which need not be taken greater than 1,0 g for this calculation.

5 Local loads

5.1 General

5.1.1 The following loads are to be considered in determining the scantlings of hull structures:

- impact pressure due to slamming, if expected to occur;
- external pressure due to hydrostatic heads and wave loads;
- internal loads.

External pressure generally determines the scantlings of side and bottom structures, whereas internal loads generally determine the scantlings of deck structures.

Where internal loads are caused by concentrated masses of significant magnitude (e.g. tanks, machinery), the capacity of the side and bottom structures to withstand such loads is to be verified according to criteria stipulated by Tasneef In such cases, the inertial effects due to acceleration of the yacht are to be taken into account.

Such verification is to disregard the simultaneous presence of any external wave loads acting in the opposite direction to internal loads.

5.2 Load points

5.2.1 Pressure on panels and strength members may be considered uniform and equal to the pressure at the following load points:

- for panels:

  lower edge of the plate, for pressure due to hydrostatic head and wave load;
- for strength members:

  centre of the area supported by the element.

Where the pressure diagram shows cusps or discontinuities along the span of a strength member, a uniform value is to be taken on the basis of the weighted mean value of pressure calculated along the length of the member.

5.3 Design pressure for the bottom

5.3.1 Planing and semi-planing yachts

The design pressure p, in kN/m², for the scantlings of structures on the bottom of the hull, plating and stiffeners is to be assumed as equal to the greater of the values p_1 and p_2 defined as follows:.

$$p_1 = 0,24L^{0,5} \cdot \left(1 - \frac{h_0}{2T}\right) + 10 \cdot (h_0 + a \cdot L)$$

$$p_2 = 15 \cdot (1 + a_V) \cdot \frac{\Delta}{L \cdot C_S} \cdot g \cdot F_L \cdot F_1 \cdot F_a$$

h_0 : vertical distance, in m, from the pdr to the full load waterline;

a : coefficient function of the longitudinal position of pdr, equal to:

- 0,036 aft of 0,5 L
- 0,04/(C_B - 0,024) in way of Pp_{AV}
- values for intermediate positions obtained by linear interpolation;

F_L : coefficient given in Fig 3 as a function of the longitudinal position of the pdr;

F_1 : coefficient function of the shape and inclination of the hull to be taken ≥ 0,4 given by:

$$\left(F_1 = \frac{50 - \beta_X}{50 - \beta_{LCG}}\right) \geq 0,4$$

where b_{LCG} is the deadrise angle, in degrees, of the section in way of the L_{CG};

F_a : coefficient given by:

$$F_a = 0,30 - 0,15 \cdot \log\left(\frac{1,43 \cdot A_1 \cdot T}{\Delta}\right)$$

where A_1 is the surface, in m², of the plating panel considered or the surface of the area supported by the stiffener;

a_V : maximum design value of vertical acceleration, in g, at the transverse section considered.

The pressure p_1 is, in any case, not to be assumed as < 10 D.

5.3.2 Displacement yacths

For the purpose of the evaluation of the design pressure for the bottom, sailing yachts with or without auxiliary engine are also included as displacement yachts.

The pressure p, in kN/m², for the scantlings of hull structures, plating and stiffeners located below the full load waterline is to be taken as equal to the value p_1, defined as follows:

$$p_1 = 0,24L^{0,5} \cdot \left(1 - \frac{h_0}{2T}\right) + 10 \cdot (h_0 + a \cdot L)$$

where h_0 and a are as defined in [5.3.1].

The pressure p is, in any case, not to be assumed <10 D.

5.4 Design pressure for the side shell

5.4.1 Planing or semi-planing yachts

The pressure p, in kN/m², for the scantlings of side structures, plating and associated stiffeners is to be taken as equal to the value p_1, defined as follows:

$$p_1 = 66,25 \cdot (a + 0,024) \cdot (0,15L - h_0)$$

The pressure p_1 in any case, not to be assumed as < 10 h_1, where h_1 is as defined in [5.4.2].

For the zones located forward of 0,3 L from the Pp_{AV}, the value p is to be not less than the value p_2 defined as follows:

$$p_2 = C_1\{k_V \cdot [0,6 + sen\gamma \cdot \cos(90 - \alpha)] + C_2 \cdot L^{0,5} \cdot sen(90 - \alpha)\}^2$$

where:

a, h_0 : as defined in [5.3.1]

C_1 : coefficient given by Fig 4 as a function of the load surface A, in m², bearing on the element considered; for plating, A = 2,5s is to be taken

C_2 : coefficient given by Fig 5 as a function of C_B and the longitudinal position of the element considered

k_V : $0,625 \cdot L^{1/2} + 0,25V$

α : angle formed at the point considered by the side and the horizontal axis (see Fig 6)

γ : angle formed by the tangent at the waterline, corresponding to the draught T, taken at the point of intersection of the transverse section of the element considered, with the above waterline and the longitudinal straight line crossing the above intersection (see Fig 7).

The value p_2 may, in any case, be assumed as not greater than 0,5p, where p is the design pressure for the bottom as defined in [5.3.1], calculated at the section considered.

5.4.2 Displacement yacht

For the purpose of the evaluation of the design pressure for the side shell, sailing yachts with or without auxiliary engine are also included as displacement yachts.

The design pressure p, in kN/m², for the scantlings of side structures located above the full load waterline is to be taken as equal to the value p_1 defined as follows:

$$p_1 = 66,25 \cdot (a + 0,024) \cdot (0,15L - h_0)$$

essendo:

a, h_0 : as defined in [5.3.1]

h_1 : distance, in m, from the pdr to the straight line of the beam of the highest continuous deck.

The pressure p_1 in any case, not to be assumed as <10 h_1 .

5.5 Design heads for decks

5.5.1 *(1/7/2021)*

The design heads, h_d in m, for the various decks are shown in Table 1.

Sheltered areas are intended to mean decks intended for accommodation.

The design heads shown in Tab 1 assume a uniformly distributed load with mass density of 0,7 t/m³ and a consequent load per square metre of deck, in kN/m², equal to 6,9 h_d.

Where distributed loads with mass density greater or lower than the above are envisaged, the value h_{0d} will be modified accordingly.

In the case of decks subject to concentrated loads, the scantlings of deck structures (plating and stiffeners) will also need to be checked with the aforementioned loads.

SECTION 6 RUDDERS

Symbols

V_{AV} : maximum ahead service speed, in knots, with the ship on summer load waterline; if V_{AV} is less than 10 knots, the maximum service speed is to be taken not less than the value obtained from the following formula:

$$V_{MIN} = \frac{V_{AV} + 20}{3}$$

V_{AD} : maximum astern speed, in knots, to be taken not less than 0,5 V_{AV}

A : total area of the rudder blade, in m^2, bounded by the blade external contour, including the mainpiece and the part forward of the centreline of the rudder pintles, if any

k_1 : material factor, defined in [1.4.4]

k : material factor, defined in Ch 2, Sec 2, [2.3] (see also [1.4.6]

C_R : rudder force, in N, acting on the rudder blade, defined in [2.1.2]

M_{TR} : rudder torque, in N.m, acting on the rudder blade, defined in [2.1.3]

M_B : bending moment, in N.m, in the rudder stock, defined in [3.1.6].

1 General

1.1 Application

1.1.1 Ordinary profile spade rudders *(1/1/2020)*

The requirements of this Section apply to ordinary profile spade rudders made of steel, without any special arrangement for increasing the rudder force, whose maximum orientation at maximum ship speed is limited to 35° on each side.

In general, an orientation greater than 35° is accepted for manoeuvres or navigation at very low speed.

1.1.2 High lift profiles *(1/1/2020)*

The requirements of this Section also apply to rudders made of steel fitted with flaps to increase rudder efficiency. For these rudder types, an orientation at maximum speed less than 35° may be accepted. In these cases, the rudder forces are to be calculated by the Designer for the most severe combinations between orientation angle and ship speed. These calculations are to be considered by the Society on a case-by-case basis.

The rudder scantlings are to be designed so as to be able to sustain possible failures of the orientation control system, or, alternatively, redundancy of the system itself may be required.

1.1.3 Steering nozzles *(1/1/2020)*

The requirements for steering nozzles are given in [10].

1.1.4 Special rudder types *(1/1/2020)*

Rudders others than those in [1.1.1], [1.1.2] and [1.1.3] will be considered by the Society on a case-by- case basis.

1.2 Gross scantlings

1.2.1 *(1/1/2020)*

All scantlings and dimensions referred to in this Section are gross, i.e. they include the margins for corrosion.

1.3 Arrangements

1.3.1 *(1/1/2020)*

Effective means are to be provided for supporting the weight of the rudder without excessive bearing pressure, e.g. by means of a rudder carrier attached to the upper part of the rudder stock. The hull structure in way of the rudder carrier is to be suitably strengthened.

1.3.2 *(1/1/2020)*

Suitable arrangements are to be provided to prevent the rudder from lifting.

In addition, structural rudder stops of suitable strength are to be provided, except where the steering gear is provided with its own rudder stopping devices, as detailed in Pt C, Ch 1, Sec 10.

1.3.3 *(1/1/2020)*

In rudder trunks which are open to the sea, a seal or stuffing box is to be fitted above the deepest load waterline, to prevent water from entering the steering gear compartment and the lubricant from being washed away from the rudder carrier. If the top of the rudder trunk is below the deepest waterline two separate stuffing boxes are to be provided.

1.4 Materials

1.4.1 *(1/1/2020)*

Rudders made of materials others than steel will be considered by the Society on a case-by-case basis.

1.4.2 *(1/1/2020)*

Rudder stocks, pintles, coupling bolts, keys and cast parts of rudders are to be made of rolled steel, steel forgings or steel castings according to the applicable requirements in Part D, Chapter 2.

1.4.3 *(1/1/2020)*

The material used for rudder stocks, pintles, keys and bolts is to have a minimum yield stress not less than 200 N/mm^2.

1.4.4 *(1/1/2020)*

The requirements relevant to the determination of scantlings contained in this Section apply to steels having a minimum yield stress equal to 235 N/mm^2.

Where the material used for rudder stocks, pintles, coupling bolts, keys and cast parts of rudders has a yield stress different from 235 N/mm^2, the scantlings calculated with the formulae

$$a_k = \frac{5Q_F}{d_k R_{eH2}}$$

$$a_k = \frac{10Q_F}{d_k R_{eH2}}$$

5.3.4 Slugging nut *(1/1/2020)*

The cone coupling is to be secured by a slugging nut, whose dimensions are to be in accordance with the following formulae:

$d_G \geq 0,65$ du

$t_N \geq 0,60\ d_G$

$d_N \geq 1,2\ d_0$ and, in any case, $d_N \geq 1,5\ d_G$

where:

d_G, t_N, d_N, d_1, d_0:geometrical parameters of the coupling, defined in Fig 4.

The above minimum dimensions of the locking nut are only given for guidance, the determination of adequate scantlings being left to the Designer.

The nut is to be secured, e.g. by a securing plate as shown in Fig 4.

5.3.5 Push-up *(1/1/2020)*

It is to be proved that 50% of the design yield moment is solely transmitted by friction in the cone couplings. This can be done by calculating the required push-up pressure and push-up length according to Pt B, Ch 10, Sec 1, [5.4.3] and [5.4.4] of Tasneef Rules for a torsional moment $Q'_F = 0,5Q_F$.

5.3.6 Rudder torque transmitted entirely by the key *(1/1/2020)*

Notwithstanding the requirements in [5.3.3] and [5.3.5], where a key is fitted to the coupling between stock and rudder and it is considered that the entire rudder torque is transmitted by the key at the couplings, the scantlings of the key as well as the push-up force and push-up length are to be evaluated on a case by case basis. The general criteria for the scantlings of the key are given by the following formulae.

The shear area of the key, in cm², is not to be less than:

$$a_S = \frac{35,1Q_F}{d_k R_{eH1}}$$

The effective surface area, in cm², of the key (without rounded edges) between key and rudder stock or cone coupling is not to be less than:

5.4 Cone couplings between rudder stocks and rudder blades with special arrangements for mounting and dismounting the couplings

5.4.1 General *(1/1/2021)*

See Pt B, Ch 10, Sec 1, [5.4] of Tasneef Rules.

5.5 Vertical flange couplings

5.5.1 *(1/1/2021)*

See Pt B, Ch 10, Sec 1, [5.5] of Tasneef Rules.

5.6 Couplings by continuous rudder stock welded to the rudder blade

5.6.1 *(1/1/2021)*

When the rudder stock extends through the upper plate of the rudder blade and is welded to it, the thickness of this plate in the vicinity of the rudder stock is to be not less than $0,20\ d_{TF}$.

5.6.2 *(1/1/2021)*

The welding of the upper plate of the rudder blade with the rudder stock is to be made with a full penetration weld and is to be subjected to non-destructive inspection through dye penetrant or magnetic particle test and ultrasonic testing.

The throat weld at the top of the rudder upper plate is to be concave shaped to give a fillet shoulder radius as large as practicable. This radius is to be not less than $0,20\ d_{TF}$.

5.7 Skeg connected with rudder trunk

5.7.1 *(1/1/2020)*

See Pt C, Ch 1, Sec 1, [5.7] of Tasneef Rules.

6 Rudder stock bearings

6.1 General

6.1.1 *(1/7/2021)*

The mean bearing pressure acting on the rudder stock bearing is to be in compliance with the following formula:

$p_F \leq p_{F,ALL}$

where:

p_F : mean bearing pressure acting on the rudder stock bearings, in N/mm², equal to:

$$p_F = \frac{F_{A1}}{d_m h_m}$$

F_{A1} : force acting on the rudder stock bearing, in N, calculated as specified in 3.1.3,

d_m : actual inner diameter, in mm, of the rudder stock bearings,

h_m : bearing length, in mm. For the purpose of this calculation it is to be taken not greater than $1,2d_m$, for spade rudders,

$p_{F,ALL}$: allowable bearing pressure, in N/mm², defined in Tab 3.

Values greater than those given in Tab 3 may be accepted by the Society in accordance with the Manufacturer's specifications if they are verified by tests, but in no case more than 10 N/mm².

The ~~minimum thickness of the lower bearing is to be 0,2d$_{TF}$ and the~~ minimum height is to be at least d_m.

Table 3 : Allowable bearing pressure *(1/1/2020)*

Bearing material	$p_{F,ALL}$, in N/mm²
Lignum vitae	2,5
White metal, oil lubricated	4,5
Synthetic material with hardness between 60 and 70 Shore D **(1)**	5,5
Steel, bronze and hot-pressed bronze-graphite materials **(2)**	7,0

(1) Indentation hardness test at 23°C and with 50% moisture to be performed according to a recognised standard. Type of synthetic bearing materials is to be approved by the Society.
(2) Stainless and wear-resistant steel in combination with stock liner approved by the Society.

6.1.2 *(1/1/2020)*

An adequate lubrication of the bearing surface is to be ensured.

6.1.3 *(1/1/2020)*

The manufacturing tolerance t_0 on the diameter of metallic supports is to be not less than the value obtained, in mm, from the following formula:

$$t_0 = \frac{d_m}{1000} + 1$$

In the case of non-metallic supports, the tolerances are to be carefully evaluated on the basis of the thermal and distortion properties of the materials employed.

The tolerance on support diameter is to be not less than 1,5 mm, unless a smaller tolerance is supported by the manufacturer's recommendation and there is documented evidence of satisfactory service history with a reduced clearance.

6.1.4 *(1/1/2020)*

Liners and bushes are to be fitted in way of bearings. The minimum thickness of liners and bushes is to be equal to:

- t_{min} = 8 mm for metallic materials and synthetic material
- t_{min} = 22 mm for lignum material.

7 Rudder blade scantlings

7.1 General

7.1.1 Application *(1/1/2020)*

The requirements in [7.1] to [7.6] apply to streamlined rudders and, when applicable, to rudder blades of single plate rudders.

7.1.2 Rudder blade structure *(1/1/2020)*

The structure of the rudder blade is to be such that stresses are correctly transmitted to the rudder stock and pintles. To this end, horizontal and vertical web plates are to be provided.

Horizontal and vertical webs acting as main bending girders of the rudder blade are to be suitably reinforced.

7.1.3 Access openings *(1/1/2020)*

Streamlined rudders, including those filled with pitch, cork or foam, are to be fitted with plug-holes and the necessary devices to allow their mounting and dismounting.

If necessary, the rudder blade plating is to be strengthened in way of these openings.

The corners of openings intended for the passage of the rudder horn heel and for the dismantling of pintle or stock nuts are to be rounded off with a radius as large as practicable.

Where the access to the rudder stock nut is closed with a welded plate, a full penetration weld is to be provided.

7.2 Strength checks

7.2.1 Bending stresses *(1/1/2020)*

For the generic horizontal section of the rudder blade it is to be checked that the bending stress σ, in N/mm², induced by the loads defined in [3.1], is in compliance with the following formula:

$\sigma \le \sigma_{ALL}$

where:

σ_{ALL} : allowable bending stress, in N/mm², specified in Tab 4.

Table 4 : Allowable stresses for rudder blade scantlings *(1/1/2020)*

Allowable bending stress σ_{ALL} in N/mm²	Allowable shear stress τ_{ALL} in N/mm²	Allowable equivalentstress$\sigma_{E,ALL}$ in N/mm²
110/k	50/k	120/k

7.2.2 Shear stresses *(1/1/2020)*

For the generic horizontal section of the rudder blade it is to be checked that the shear stress τ, in N/mm², induced by the loads defined in [3.1], is in compliance with the following formula:

$\tau \le \tau_{ALL}$

where:

τ_{ALL} : allowable shear stress, in N/mm², specified in Tab 4.

7.2.3 Combined bending and shear stresses *(1/1/2020)*

For the generic horizontal section of the rudder blade it is to be checked that the equivalent stress σ_E is in compliance with the following formula:

$\sigma_E \le \sigma_{E,ALL}$

where:

σ_E : equivalent stress induced by the loads defined in [3.1], to be obtained, in N/mm², from the following formula:

APPENDIX 2 WATERTIGHT DOORS AND HATCHES: DESIGN AND TESTING CRITERIA

1 Watertight doors: design and testing criteria

1.1 Field of application

1.1.1

These requirements apply to the design, manufacturing and testing of watertight doors and associated manoeuvring systems.

They are essentially intended for sliding doors, but they are also applicable, as far as for the scantling and hydraulic test are concerned, to hinged doors.

As regards matters not explicitly dealt with in this Section the additional requirements given in Pt C for electrical systems are also to be applied.

1.2 Documentation to be submitted

1.2.1

Prior to starting the actual construction, the Manufacturer shall submit to Tasneef for approval the following drawings, diagrams and specifications, in triplicate:

a) Constructional drawings of the doors and associated accessories (guides, wedges, seals, frame, etc.); the drawings shall contain the constructional details of the components employed and shall indicate, inter alia, the type and characteristics of the materials employed, and the welding details and, for each door, the scantling hydrostatic head and the position on board foreseen for the door itself.

b) Diagrammatic plans of the hydraulic plant for the manoeuvring system. These plans shall indicate all the necessary information for their interpretation and verification and, in particular, the working and design pressures, the delivery of the pumps, the materials employed for the piping and fittings, and the dimensions of the pipes.

c) Constructional drawings of the manoeuvring hydraulic cylinders and of the pressure vessels. These drawings shall be complete with all dimensions and shall indicate, inter alia, the materials employed and any necessary information for their interpretation and verification.

d) Functional diagrams of power circuits, of control circuits from the navigating bridge, of signalling and alarm circuits, including specification of the type and characteristics of the equipment and specification of the electrical protection.

1.3 Scantlings of watertight bulkhead in way of watertight doors

1.3.1 Frames

When the frame is connected to the bulkhead by means of rivets or bolts, a thin heat-resisting seal is to be inserted between the frame and the bulkhead shell to assure watertightness.

Each side of the frame section is to have a moment of inertia J in cm^4, about the axis, through the centre of gravity, parallel to the door plane, not less than that given by the following formula:

$J = 27AB^3h$

where:

A = minor side of the clear door opening on the bulkhead, in m;

B = major side of the clear door opening on the bulkhead, in m;

h = water head resulting from the stability scantling, in m, measured from the door sill; this head is not to be taken less than 2 m.

Any stiffener on the bulkhead, fitted in way of the frame and surrounding the whole opening, together with the attached plating of the bulkhead, may be included in the calculation of the moment of inertia of the frame.

1.3.2 Bulkhead stiffeners

The bulkhead shell around the door opening is to be suitably reinforced by means of stiffeners, both vertical and horizontal.

The distance of such stiffeners from the outer edge of the door frame is generally to be not greater than 300 mm or less than 150 mm, and their scantlings are to be as required for the stiffeners of a watertight subdivision bulkhead, without taking into account the door frame and considering the door in closed position.

In way of the structure of connection of the door manoeuvring cylinder to the bulkhead, suitable local stiffeners are to be fitted, and the thickness of the bulkhead shell is to be increased, or a fastening plate is to be fitted.

1.4 Scantlings of watertight subdivision doors

1.4.1

The scantlings of the door shell and stiffeners, both horizontal and vertical, are to be in conformity with the requirements of Ch 2, Sec 10 for steel bulkheads.

1.5 Seals and wedges of sliding watertight doors

1.5.1 Seals

In general, door seals are to be of metallic material.

However, non-metallic materials may be employed, provided they are suitable for the application.

1.5.2 Wedges

The total number of fixed wedges on the door and on the frame, as well as their scantlings and shape, is to ensure a tightness of the seal such that the water leakage rate during the test does not exceed that stated in [9] .

value may be taken equal to 22,5 l/h if this value is greater than that calculated by the above-mentioned formula.

In special cases Tasneef may allow the hydraulic test to be carried out on board, with an agreed case-by-case test procedure.

During the tests, it is to be ascertained with a practical test that the door manoeuvring devices and systems are such as to allow the closure of the door with the ship listed by 15° on either side. The test may be carried out on board.

Moreover, the correct closure of the door, subjected to a water head of 1 m, is also to be ascertained with a practical test.

1.10.2 Testing of the manoeuvring systems

The testing of the manoeuvring systems consists of the following operations:

a) verification of compliance with the approved drawings;

b) testing of valves, pressure vessels (cylinders, tanks, accumulators, etc.), pumps, piping and associated fittings and electrical components in accordance with the relevant Rules;

c) hydrostatic pressure test of the system, at 1,5 times the maximum working pressure;

d) test in the working condition, as far as practical, in order to check the system functioning, safety devices included.

The tests foreseen in items (c) and (d) may be carried out on board.

1.11 Watertight door manoeuvring system tests on board

1.11.1

Watertight door manoeuvring systems are to be tested on board in order to ascertain their compliance with these Rules.

1.11.2

In particular, the following tests are to be carried out:

a) testing of the closure from the navigating bridge, with verification of the time necessary to carry out such closure;

b) testing of the closure of each door from the relevant manoeuvring position above the bulkhead deck, with verification of the time necessary to carry out such closure;

c) testing of opening and closure of each door from each side of the bulkhead, with verification of the time necessary to carry out the closure. The test is to be carried out both with power and with hand operation;

d) verification that the control handles which allow the opening of the door from each side of the bulkhead by power are so arranged as to enable persons passing through the doorway to hold both handles in the open position;

e) verification that, when released, the above-mentioned handles come back automatically to the position which ensures the closure of the door, if the door itself has been previously closed from the navigating bridge;

f) verification that the capacity of the hydraulic accumulators, if fitted, is sufficient to operate the connected doors at least three times, i.e. closed-open-closed, at the pump cut-in pressure;

g) testing of the indication and alarm systems.

1.12 Certification

1.12.1

A test certificate is to be issued for each door.

1.12.2

As an alternative to 12.1 for mass production products, a Type Approval Certificate for watertight doors may be issued.

A Tasneef Type Approval Certificate valid for 3 years can be obtained by the maker by testing a prototype according to the requirements given in [10] and [11].

The validity of the certificate in the course of the 3 years is subject to satisfactory results of shop trials witnessed by a Tasneef Surveyor; the periodicity and procedures are to be agreed with Tasneef on a case-by-case basis.

During the period of the Certificate's validity, and for the next appliances produced of the same type, the tests required by the Rules can be carried out by the maker, who will issue a Certificate of conformity to the prototype.

1.12.3

For the renewal of the Tasneef Type Approval Certificate, the tests that will be carried out are to be specified in a scheme that is to be agreed with Tasneef

2 Hatches, design and testing criteria

2.1 Documentation to be submitted

2.1.1

Prior to starting the actual construction, the Manufacturer shall submit to Tasneef for approval the following drawings, in triplicate:

- constructional drawings of the hatch and associated accessories (guides, wedges, seals, frame, etc.); the drawings shall contain the constructional details of the components employed and shall indicate, inter alia, the type and characteristics of the materials employed, and the welding details and, for each hatch, the scantling hydrostatic head and the position foreseen on board.

2.2 Hatch scantling

2.2.1

For the scantling requirements of the deck hatch, reference is to be made to Pt B, Ch 1, Sec 1 [5.5]

2.3 Testing of Hatch

2.3.1 *(1/7/2021)*

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 30 min with an outside water pressure of at least:

1,3 p

or

14 KPa

whichever is greater, where:

p is the deck design pressure in kPa corresponding to the deck head h_d specified in Pt B, Ch 1, Sec 5, [5.5].

SECTION 7 DOUBLE BOTTOM

1 General

1.1

1.1.1 This Section stipulates the criteria for the structural scantlings of a double bottom, which may be of either longitudinal or transverse type.

The longitudinal type structure is made up of ordinary reinforcements placed longitudinally, supported by floors.

The fitting of a double bottom with longitudinal framing is recommended for planing and semi-planing yachts.

1.1.2 *(1/7/2021)*

The fitting of a double bottom extending from the collision bulkhead to the forward bulkhead in the machinery space, or as near thereto as practicable, is requested for yachts of L > or = 50 m.

On yachts of L > 61 m a double bottom is to be fitted outside the machinery space extending, as far as practicable, forward to the collision bulkhead and aft to the after peak bulkhead.

On yachts of L > 76 m the double bottom is to extend, as far as this is practicable, throughout the length of the yacht.

The double bottom is to extend transversely to the side so as to protect the bottom in the bilge area, as far as possible.

The double bottom may be avoided if the vessel satisf~~y~~ies what required in Ch.II-1 part B-2 Regulation 9 SOLAS'74 as amended. For yachts of less than 80 m in load line length, the alternative arrangements to provide a level of safety may be limited to compartments not having a double bottom or having a double bottom arrangement not in line with what required below. In these cases compliance with the bottom damage standard may be carried out assuming that the damage will only occur between the transverse watertight bulkheads in compartments not having a double bottom or having a double bottom not in line with what below.

1.1.3 The dimensions of the double bottom, and in particular the height, are to be such as to allow access for inspection and maintenance.

In floors and in side girders, manholes are to be provided in order to guarantee that all parts of the double bottom can be inspected at least visually.

The height of manholes is generally to be not greater than half the local height in the double bottom. When manholes with greater height are fitted, the free edge is to be reinforced by a flat iron bar or other equally effective reinforcements are to be arranged.

Manholes are not to be placed in the continuous centre girder, or in floors and side girders below pillars, except in special cases at the discretion of Tasneef

1.1.4 Openings are to be provided in floors and girders in order to ensure down-flow of air and liquids in every part of the double bottom.

Holes for the passage of air are to be arranged as close as possible to the top and those for the passage of liquids as close as possible to the bottom.

Bilge wells placed in the inner bottom are to be watertight and limited as far as possible in height and are to have walls and bottom of thickness not less than that prescribed for inner bottom plating.

In zones where the double bottom varies in height or is interrupted, tapering of the structures is to be adopted in order to avoid discontinuities.

2 Minimum height

2.1

2.1.1 The height of the double bottom is to be sufficient to allow access to all areas and, in way of the centre girder, is to be not less than the value h_{DF}, in mm, obtained from the following formula:

$$h_{df} = 28B + 32(T + 10)$$

The height of the double bottom is, in any event, to be not less than 700 mm. For yachts less than 50 m in length, Tasneef may accept reduced height.

3 Inner bottom plating

3.1

3.1.1 *(1/1/2019)*

The thickness of the inner bottom plating is to be not less than the value t_1, in mm,calculated with the following formula:

$$t_1 = (0,04L + 5s + 1)k^{0,5}$$

dove:

s : spacing of the ordinary stiffeners, in m.

For yachts of length L ≤ less than 50 m, the thickness is to be maintained throughout the length of the hull.

For yachts of length L > or = 50 m, the thickness may be gradually reduced outside 0,4 L amidships so as to reach a value no less than 0,9 t_1 at the ends.

Where the inner bottom forms the top of a tank intended for liquids, the thickness of the top is also to comply with the provisions of Sec 10.

4 Centre girder

4.1

4.1.1

A centre girder is to be fitted, as far as this is practicable, throughout the length of the hull.

SECTION 1 GENERAL REQUIREMENTS

1 Field of application

1.1

1.1.1 Chapter 3 of Section B applies to monohull yachts with hulls made of aluminium alloy and a length L not exceeding 90 m, with motor or sail power with or without auxiliary engines.

Multi-hulls or hulls with a greater length will be considered case-by-case.

In the examination of constructional plans, Tasneef may take into consideration material distribution and structural scantlings other than those that would be obtained by applying these regulations, provided that structures with longitudinal, transverse and local strength not less than that of the corresponding Rule structure are obtained or provided that such material distribution and structural scantlings prove adequate, in the opinion of Tasneef on the basis of direct test calculations of the structural strength.

The formulae indicated in this Chapter are based on use of an aluminium alloy having yield strength, in the welded condition, $R_{p\,0,2}$ = 110 N/mm^2 (corresponding to a permanent elongation of 0,2%).

The scantlings of structures made with light alloys having different values of yield strength are obtained taking into account coefficient K as defined in Section 2.

2 Definitions and symbols

2.1 Premise

2.1.1 The definitions and symbols in this Article are valid for all the Sections of this Chapter.

The definitions of symbols having general validity are not normally repeated in the various Sections, whereas the meanings of those symbols which have specific validity are specified in the relevant Sections.

2.2 Definitions and symbols

2.2.1

L : scantling length, in m, on the full load waterline, assumed to be equal to the length on the full load waterline with the yacht at rest;

B : maximum breadth of the yacht, in m, outside frames; in tests of the longitudinal strength of twin hull yachts, B is to be taken as equal to twice the breadth of the single hull, measured immediately below the cross-deck;

D : depth of the yacht, in m, measured vertically in the transverse section at half the length L, from the base line up to the deck beam of the uppermost continuous deck;

T : draught of the yacht, in m, measured vertically in the transverse section at half the length L, from the base line to the full load waterline with the yacht at rest in calm water;

s : spacing of the longitudinal or transverse ordinary stiffener, in m;

Δ : displacement of the yacht outside frames, in t, at draught T;

K : factor as a function of the mechanical properties of the aluminium alloy used, as defined in Sec 2.

3 Plans, calculations and other information to be submitted

3.1

3.1.1 Table 1 lists the structural plans that are to be presented in advance to Tasneef in triplicate, for examination and approval when required.

The table also indicates the information that is to be supplied with the plans or, in any case, submitted to Tasneef for the examination of the documentation.

For documentation purposes, copies of the following plans are to be submitted:

- general arrangement;
- capacity plan;
- lines plan;

In the design, care is to be taken in order to avoid structural discontinuities in particular in way of the ends of superstructures and of the openings on the deck or side of the yacht.

For yachts similar in performance to high speed craft, a longitudinal structure with reinforced floors, placed at a distance of not more than 2 m, is required for the bottom.

Such interval is to be suitably reduced in the areas forward of amidships subject to the forces caused by slamming.

6 Minimum thicknesses

6.1

6.1.1 In general, the thicknesses of plating stiffeners and cores of reinforced beams is to be not less than the minimum values shown in Table 2.

Lesser thicknesses may be accepted provided that, in the opinion of Tasneef their adequacy in terms of buckling strength and resistance to corrosion is demonstrated.

Where plating and stiffeners contribute to the longitudinal strength of the yacht, their scantlings are to be such as to fulfil the requirements for yacht longitudinal strength stipulated in Sec 4.

Table 2

Member	Minimum thickness (mm)
Keel, bottom plating	$t_1 = 1,75 \cdot L^{1/3} \cdot K^{0,5}$
Side plating	$t_2 = 1,50 \cdot L^{1/3} \cdot K^{0,5}$
Open strength deck plating	$t_3 = 1,50 \cdot L^{1/3} \cdot K^{0,5}$
Lower and enclosed deck plating	$t_4 = t_3 - 0,5$
1st tier superstructure front bulkhead	$t_5 = t_1$
Superstructure bulkhead	$t_6 = t_5 - 1,5$
Watertight subdivision bulkhead	$t_7 = t_2 - 0,5$
Tank bulkhead	$t_8 = t_2$
Centre girder	$t_9 = 2,3 \cdot L^{1/3} \cdot K^{0,5}$
Floors and side girders	$t_{10} = 1,70 \cdot L^{1/3} \cdot K^{0,5}$
Tubular pillars	$t_{11} = 0,05$ d **(1)**
(1) d = diameter of the pillar, in mm	

7 Plating attached to griders

7.1 Primary supporting members

7.1.1 *(1/1/2020)*

The section modulus and the moment of inertia of primary supporting members are to be calculated in association with an effective area A_S, in cm², of attached load bearing plating obtained from the following:

$$A_S = 10c \cdot b_F \cdot t_S$$

where:

$$\text{for } \mathbf{S_L/b_F} < 8 : \mathbf{c} = 0,25 \cdot \left(\frac{\mathbf{S_L}}{\mathbf{b_F}}\right) - 0,016 \cdot \left(\frac{\mathbf{S_L}}{\mathbf{b_F}}\right)^2$$

$$\text{for } \mathbf{S_L/b_F} \geq 8 : \mathbf{c} = 1$$

where:

Girders : primary supporting members of ordinary stiffeners such as deck girders, beams and web frames, side stringers, vertical and horizontal girders of bulkheads, floors, centre and side bottom girders, and similar.

Ordinary stiffeners: supporting members of shell plating, decks, double bottom or tank top plating, bulkheads, and similar.

$\mathbf{S_L}$: overall length of the girder, in m

$\mathbf{b_F}$: actual width of the load bearing plating, i.e. one-half of the sum of the spaces between parallel stiffeners adjacent to that considered, in m

$\mathbf{t_s}$: mean thickness, in mm, of the attached plating

$\mathbf{A_s}$: area of the attached plating, in cm²

$\mathbf{t_a}$: web thickness, in mm, in built sections

$\mathbf{d_a}$: web depth in built sections, measured between the inside of the face plate and the inside of the attached plating, in mm

7.2 Ordinary stiffeners

7.2.1 *(1/1/2020)*

Unless otherwise stated in specific requirements, the section modulus and the moment of inertia of the ordinary stiffeners are to be calcolated in association with an effective load bearing plating having width equal to the spacing of the stiffeners and thickness equal to the mean thickness of the attached plating.

7.3 Special cases

7.3.1 *(1/1/2020)*

In way of fore and aft regions and, in general, where the web of the section is at an angle a less than 90° to the attached plating, the section modulus shall be calculated taking account of the inclination of the attached plating.

Where the above angle α is less than 75°, the section modulus of the stiffener may be approximately calculated by multiplying the section modulus of the web fitted at right angles to the attached plating by cos (90 - α).

7.4 Calculation of section modulus

7.4.1 Primary supporting members *(1/1/2020)*

The section modulus $\mathbf{W_T}$, in cm³, of a built section with attached plating of area $\mathbf{A_S}$, in cm², may be calculated using the following formula:

$$\mathbf{W_T} = \frac{\mathbf{A_p} \cdot \mathbf{d_a}}{10} + \frac{\mathbf{t_S} \cdot \mathbf{d_a^2}}{6000} \cdot \left(1 + \frac{200 \cdot (\mathbf{A_S} - \mathbf{A_p})}{200\mathbf{A_S} + \mathbf{t_a} \cdot \mathbf{d_a}}\right)$$

In cases of symmetrical sections, the section modulus may be calculated as follows:

$$W_T = \frac{A_P \cdot d_A}{10} + \frac{t_a \cdot d^2_a}{6000}$$

As a rule A_S is to be greater than A_p; in this respect, the thickness of the attached plating is to be increased accordingly where necessary.

A_a : web area, in cm², in built sections

b_p : face plate width, in mm, in built sections

A_a : face plate area, in cm², in built sections

In the case of members located along the edge of openings, the effective area of the attached plating is to be assumed equal to 7/10 of the value of A_S calculated by assuming b_F equal to half the distance between the member considered and its adjacent member.

Table 3 (1/1/2020)

Member	Minimum thickness (mm)
Keel, bottom plating	$t_1 = 1,35 \cdot L^{1/3} \cdot K^{0,5}$
Side plating	$t_2 = 1,15 \cdot L^{1/3} \cdot K^{0,5}$
Open strength deck plating	$t_3 = 1,15 \cdot L^{1/3} \cdot K^{0,5}$
Lower and enclosed deck plating	$t_4 = t_3 - 0,5$
1st tier superstructure front bulkhead	$t_5 = t_4$
Superstructure bulkhead	$t_6 = t_5 - 1$
Watertight subdivision bulkhead	$t_7 = t_2 - 0,5$
Tank bulkhead	$t_8 = t_2$
Centre girder	$t_9 = 1,75 \cdot L^{1/3} \cdot K^{0,5}$
Floors and side girders	$t_{10} = 1,30 \cdot L^{1/3} \cdot K^{0,5}$
Tubular pillars	$0,03\ d \cdot K^{0,5} \geq 3,0$ (1)
(1) d = diameter of the pillar, in mm	

SECTION 7 DOUBLE BOTTOM

1 General

1.1

1.1.1 This Section stipulates the criteria for the structural scantlings of a double bottom, which may be of either longitudinal or transverse type.

The longitudinal type structure is made up of ordinary reinforcements placed longitudinally, supported by floors.

The fitting of a double bottom with longitudinal framing is recommended for planing and semi-planing yachts.

1.1.2 *(1/7/2021)*

The fitting of a double bottom extending from the collision bulkhead to the forward bulkhead in the machinery space, or as near thereto as practicable, is requested for yachts of L > or = 50 m.

On yachts of L > 61 m a double bottom is to be fitted outside the machinery space extending, as far as possible, forward to the collision bulkhead and aft to the after peak bulkhead.

On yachts of L > 76 m the double bottom is to extend, as far as possible, throughout the length of the yacht.

The double bottom is to extend transversely to the side so as to protect the bottom in the bilge area, as far as possible.

The double bottom may be avoided if the vessel satisf~~y~~ies what required in Ch.II-1 part B-2 Regulation 9 SOLAS'74 as amended. For yachts of less than 80 m in load line length, the alternative arrangements to provide a level of safety may be limited to compartments not having a double bottom or having a double bottom arrangement not in line with what required below. In these cases compliance with the bottom damage standard may be carried out assuming that the damage will only occur between the transverse watertight bulkheads in compartments not having a double bottom or having a double bottom not in line with what below.

1.1.3 The dimensions of the double bottom, and in particular the height, are to be such as to allow access for inspection and maintenance.

In floors and in side girders, manholes are to be provided in order to guarantee that all parts of the double bottom can be inspected at least visually.

The height of manholes is generally to be not greater than half the local height in the double bottom. When manholes with greater height are fitted, the free edge is to be reinforced by a flat iron bar or other equally effective reinforcements are to be arranged.

Manholes are not to be placed in the continuous centre girder, or in floors and side girders below pillars, except in special cases at the discretion of Tasneef

1.1.4 Openings are to be provided in floors and girders in order to ensure down-flow of air and liquids in every part of the double bottom.

Holes for the passage of air are to be arranged as close as possible to the top and those for the passage of liquids as close as possible to the bottom.

Bilge wells placed in the inner bottom are to be watertight and limited as far as possible in height and are to have walls and bottom of thickness not less than that prescribed for inner bottom plating.

In zones where the double bottom varies in height or is interrupted, tapering of the structures is to be adopted in order to avoid discontinuities.

2 Minimum height

2.1

2.1.1 The height of the double bottom is to be sufficient to allow access to all areas and, in way of the centre girder, is to be not less than the value h_{DF}, in mm, obtained from the following formula:

$$h_{df} = 28B + 32(T + 10)$$

The height of the double bottom is, in any event, to be not less than 700 mm. For yachts less than 50 m in length, Tasneef may accept reduced height.

3 Inner bottom plating

3.1

3.1.1 *(1/1/2019)*

The thickness of the inner bottom plating is to be not less than the value t_1, in mm, calculated with the following formula:

$$t_1 = 1,4(0,04L + 5s + 1)k$$

where:

s : spacing of the ordinary stiffeners, in m.

For yachts of length L less than 50 m, the thickness is to be maintained throughout the length of the hull.

For yachts of length L > or = 50 m, the thickness may be gradually reduced outside 0,4 L amidships so as to reach a value no less than 0,9 t_1 at the ends.

Where the inner bottom forms the top of a tank intended for liquids, the thickness of the top is also to comply with the provisions of Sec 10.

4 Centre girder

4.1

4.1.1

A centre girder is to be fitted, as far as this is practicable, throughout the length of the hull.

SECTION 3 CONSTRUCTION AND QUALITY CONTROL

1 Shipyards or workshops

1.1 General

1.1.1 All constructions are to be built using materials and working processes approved or accepted by Tasneef

The builder is to obtain approval or acceptance for the materials he uses; furthermore, it is the builder's responsibility to ensure that all the materials are used in accordance with the Manufacturer's instructions and recommendations.

Shipyards or workshops for hull construction are to be suitably equipped to provide the necessary working environment according to these requirements, which are to be complied with for the recognition of the shipyard or workshop as suitable for the construction of hulls in reinforced plastic. This suitability is to be ascertained by a Tasneef Surveyor, the responsibility for the fulfilment of the requirements specified below as well as all other measures for the proper carrying out of construction being left to the shipyard or workshop.

When it emerges from the tests carried out that the shipyard or workshop complies with the following provisions, uses type approved materials, and has a system of production and quality control that satisfies the Tasneef Rules, so as to ensure a consistent level of quality, the shipyard or workshop may obtain from Tasneef a special recognition of suitability for the construction of reinforced plastic hulls.

The risks of contamination of the materials are to be reduced as far as possible; separate zones are to be provided for storage and for manufacturing processes. Alternative arrangements of the same standard may be adopted.

Compliance with the requirements of this Section does not exempt those in charge of the shipyard or workshop from the obligation of fulfilling all the hygiene requirements for work stipulated by the relevant authorities.

1.2 Moulding shops

1.2.1 Where hand lay-up or spray lay-up processes are used for the manufacture of laminates, a temperature of between 16° and 32°C is to be maintained in the moulding shop during the lay-up and polymerisation periods. Small variations in temperature may be allowed, at the discretion of the Tasneef Surveyor, always with due consideration being given to the resin Manufacturer's recommendations. Where moulding processes other than those mentioned above are used, the temperatures of the moulding shop are to be established accordingly.

The relative humidity of the moulding shop is to be kept as low as possible, preferably below 70%, and in any case lower than the limit recommended by the resin Manufacturer. Significant changes in humidity, such as would lead to condensation on moulds and materials, are to be avoided.

Instruments to measure the humidity and temperature are to be placed in sufficient number and in suitable positions. If necessary, due to environmental conditions, an instrument capable of providing a continuous readout and record of the measured values may be required.

Ventilation systems are not to cause an excessive evaporation of the resin monomer and draughts are to be avoided.

The work areas are to be suitably illuminated. Precautions are to be taken to avoid effects on the polymerisation of the resin due to direct sunlight or artificial light.

1.3 Storage areas for materials

1.3.1 Resins are to be stored in dry, well-ventilated conditions at the temperature recommended by the resin Manufacturer. If the resins are stored in tanks, it is to be possible to stir them at a frequency for a length of time indicated by the resin Manufacturer. When the resins are stored outside the moulding shop, they are to be brought into the shop in due time to reach the working temperature required before being used.

Catalysts and accelerators are to be stored separately in clean, dry and well-ventilated conditions in accordance with the Manufacturer's recommendations.

Fillers and additives are to be stored in closed containers that are impervious to dust and humidity.

Reinforcements, e.g. glass fibre, are to be stored in dust-free and dry conditions, in accordance with the Manufacturer's recommendations. When they are stored outside the cutting area, the reinforcements are to be brought into the latter in due time so as to reach the temperature of the moulding shop before being used.

Pre-impregnated reinforcements are to be stored in an area set aside for the purpose. The quality control documentation is to keep a record of the storage and depletion of the stock of such reinforcements.

Materials for the cores of sandwich type structures are to be stored in dry areas and protected against damage; they are to be stored in their protective covering until they are used.

1.4 Identification and handling of materials

1.4.1 In the phases of reception and handling the materials are not to suffer contamination or degradation and are to bear adequate identification marks at all times, including those relative to Tasneef type approval. Storage is to be so arranged that the materials are used, whenever possible, in chronological order of receipt. Materials are not to be used after the Manufacturer's date of expiry, except when the latter has given the hull builder prior written consent.

2 Hull construction processes

2.1 General

2.1.1 The general requirements for the construction of hand lay-up or spray lay-up laminates are set out below; processes of other types (e.g. by resin transfer, vacuum or pressurised moulding with mat and continuous filaments) are to be individually recognised as suitable by Tasneef

2.2 Moulds

2.2.1 Moulds for production of laminates are to be constructed with a suitable material which does not affect the resin polymerisation and are to be adequately stiffened in order to maintain their shape and precision in form. They are also not to prevent the finished laminate from being released, thus avoiding cracks and deformations.

During construction, provision is to be made to ensure satisfactory access such as to permit the proper carrying out of the laminating.

Moulds are to be thoroughly cleaned, dried and brought to the moulding shop temperature before being treated with the mould release agents, which are not to have an inhibiting effect on the gel coat resin.

2.3 Laminating

2.3.1 The gel coat is to be applied by brush, roller or spraying device so as to form a uniform layer with a thickness of between 0,4 and 0,6 mm. Furthermore, it is not to be left exposed for longer than is recommended by the Manufacturer before the application of the first layer of reinforcement.

A lightweight reinforcement, generally not exceeding a mass per area of 300 g/m^2, is to be applied to the gel coat itself by means of rolling so as to obtain a content of reinforcement not exceeding approximately 0,3.

In the case of hand lay-up processing, the laminates are to be obtained with the layers of reinforcement laid in the sequence indicated in the approved drawings and each layer is to be thoroughly "wet" in the resin matrix and compacted to give the required weight content.

The amount of resin laid "wet on wet" is to be limited to avoid excessive heat generation.

Laminating is to be carried out in such a sequence that the interval between the application of layers is within the limits recommended by the resin Manufacturer.

Similarly, the time between the forming and bonding of structural members is to be kept within these limits; where this is not practicable, the surface of the laminate is to be treated with abrasive agents in order to obtain an adequate bond.

When laminating is interrupted so that the exposed resin gels, the first layer of reinforcement subsequently laid is to be of mat type.

Reinforcements are to be arranged so as to maintain continuity of strength throughout the laminate. Joints between the sections of reinforcement are to be overlapped and staggered throughout the thickness of the laminate.

In the case of simultaneous spray lay-up of resin and cut fibres, the following requirements are also to be complied with:

- before the use of the simultaneous lay-up system, the Manufacturer is to satisfy himself of the efficiency of the equipment and the competence of the operator;
- the use of this technique is limited to those parts of the structure to which sufficiently good access may be obtained so as to ensure satisfactory laminating;
- before use, the spray lay-up equipment is to be calibrated in such a way as to provide the required fibre content by weight; the spray gun is also to be calibrated, according to the Manufacturer's instruction manual, such as to obtain the required catalyst content, the general spray conditions and the appropriate length of cut fibres. Such length is generally to be not less than 35 mm for structural laminates, unless the mechanical properties are confirmed by tests; in any event, the length of glass fibres is to be not less than 25 mm;
- the calibration of the lay-up system is to be checked periodically during the operation;
- the uniformity of lamination and fibre content is to be systematically checked during production.

The manufacturing process for sandwich type laminates is taken into consideration by Tasneef in relation to the materials, processes and equipment proposed by the Manufacturer, with particular regard to the core material and to its lay-up as well as to details of connections between prefabricated parts of the sandwich laminates themselves. The core materials are to be compatible with the resins of the surface laminates and suitable to obtain strong adhesion to the latter (Manufacturer's instructions to be followed).

Attention is drawn, in particular, to the importance of ensuring the correct carrying out of joints between panels.

Where rigid core materials are used, then dry vacuum bagging techniques are to be adopted. Particular care is to be given to the core bonding materials and to the holes provided to ensure efficient removal of air under the core. Bonding paste is to be visible at these holes after vacuum bagging.

2.4 Hardening and release of laminates

2.4.1 On completion of the laminating, the laminate is to be left in the mould for a period of time to allow the resin to harden before being removed. This period may vary, depending on the type of resin and the complexity of the laminate, but is to be at least 24 hours, unless a different period is recommended by the resin Manufacturer.

The hull, deck and large assemblies are to be adequately braced and supported for removal from the moulds as well as during the fitting-out period of the yacht.

After the release and before the application of any special post-hardening treatment, which is to be examined by Tasneef the structures are to be stabilised in the moulding environment for the period of time recommended by the resin Manufacturer. In the absence of recommendations, the period is to be at least 24 hours.

2.5 Defects in the laminates

2.5.1 The manufacturing processes of laminates are to be such as to avoid defects, such as in particular: surface cracks, surface or internal blistering due to the presence of air bubbles, cracks in the resin for surface coating, internal areas with non-impregnated fibres, surface corrugation, and surface areas without resin or with glass fibre reinforcements exposed to the external environment.

Any defects are to be eliminated by means of appropriate repair methods to the satisfaction of the Tasneef Surveyor.

Dimensions and tolerances are to conform to the approved construction documentation.

2.5.2 The responsibility for maintaining the required tolerances rests with the builder.

Monitoring and random checking by the Surveyor does not absolve the builder from this responsibility.

2.6 Checks and tests

2.6.1 Checks and tests are to be arranged during the lamination process by the hull builder, in accordance with the relevant quality system, and by the Tasneef Surveyor.

The hull builder is to maintain a constant check on the laminate.

Any defects found are to be eliminated immediately.

In general the following checks and tests are to be carried out:

a) check of the mould before the application of the release agent and of the gel coat;

b) check of the thickness of the gel coat and the uniformity of its application;

c) ~~e)~~ check of the resin and the amount of catalyst, accelerator, hardener and various additives;

d) check of the uniformity of the impregnation of reinforcements, their lay-up and superimposition;

e) check and recording of the percentage of the reinforcement in the laminate;

f) checks of any post-hardening treatments;

g) general check of the laminate before release from the mould;

h) check and recording of the laminate hardness before release from the mould;

i) check of the thickness of the laminate which, in general, is not to differ by more than 15% from the thickness indicated in approved structural plans;

j) mechanical tests on laminates taken from the hull or prepared during the lamination of the hull (in accordance with Pt D, Ch 6, Sec 3).

The thicknesses of the laminates are, in general, to be measured at not less than ten points, evenly distributed across the surface.

The above-mentioned checks and tests are to be carried out, as a rule, in the presence of a Tasneef Surveyor; where the shipyard has a system of production organisation and quality control certified by Tasneef the checks may be carried out directly by the shipyard without the presence of a Tasneef Surveyor.

2.6.2 Where ultrasonic thickness gauges are used, relevant tools are to be calibrated against an identical laminate (of measured thickness).

2.6.3 As a general rule, a method of validating the complete laminate thickness is to be agreed between the builder and the Surveyor.

SECTION 7 DOUBLE BOTTOM

1 General

1.1

1.1.1 This Section stipulates the criteria for the structural scantlings of a double bottom, which may be of either longitudinal or transverse type.

The longitudinal type structure is made up of ordinary reinforcements placed longitudinally, supported by floors.

The fitting of a double bottom with longitudinal framing is recommended for planing and semi-planing yachts.

1.1.2 *(1/7/2021)*

The fitting of a double bottom extending from the collision bulkhead to the forward bulkhead of the machinery space, or as near thereto as practicable, is requested for yachts of L > or = 50 m.

The double bottom may be avoided if the vessel satisfyies what required in Ch.II-1 part B-2 Regulation 9 SOLAS'74 as amended. For yachts of less than 80 m in load line length, the alternative arrangements to provide a level of safety may be limited to compartments not having a double bottom or having a double bottom arrangement not in line with what required below. In these cases compliance with the bottom damage standard may be carried out assuming that the damage will only occur between the transverse watertight bulkheads in compartments not having a double bottom or having a double bottom not in line with what below.

1.1.3 The dimensions of the double bottom, and in particular the height, are to be such as to allow access for inspection and maintenance.

In floors and in side girders, manholes are to be provided in order to guarantee that all parts of the double bottom can be inspected at least visually.

The height of manholes is generally to be not greater than half the local height in the double bottom. When manholes with greater height are fitted, the free edge is to be reinforced by a flat iron bar or other equally effective reinforcements are to be arranged.

Manholes are not to be placed in the continuous centre girder, or in floors and side girders below pillars, except in special cases at the discretion of Tasneef

1.1.4 Openings are to be provided in floors and girders in order to ensure down-flow of air and liquids in every part of the double bottom.

Holes for the passage of air are to be arranged as close as possible to the top and those for the passage of liquids as close as possible to the bottom.

The edges of the holes are to be suitably sealed in order to prevent the absorption of liquid into the laminate.

Bilge wells placed in the inner bottom are to be watertight and limited as far as possible in height and are to have walls and bottom of thickness not less than that prescribed for inner bottom plating.

In zones where the double bottom varies in height or is interrupted, tapering of the structures is to be adopted in order to avoid discontinuities.

2 Minimum height

2.1

2.1.1 The height of the double bottom is to be sufficient to allow access to all areas and, in way of the centre girder, is to be not less than the value h_{dF}, in mm, obtained from the following formula:

$$h_{df} = 28B + 32(T + 10)$$

The height of the double bottom is, in any event, to be not less than 700 mm. For yachts less than 50 m in length, Tasneef may accept reduced height.

3 Inner bottom plating

3.1

3.1.1 *(1/1/2019)*

The thickness of the inner bottom plating is to be not less than the value t_1, in mm, calculated with the following formula:

$$t_1 = 1,3(0,04L + 5s + 1)k_{of} \text{ for single-skin laminate}$$

$$t_1 = (0,04L + 5s + 1)k_{of} \text{ for sandwich laminate}$$

where:

s : spacing of the ordinary stiffeners, in m

k_{of} : coefficients for the properties of the material defined in Sec 2.

For yachts of length L less than 50 m, the thickness is to be maintained throughout the length of the hull.

For yachts of length L > or = 50 m, the thickness may be gradually reduced outside 0,4 L amidships so as to reach a value no less than 0,9 t_1 at the ends.

Where the inner bottom forms the top of a tank intended for liquids, the thickness of the top is also to comply with the provisions of Sec 10.

4 Centre girder

4.1

4.1.1 A centre girder is to be fitted, as far as this is practicable, throughout the length of the hull.

The thickness, in mm, of the core of a sandwich type centre girder is to be not less than the following value t_{pc}:

$$t_{pc} = (0,125L + 3,5)k_{of}$$

SECTION 6 MAIN PROPULSION SHAFTING

1 General

1.1 Application

1.1.1 This Section applies to shafts, couplings, clutches and other shafting components transmitting power for main propulsion.

1.2 Documentation to be submitted

1.2.1 The Manufacturer is to submit to Tasneef the documents listed in Tab 1 for approval.

Plans of power transmitting parts and shaft liners listed in Tab 1 are to include the relevant material specifications.

2 Design and construction

2.1 Materials

2.1.1 General

The use of other materials or steels having values of tensile strength exceeding the limits given in [2.1.2], [2.1.3] and [2.1.4] will be considered by Tasneef in each case.

2.1.2 Shaft materials

In general, shafts are to be of forged steel having tensile strength, R_m, between 400 and 930 N/mm^2.

Table 1 : Documentation to be submitted

No	Document (drawings, calculations, etc.)
1	Shafting arrangement **(1)**
2	Thrust shaft
3	Intermediate shafts (if any)
4	Propeller shaft
5	Shaft liners, relevant manufacture and welding procedures, if any
6	Couplings and coupling bolts
7	Flexible couplings **(2)**
8	Sterntube
9	Details of sterntube glands
10	Oil piping diagram for oil lubricated propeller shaft bearings
11	Shaft alignment calculation; see also [3.3]

(1) This drawing is to show the entire shafting, from the main engine coupling flange to the propeller. The location of the thrust block, and the location and number of shafting bearings (type of material and length) are also to be shown.

(2) The Manufacturer of the elastic coupling is also to submit the following data:
- allowable mean transmitted torque (static) for continuous operation
- maximum allowable shock torque
- maximum allowable speed of rotation
- maximum allowable values for radial, axial and angular misalignment

In addition, when the torsional vibration calculation of the main propulsion system is required (see Sec 8), the following data are also to be submitted:
- allowable alternating torque amplitude and power loss for continuous operation, as a function of frequency and/or mean transmitted torque
- static and dynamic stiffness, as a function of frequency and/or mean transmitted torque
- moments of inertia of the primary and secondary halves of the coupling
- damping coefficient or damping capability
- properties of rubber components
- for steel springs of couplings: chemical composition and mechanical properties of steel employed.

2.1.3 Couplings, flexible couplings, hydraulic couplings

Non-solid-forged couplings and stiff parts of elastic couplings subjected to torque are to be of forged or cast steel, or nodular cast iron.

Rotating parts of hydraulic couplings may be of grey cast iron, provided that the peripheral speed does not exceed 40m/s.

2.1.4 Coupling bolts *(1/7/2021)*

Coupling bolts are to be of forged, rolled or drawn steel.

~~In general, the value of the tensile strength of the bolt material R_{mB} is to comply with the following requirements:~~

- ~~$R_m \leq R_{mB} \leq 1,7\ R_m$~~
- ~~$R_{mB} \leq 1000\ N/mm^2$.~~

2.1.5 Shaft liners

Liners are to be of metallic corrosion-resistant material complying with the applicable requirements of Part D and with the approved specification, if any; in the case of liners fabricated in welded lengths, the material is to be recognised as suitable for welding.

In general, liners are to be manufactured from castings.

For small shafts, the use of liners manufactured from pipes instead of castings may be considered.

Where shafts are protected against contact with sea water not by metal liners but by other protective coatings, the coating procedure is to be approved by Tasneef

2.1.6 Sterntubes

The sterntube thickness is considered by Tasneef on a case-by-case basis. In no case, however, may it be less than the thickness of the side plating adjacent to the sternframe.

Where the materials adopted for the sterntube and the plating adjacent to the sternframe are different, the sterntube thickness is to be at least equivalent to that of the plating.

2.2 Shafts - Scantling

2.2.1 General

For the check of the scantling, the methods given in [2.2.2] and [2.2.3] apply for intermediate shafts and propeller shafts, respectively. As an alternative, the direct stress calculation method as per [2.2.4] may be applied.

2.2.2 Intermediate and thrust shafts

The minimum diameter of intermediate and thrust shafts is not to be less than the value d, in mm, given by the following formula:

$$d = F \cdot k \cdot \left[\frac{P}{n \cdot (1 - Q^4)} \cdot \frac{560}{R_m + 160}\right]^{1/3}$$

where:

Q :
- in the case of solid shafts: Q = 0
- in the case of hollow shafts: Q = ratio of the hole diameter to the outer shaft diameter in the section concerned.

  where $Q \leq 0,3$, Q = 0 is to be taken.

  Hollow shafts whose longitudinal axis does not coincide with the longitudinal hole axis will be specially considered by Tasneef in each case.

F :
- 95 for main propulsion systems powered by diesel engines fitted with slip type couplings, by turbines or by electric motors;
- 100 for main propulsion systems powered by diesel engines fitted with other types of couplings.

k : Factor whose value is given in Tab 2 depending on the different design features of the shafts.

For shaft design features other than those given in the table, the value of k will be specially considered by Tasneef in each case.

n : Speed of rotation of the shaft, in r.p.m., corresponding to power P

P : Maximum continuous power of the propulsion machinery for which the classification is requested, in kW.

R_m : Value of the minimum tensile strength of the shaft material, in N/mm^2.

The scantlings of intermediate shafts inside tubes or sterntubes will be subject to special consideration by Tasneef Where intermediate shafts inside sterntubes are water lubricated, the requirements of [2.4.7] are to be applied.

2.2.3 Propeller shafts

The minimum diameter of the propeller shaft is not to be less than the value d_P, in mm, given by the following formula:

$$d_P = 100 \cdot k_P \cdot \left[\frac{P}{n \cdot (1 - Q^4)} \cdot \frac{560}{R_m + 160}\right]^{1/3}$$

where:

k_p : Factor whose value, depending on the different constructional features of shafts, is given below.

The other symbols have the same meaning as in [2.2.2].

In cases of stainless steels and in other particular cases, at the discretion of the Tasneef the value of R_m to be introduced in the above formula will be specially considered. In general, the diameter of the part of the propeller shaft located forward of the forward sterntube seal may be gradually reduced to the diameter of the intermediate shaft.

Table 2 : Values of factor k

For intermediate shafts with					For thrust shafts external to engines	
integral coupling flange	shrink fit coupling	keyways	radial bores, transverse holes	longitudinal slots	on both sides of thrust collar	in way of axial bearing, where a roller bearing is used as a thrust bearing
1,00 **(1)**	1,00	1,10 **(2)**	1,10 **(3)**	1,20 **(4)**	1,10	1,10

(1) Value applicable in the case of fillet radii in accordance with the provisions of [2.5.1].
(2) After a distance of not less than 0,2 d from the end of the keyway, the shaft diameter may be reduced to the diameter calculated using k = 1,0. Fillet radii in the transverse section of the bottom of the keyway are to be not less than 0,0125 d, d being the diameter as calculated above using k = 1,0.
(3) Value applicable in the case of diameter of bore not exceeding 0,3 d, d being as defined in **(2)**
(4) Value normally applicable in the case of slot having length not exceeding 1,4 d and width not exceeding 0,2 d, d being as defined in **(2)**, however to be justified on a case-by-case basis by the Manufacturers.

Table 3 : Values of factor K_m and R_t *(1/7/2021)*

Material	Material factor (**K_m**)	Maximum value R_t (N/mm^2) to be introduced in the formula
Aquamet 17, Aquamet 22	650	500
Stainless steel type 316 (austenitic)	530	160
Nickel copper alloy - monel K 500	560	460
Duplex steels	500	500
Temet (duplex 2205)	620	450

The values of factor k_P to be introduced in the above formula are to be taken as follows:

a) for yachts having GT < 500

k_P : 1,04; for any portion of the propeller shaft.

b) for yachts having GT > or = 500

k_P : k_P = 1,26, for propeller shafts where:

- the propeller is keyed onto the shaft taper in compliance with the requirements of [2.5.5]

k_P = 1,22, for propeller shafts where:

- the propeller is keyless fitted onto the shaft taper by a shrinkage method in compliance with Sec 7, [3.1.2], or the propeller boss is attached to an integral propeller shaft flange in compliance with [2.5.1]
- the sterntube of the propeller shaft is oil lubricated and provided with oil sealing glands approved by Tasneef or when the sterntube is water lubricated and the propeller shaft is fitted with a continuous liner.

The above values of k_P apply to the portion of propeller shaft between the forward edge of the aftermost shaft bearing and the forward face of the propeller boss or the forward face of the integral propeller shaft flange for the connection to the propeller boss. In no case is the length of this portion of propeller shaft to be less than 2,5 times the Rule diameter d_P obtained with the above formula.

The determination of factor k_P for shaft design features other than those given above will be specially considered by Tasneef in each case.

For the length of the propeller shaft between the forward edge of the aftermost shaft bearing and the forward edge of the forward sterntube seal:

- k_P = 1,15 is to be taken in any event.

2.2.4 Corrosion-resistant propeller shaft materials *(1/1/2019)*

For corrosion-resistant material, such as Aquamet 17, Aquamet 22, Nickel copper alloy - monel K 500, stainless steel type 316 and duplex steels, the following alternative formula can be used instead of that stated in item [2.2.2] and [2.2.3] to calculate the minimum diameter of the intermediate and propeller shafts:

$D = K_m [P / (n \times R_t)]^{1/3}$

where:

k_m : Material factor (see Tab 3);

D : Rule diameter of the intermediate and propeller shafts (mm);

P : Maximum service power (kW);

N : Shaft rational speed, in r.p.m., corresponding to P;

R_t : Yield stength in torsional shear (N/mm^2) (see Tab 3).

Shafts for which the scantling is determined according to the previous formula are to comply with the criteria listed in items a) to f), irrespective of the shaft material:

a) Torsional and lateral shaft vibration analysis carried out according to Sec 8 is to be submitted to Tasneef If requested

2.4.6 Oil or grease lubrication system

a) For oil lubricated bearings, provision for oil cooling is to be made.

A gravity tank is to be fitted to supply lubricating oil to the sterntube; the tank is to be located above the full load waterline.

Oil sealing glands are to be suitable for the various sea water temperatures which may be encountered in service.

b) Grease lubricated bearings will be specially considered by Tasneef

2.4.7 Water circulation system

For water lubricated bearings, efficient water circulation is to be provided.

The water grooves on the bearings are to be of ample section such as to ensure efficient water circulation and be scarcely affected by wear-down, particularly for bearings of the plastic type.

The shut-off valve or cock controlling the water supply is to be fitted in way of the water inlet to the sterntube.

2.5 Couplings

2.5.1 Flange couplings *(1/7/2021)*

a) Flange couplings of intermediate and thrust shafts and the flange of the forward coupling of the propeller shaft are to have a thickness not less than 0,2 times the Rule diameter of the solid intermediate shaft and not less than the coupling bolt diameter calculated for a tensile strength equal to that of the corresponding shaft.

The fillet radius at the base of solid forged flanges is to be not less than 0,08 times the actual shaft diameter.

The fillet may be formed of multi-radii in such a way that the stress concentration factor will not be greater than that for a circular fillet with radius 0,08 times the actual shaft diameter.

For non-solid forged flange couplings, the above fillet radius is not to cause a stress in the fillet higher than that caused in the solid forged flange as above.

Fillets are to have a smooth finish and are not to be recessed in way of nuts and bolt heads.

b) Where the propeller is connected to an integral propeller shaft flange, the thickness of the flange is to be not less than 0,25 times the Rule diameter of the aft part of the propeller shaft. The fillet radius at the base of the flange is to be not less than 0,125 times the actual diameter.

The strength of coupling bolts of the propeller boss to the flange is to be equivalent to that of the aft part of the propeller shaft.

c) Non-solid forged flange couplings and associated keys are to be of a strength equivalent to that of the shaft.

They are to be carefully fitted and shrunk on to the shafts, and the connection is to be such as to reliably resist the vibratory torque and astern pull.

d) For couplings of intermediate and thrust shafts and for the forward coupling of the propeller shaft having all fitted coupling bolts, the coupling bolt diameter in way of the joining faces of flanges is not to be less than the value d_B, in mm, given by the following formula:

$$d_B = 0,65 \cdot \left[\frac{d^3 \cdot (R_m + 160)}{n_B \cdot D_C \cdot R_{mB}}\right]^{0,5}$$

where:

- d : Rule diameter of solid intermediate shaft, in mm,
- n_B : Number of fitted coupling bolts
- D_C : Pitch circle diameter of coupling bolts, in mm
- R_m : Value of the minimum tensile strength of intermediate shaft material taken for calculation of d, in N/mm²
- R_{mB} : Value of the minimum tensile strength of coupling bolt material, in N/mm². ~~Where, in compliance with [2.1.1], the use of a steel having R_{mB} in excess of the limits specified in [2.1.4] is allowed for coupling bolts, the value of R_{mB} to be introduced in the formula is not to exceed the above limits~~The value of the tensile strength of the bolt material taken for calculation R_{mB} is to comply with the following requirements:~~.~~
  - $R_m \le R_{mb} \le 1,7 R_m$
  - $R_{mb} \le 1000$ N/mm²

e) Flange couplings with non-fitted coupling bolts may be accepted on the basis of the calculation of bolt tightening, bolt stress due to tightening, and assembly instructions.

To this end, the torque based on friction between the mating surfaces of flanges is not to be less than 2,8 times the transmitted torque, assuming a friction coefficient for steel on steel of 0,18. In addition, the bolt stress due to tightening in way of the minimum cross-section is not to exceed 0,8 times the minimum yield strength (R_{eH}), or 0,2 proof stress ($R_{p\,0,2}$), of the bolt material.

Transmitted torque has the following meanings:

- For main propulsion systems powered by diesel engines fitted with slip type or high elasticity couplings, by turbines or by electric motors: the mean transmitted torque corresponding to the maximum continuous power P and the relevant speed of rotation n, as defined under [2.2.2].
- For main propulsion systems powered by diesel engines fitted with couplings other than those mentioned in (a): the mean torque above increased by 20% or by the torque due to torsional vibrations, whichever is the greater.

The value 2,8 above may be reduced to 2,5 in the following cases:

- yachts having two or more main propulsion shafts
- when the transmitted torque is obtained, for the whole functioning rotational speed range, as the sum of the nominal torque and the alternate torque due to the torsional vibrations, calculated as required in Sec 8.

2.5.2 Shrunk couplings

Non-integral couplings which are shrunk on the shaft by means of the oil pressure injection method or by other means may be accepted on the basis of the calculation of shrinking and induced stresses, and assembly instructions.

SECTION 9 PIPING SYSTEMS

1 General

1.1 Application

1.1.1

a) General requirements applying to all piping systems are contained in:
   - [2] for their design and construction
   - [3] for the welding of steel pipes
   - [4] for the bending of pipes
   - [5] for their arrangement and installation
   - [12] for their certification, inspection and testing
   - [3] and [4] only applicable to yachts of equal to or greater than 500 GT.

b) Specific requirements for yacht piping systems and machinery piping systems are given in [6] to [11].

1.2 Documentation to be submitted

1.2.1 Documents

The documents listed in Tab 1 are to be submitted.

1.2.2 Additional information

The information listed in Tab 2 is also to be submitted.

1.3 Definitions

1.3.1 Piping and piping systems

a) Piping includes pipes and their connections, flexible hoses and expansion joints, valves and their actuating systems, other accessories (filters, level gauges, etc) and pump casings.

b) Piping systems include piping and all the interfacing equipment such as tanks, pressure vessels, heat exchangers, pumps and centrifugal purifiers, but do not include turbines, internal combustion engines and reduction gears.

Table 1 : Documents to be submitted

Item No	I/A **(1)**	Document **(2)**
1	A	Diagram of the bilge and ballast systems (in and outside machinery spaces)
2	A	Diagram of the air, sounding and overflow systems
3	A	Diagram of cooling systems (sea water and fresh water)
4	A	Diagram of the fuel oil system
5	A	Diagram of the lubricating oil system **(3)**
6	A	Diagram of the compressed air system

(1) A = to be submitted for approval in four copies;
(2) Diagrams are also to include, where applicable, the (local and remote) control and monitoring systems and automation systems;
(3) Only required if the system is not integral to the engine

Table 2 : Information to be submitted

Item No	I/A **(1)**	Document
1	I	Nature, service temperature and pressure of the fluids
2	A	Material, external diameter and wall thickness of the pipes
3	A	Type of the connections between pipe lengths, including details of the weldings, where provided
4	A	Material, type and size of the accessories
5	A	Capacity, prime mover and, when requested, location of the pumps
6	A	For plastic pipes: • the chemical composition • the physical and mechanical characteristics as a function of temperature • the characteristics of inflammability and fire resistance • the resistance to the products intended to be conveyed

(1) A = to be submitted for approval in four copies;
I = to be submitted for information in triplicate.

Table 25 : Compressed air systems *(1/1/2016)*

Symbol convention H = High, HH = High high, G = group alarm L = Low, LL = Low low, I = individual alarm X = function is required, R = remote	Monitoring		Automatic control				
			System			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
Compressor lubricating oil pressure (except where splash lubrication)	L						
Air pressure after reducing valves	L+H	local					
Starting air pressure before main shut-off valve	L	local + R **(1)**					
Air vessel pressure	L+H						
(1) Remote indication is required if starting of air compressor are remote controlled, from wheelhouse for example							

13 Use of reductants in SCR systems

13.1

13.1.1 Use of aqueous and anydrous ammonia *(1/1/2018)*

Aqueous and Anydrous ammonia are not to be used as a reductant in a SCR except where it can be demonstrated that it is not practicable to use a urea based reductant.

Use of Anydrous ammonia is to be agreed with the Flag Administration.

13.1.2 Use of urea based ammonia *(1/7/2021)*

Where urea based ammonia (e.g. AUS 40 - aqueous urea solution specified in ISO 18611-1) is used, the storage tank is to be arranged so that any leakage will be contained and prevented from making contact with heated surfaces. All pipes or other tank penetrations are to be provided with manual closing valves attached to the tank. Tank and piping arrangements are to be approved.

The storage tank may be located within the engine room.

The storage tank is to be protected from excessively high or low temperatures applicable to the particular concentration of the solution. Depending on the operational area of the ship, this may necessitate the fitting of heating and/or cooling systems. The physical conditions recommended by applicable recognized standards (such as ISO 18611-3) are to be taken into account to ensure that the contents of the aqueous urea tank are maintained to avoid any impairment of the urea solution during storage.

If a urea storage tank is installed in a closed compartment, the area is to be served by an effective mechanical supply and exhaust ventilation system providing not less than 6 air changes per hour which is independent from the ventilation system of accommodation, service spaces, or control stations. The ventilation system is to be capable of being controlled from outside ~~the compartment and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly air purged. If the ventilation stops, an audible and visual alarm shall be provided outside the compartment adjacent to each point of entry and inside the compartment, together with a warning notice requiring the use of such ventilation~~.

A warning notice requiring the use of such ventilation before entering the compartment shall be provided outside the compartment adjacent to each point of entry.

Alternatively, where a urea storage tank is located within an engine room a separate ventilation system is not required when the general ventilation system for the space is arranged so as to provide an effective movement of air in the vicinity of the storage tank and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly ventilated~~air purged~~.

Each urea storage tank is to be provided with temperature and level monitoring arrangements. High and low level alarms together with high and low temperature alarms are also to be provided.

Where urea based ammonia solution is stored in integral tanks, the following are to be considered during the design and construction:

- These tanks may be designed and constructed as integral part of the hull, (e.g. double bottom, wing tanks).
- These tanks are to be coated with appropriate anti-corrosion coating and cannot be located adjacent to any fuel oil and fresh water tank.
- These tanks are to be designed and constructed as per the structural requirements applicable to hull and primary support members for a deep tank construction.
- ~~These tanks are to be fitted with but not limited to level gauge, temperature gauge, high temperature alarm, low level alarm, etc.~~
- These tanks are to be included in the ship's stability calculation.

The above requirements also apply to closed compartments normally entered by persons:

- when they are adjacent to the urea integral tanks and there are possible leak points (e.g. manhole, fittings) from these tanks; or
- when the urea piping systems pass through these compartments, unless the piping system is made of steel or other

equivalent material with melting point above 925 degrees C and with fully welded joints.

The reductant piping and venting systems are to be independent of other ship service piping and/or systems. Reductant piping systems are not to be located in accommodation, service spaces, or control stations. The vent pipes of the storage tank are to terminate in a safe location on the weather deck and the tank venting system is to be arranged to prevent entrance of water into the urea tank.

~~Reductant related piping systems, tanks, and other components which may come into contact with the reductant solution are to be of a suitable grade of non-combustible compatible material established to be suitable for the application.~~

Reductant tanks are to be of steel or other equivalent material with a melting point above 925 degrees C. Pipes/piping systems are to be of steel or other equivalent material with melting point above 925 degrees C, except downstream of the tank valve, provided this valve is metal seated and arranged as fail-to-closed or with quick closing from a safe position outside the space in the event of fire; in such case, type approved plastic piping may be accepted even if it has not passed a fire endurance test. Reductant tanks and pipes/piping systems are to be made with a material compatible with reductant or coated with appropriate anti-corrosion coating.

For the protection of crew members, the ship is to have on board suitable personnel protective equipment. Eyewash and safety showers are to be provided, the location and number of these eyewash stations and safety showers are to be derived from the detailed installation arrangements.

Urea storage tanks are to be arranged so that they can be emptied of urea, and ventilated by means of portable or permanent systems~~purged and vented~~.

14 Certification, inspection and testing of piping systems

14.1 Application

14.1.1 Items [13.2] to [13.6] define the certification and workshop inspection and testing program to be performed on piping systems to be fitted on board of yachts for which the ? **MACH** notation is required.

In addition, all yachts are to be subjected to the onboard testing as defined in Sec 13.

14.1.2 On yachts for which the ?**MACH** notation is required, all inspections and tests required in these paragraphs [13.2] to [13.6] are to be carried out at the workshop under the responsibility and supervision of the Manufacturers are to be provided.

14.2 Type tests

14.2.1 Type tests of flexible hoses and expansion joints *(1/1/2019)*

a) Type approval tests are to be carried out on flexible hoses or expansion joints of each type and of sizes in accordance with Tab 26 (see also the "Rules for the type approval of flexible hoses and expansion joints").

b) The flexible hoses or expansion joints subjected to the tests are to be fitted with their connections.

14.3 Testing of materials

14.3.1 General

a) Detailed specifications for material tests are given in Part D.

b) Requirements for the inspection of welded joints are given in Part D.

14.3.2 Tests for materials *(1/1/2019)*

a) Where required in Tab 27, materials used for pipes, valves and other accessories are to be subjected to the following tests:
   - tensile test at ambient temperature
   - flattening test or bend test, as applicable
   - tensile test at the design temperature, except if one of the following conditions is met:
     - the design temperature is below 200°C
     - the mechanical properties of the material at high temperature have been approved
     - the scantling of the pipes is based on reduced values of the permissible stress.

b) Plastic materials are to be subjected to the tests specified in App 1.

Table 26 : Type tests to be performed for flexible hoses and expansion joints

Test	Flexible hoses and expansion joints in non-metallic material	Flexible hoses and expansion joints in metallic material
bursting test	X	X
fire resistance test	X **(1)**	NR
vibration test **(2)**	X	X
pressure impulse test	X **(6)**	NR
flexibility test	X **(3)**	NR
elastic deformation test	NR	X
cyclic expansion test **(4)**	NR	X
resistance of the material **(5)**	X	X

(1) only for flexible hoses and expansion joints used in flammable oil systems and, when required, in sea water systems.
(2) Tasneef reserves the right to require the vibration test in cases of installation of the components on sources of high vibrations.
(3) only for flexible hoses conveying low temperature fluids.
(4) Tasneef reserves the right to require the cyclic expansion test for piping systems subjected to expansion cycles
(5) resistance to the conveyed fluid to be demonstrated by suitable documentation and/or tests
(6) only for flexible hoses.
Note 1: X = required, NR = not required.

14.4 Hydrostatic testing of piping systems and their components

14.4.1 General

Pneumatic tests are to be avoided wherever possible. Where such testing is absolutely necessary in lieu of the hydraulic pressure test, the relevant procedure is to be submitted to Tasneef for acceptance prior to testing.

APPENDIX 1 PLASTIC PIPES

1 General

1.1 Application

1.1.1 These requirements are applicable to all piping systems with parts made of rigid plastic.

1.1.2 Piping systems made of thermoplastic materials, such as polyethylene(PE), polypropylene(PP), and polybutylene (PB), and intended for non-essential services are to meet the requirements of recognised standards as well as [2.1.2], [2.3.4], [2.4.2], [3] and [4].

1.2 Use of plastic pipes

1.2.1 Plastic may be used in piping systems in accordance with the provisions of Sec 9, [2.1.3], provided the following requirements are complied with.

1.2.2 Plastic pipes are to be type approved by Tasneef

1.3 Definitions

1.3.1 Plastic

Plastic includes both thermoplastic and thermosetting plastic materials with or without reinforcement, such as PVC and FRP (reinforced plastic pipes).

1.3.2 Piping systems

Piping systems mean those made of plastic and include the pipes, fittings, joints, and any internal or external liners, coverings and coatings required to comply with the performance criteria.

1.3.3 Joints

Joints include all pipe assembling devices or methods, such as adhesive bonding, laminating, welding, etc.

1.3.4 Fittings

Fittings include bends, elbows, fabricated branch pieces, etc made of plastic materials.

1.3.5 Nominal pressure

Nominal pressure is the maximum permissible working pressure, which is to be determined in accordance with [2.2.2]

1.3.6 Design pressure

Design pressure is the maximum working pressure which is expected under operating conditions or the highest set pressure of any safety valve or pressure relief device on the system, if fitted.

1.3.7 Fire endurance

Fire endurance is the capability of the piping system to perform its intended function, i.e. maintain its strength and integrity, for some predicted period of time while exposed to fire.

2 Design of plastic piping systems

2.1 General

2.1.1 Specification

The specification of the plastic piping is to be submitted in accordance with the provisions of Sec 10, [1.2.2]. It is to comply with a recognised national or international standard approved by Tasneef In addition, the requirements stated below are to be complied with.

2.1.2 Marking

Plastic pipes and fittings are to be permanently marked with identification, including:

- pressure ratings
- the design standards that the pipe or fitting is manufactured in accordance with
- the material of which the pipe or fitting is made.

2.2 Strength

2.2.1 General

a) The piping is to have sufficient strength to take account of the most severe concomitant conditions of pressure, temperature, the weight of the piping itself and any static and dynamic loads imposed by the design or environment.

b) The maximum permissible working pressure is to be specified with due regard for the maximum possible working temperature in accordance with the Manufacturer's recommendations.

2.2.2 Permissible pressure

Piping systems are to be designed for a nominal pressure determined from the following conditions:

a) Internal pressure

The nominal internal pressure is not to exceed the smaller of:

- $P_{sth}/4$
- $P_{lth}/2,5$

where:

P_{sth} : Short-term hydrostatic test failure pressure, in MPa

P_{lth} : Long-term hydrostatic test failure pressure (>100 000 hours), in MPa.

b) External pressure (to be considered for any installation subject to vacuum conditions inside the pipe or a head of liquid acting on the outside of the pipe)

The nominal external pressure is not to exceed $P_{col}/3$, where:

2.4 Pipe and fitting connections

2.4.1 General

a) The strength of connections is not to be less than that of the piping system in which they are installed.

b) Pipes and fittings may be assembled using adhesive-bonded, welded, flanged or other joints.

c) When used for joint assembly, adhesives are to be suitable for providing a permanent seal between the pipes and fittings throughout the temperature and pressure range of the intended application.

d) Tightening of joints, where required, is to be performed in accordance with the Manufacturer's instructions.

e) Procedures adopted for pipe and fitting connections are to be submitted to Tasneef for approval, prior to commencing the work.

Table 1 : Fire endurance of piping systems *(1/7/2021)*

PIPING SYSTEM	LOCATION						
	Machinery spaces of category A **(4)**	Other machinery spaces **(5)**	Fuel oil tanks	Ballast water tanks	Cofferdams, void spaces, pipe tunnels and ducts **(6)**	Accommodation, service and control spaces **(7)**	Open decks **(8)**
FLAMMABLE LIQUIDS (FLASHPOINT > 60°C)							
Fuel oil	X	X	0	0	0	L1 **(9)**	L1 **(9)**
Lubricating oil	X	X	NA	NA	0	L1 **(9)**	L1 **(9)**
Hydraulic oil	X	X	0	0	0	L1 **(9)**	L1 **(9)**
SEA WATER **(10)**							
Bilge main and branches	L1	L1	0	0	0	L1 **(9)**	L1
Fire main and water spray	L1	L1	NA	0	0	X	L1
Foam system	L1	L1	NA	NA	0	L1	L1
Sprinkler system	L1	L1	NA	0	0	L3	L3
Ballast	L3	L3	0	0	0	L2	L2
Cooling water, essential services	L3	L3	NA	0	0	L2	L2
Non-essential systems	0	0	0	0	0	0	0
FRESH WATER							
Cooling water, essential services	L3	L3	0	0	0	L3	L3
Non-essential systems	0	0	0	0	0	0	0
SANITARY, DRAINS, SCUPPERS							
Deck drains (internal)	L1 **(2)**	L1 **(2)**	0	0	0	0	0
Sanitary drains (internal)	0	0	0	0	0	0	0
Scuppers and discharges (overboard): Fitted above heaviest water level	X **(1)**	X **(1)**	0	0	0	X **(1)**	0
Scuppers and discharges (overboard): Fitted below heaviest water level	X	X	0	0	0	X	X
SOUNDING, AIR							

PIPING SYSTEM	LOCATION						
	Machinery spaces of category A **(4)**	Other machinery spaces **(5)**	Fuel oil tanks	Ballast water tanks	Cofferdams, void spaces, pipe tunnels and ducts **(6)**	Accommodation, service and control spaces **(7)**	Open decks **(8)**
Water tanks, dry spaces	0	0	0	0	0	0	0
Oil tanks (flashpoint > 60°C)	X	X	0	0	0	X	X
MISCELLANEOUS							
Control air	L1 **(3)**	L1 **(3)**	0	0	0	L1 **(3)**	L1 **(3)**
Service air (non-essential)	0	0	0	0	0	0	0
Brine	0	0	NA	NA	0	0	0

(1) For scuppers and draining coming from the open deck, ~~M~~X may be replaced by 0 if a remote control valve is to be fitted at vessel side, and suitable means are to be provided to blank the intake opening on deck.
(2) For drains serving only the space concerned, “0” may replace “L1”.
(3) When controlling functions are not required by the Rules, “0” may replace “L1”.
(4) Machinery spaces of category A are defined in Sec 1, [1.3.1].
(5) Spaces, other than category A machinery spaces and cargo pump rooms, containing propulsion machinery, boilers, steam and internal combustion engines, generators and major electrical machinery, pumps, oil filling stations, refrigerating, stabilising, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces
(6) Empty spaces between two bulkheads separating two adjacent compartments.
(7) Accommodation spaces, service spaces and control stations are defined in Ch 4, Sec 1, [1].
(8) Open decks are defined in Ch 4, Sec 1, [1].
(9) For yachts less than 500 GT, L1 may be replaced by L2.
(10) Pipes fitted below the heaviest water level, and connected to sea inlet and overboard discharge are to be metallic structural pipes.

2.4.2 Bonding of pipes and fittings

a) The procedure for making bonds is to be submitted to Tasneef for qualification. It is to include the following:
   - materials used
   - tools and fixtures
   - joint preparation requirements
   - cure temperature
   - dimensional requirements and tolerances
   - acceptance criteria for the test of the completed assembly.

b) When a change in the bonding procedure may affect the physical and mechanical properties of the joints, the procedure is to be requalified.

3 Arrangement and installation of plastic pipes

3.1 General

3.1.1 Plastic pipes and fittings are to be installed in accordance with the Manufacturer’s guidelines.

3.2 Supporting of the pipes

3.2.1

a) Selection and spacing of pipe supports in shipboard systems are to be determined as a function of allowable stresses and maximum deflection criteria.

b) The selection and spacing of pipe supports are to take into account the following data:
   - pipe dimensions
   - mechanical and physical properties of the pipe material
   - mass of pipe and contained fluid
   - external pressure
   - operating temperature
   - thermal expansion effects
   - load due to external forces
   - thrust forces
   - water hammer
   - vibrations
   - maximum accelerations to which the system may be subjected.

   Combinations of loads are also to be considered.

c) Support spacing is not to be greater than the pipe Manufacturer’s recommended spacing.

3.2.2 Each support is to evenly distribute the load of the pipe and its content over the full width of the support. Measures are to be taken to minimise wear of the pipes where they are in contact with the supports.

3.2.3 Heavy components in the piping system such as valves and expansion joints are to be independently supported.

3.3 Provision for expansion

3.3.1 Suitable provision is to be made in each pipeline to allow for relative movement between pipes made of plastic and the steel structure, having due regard to:

- the high difference in the coefficients of thermal expansion
- deformations of the ship's structure.

3.3.2 Calculations of the thermal expansions are to take into account the system working temperature and the temperature at which the assembly is performed.

3.4 External loads

3.4.1 When installing the piping, allowance is to be made for temporary point loads, where applicable. Such allowance is to include at least the force exerted by a load (person) of 100 kg at mid-span on any pipe of more than 100 mm nominal outside diameter.

3.4.2 Pipes are to be protected from mechanical damage where necessary.

3.4.3 As well as providing adequate robustness for all piping, including open-ended piping, the minimum wall thickness complying with [2.2.2] a) may be increased at the request of Tasneef taking into account the conditions encountered during service on board vessels.

3.5 Earthing

3.5.1 Where, in pursuance of [2.3.4], pipes are required to be electrically conductive, the resistance to earth from any point in the piping system is not to exceed 1 x 10^6 ohm.

3.5.2 Where provided, earthing wires are to be accessible for inspection.

3.6 Penetration of fire divisions and watertight bulkheads or decks

3.6.1 Where plastic pipes pass through "A" or "B" class divisions, arrangements are to be made to ensure that fire endurance is not impaired. These arrangements are to be tested in accordance with "Recommendations for Fire Test Procedures for "A", "B" and "F" Bulkheads" (IMO Resolution A754 (18) as amended).

3.6.2 *(1/7/2021)*

When plastic pipes pass through watertight bulkheads or decks, the watertight integrity of the bulkhead or deck is to be maintained. ~~If the bulkhead or deck is also a fire division and destruction by fire of plastic pipes may cause the inflow of liquid from tanks,~~ providing~~a~~ metallic shut-off valve operable from above the freeboard deck ~~is to be fitted~~ at the bulkhead or deck. This valve may be omitted if the penetration is fitted at a distance more than B/3 from the sides and above the design waterline, or somehow protected with watertight divisions from minor hull damages

3.7 Systems connected to the hull

3.7.1 Bilge and sea water systems

a) Where, in pursuance of [2.3.1], plastic pipes are permitted in bilge and sea water systems, the ship side valves required in Sec 10, [2.8] and, where provided, the connecting pipes to the shell are to be made of metal in accordance with Sec 10, [2.1].

b) Vessel side valves are to be provided with remote control from outside the space concerned, see Tab 1, footnote **(1)**.

3.7.2 Scuppers and sanitary discharges

a) Where, in pursuance of [2.3.1], plastic pipes are permitted in scuppers and sanitary discharge systems connected to the shell, their upper end is to be fitted with closing means operated from a position above the freeboard deck in order to prevent downflooding, see Tab 1, footnotes **(1)** and **(3)**.

b) Discharge valves are to be provided with remote control from outside the space concerned.

3.8 Application of fire protection coatings

3.8.1 Where necessary for the required fire endurance as stated in [2.3.3], fire protection coatings are to be applied on the joints, after performing hydrostatic pressure tests of the piping system.

3.8.2 The fire protection coatings are to be applied in accordance with the Manufacturer's recommendations, using a procedure approved in each case.

4 Certification, inspection and testing of plastic piping

4.1 Certification

4.1.1 Type approval

Plastic pipes, fittings, joints and any internal or external liners, coverings and coatings are to be of a type approved by Tasneef for the intended use according to the Rules for Type Approval of Plastic Pipes. For yachts less than 500 GT, plastic piping that is not type approved may also be accepted provided that it is in conformity with a standard recognised by Tasneef

4.1.2 Bonding qualification test

a) A test assembly is to be fabricated in accordance with the procedure to be qualified. It is to consist of at least one pipe-to-pipe joint and one pipe-to-fitting joint.

b) When the test assembly has been cured, it is to be subjected to a hydrostatic test pressure at a safety factor of 2,5 times the design pressure of the test assembly, for not less than one hour. No leakage or separation of joints is allowed. The test is to be conducted so that the joint is loaded in both longitudinal and circumferential directions.

SECTION 3 FIRE CONTAINMENT

1 Structure

1.1 General

1.1.1 The purpose of these provisions is to contain a fire in the space of origin.

For this purpose, the following functional requirements are to be met:

- the yacht is to be subdivided by thermal and structural boundaries as required by these Rules;
- thermal insulation of boundaries is to have due regard to the fire risk of the space and adjacent spaces;
- the fire integrity of the division is to be maintained at openings and penetrations.

2 Forms of construction - fire divisions

2.1

2.1.1 When fire divisions are required in compliance with these Rules, they are to be constructed in accordance with the following requirements.

2.1.2 Fire divisions using steel equivalent, or alternative forms of construction, may be accepted if it can be demonstrated that the material by itself, or due to non-combustible insulation provided, has fire resistance properties equivalent to those divisions required by these Rules.

2.1.3 Insulation is to be such that the temperature of the structural core does not rise above the point at which the structure would begin to lose its strength at any time during the applicable exposure to the standard fire test. For A class divisions, the applicable exposure is 60 minutes, and for B class divisions, the applicable exposure is 30 minutes.

2.1.4 For aluminum alloy structures, the insulation is to be such that the temperature of the structural core does not rise more than 200ºC above the ambient temperature at any time during the applicable fire exposure.

2.1.5 For composite structures, the insulation is to be such that the temperature of the laminate does not rise more than the minimum temperature of deflection under load of the resin at any time during the applicable fire exposure. The temperature of deflection under load is to be determined in accordance with a recognised international standard.

2.1.6 Insulation need only be applied on the side that is exposed to the greater fire risk; inside the engine room, a division between two such spaces is, however, to be insulated on both sides unless it is a steel division.

2.1.7 Special attention is to be given to the fixing of fire door frames in bulkheads constructed of materials other than steel. Measures are to be taken to ensure that the temperature of the fixings when exposed to fire does not exceed the temperature at which the bulkhead itself loses strength.

2.2 Equivalent fire division accepted without the exposure to the standard fire test

2.2.1 When fire divisions are required according to these Rules, the following may be accepted without the fire test.

of the fuel are to be such that, having regard to the hazards of fire and explosion which the use of such fuel may entail, the safety of the vessel and the persons on board are preserved.

In particular, open flame gas appliances provided for cooking, heating or any other purposes are to comply with the requirements of EC directive 90/396/EEC or equivalent and the installation of open flame gas appliances is to comply with the appropriate provisions of Section 2, [2.1].

4 Ventilating systems

4.1 General

4.1.1 Ventilation fans for machinery spaces and enclosed galleys are to be capable of being stopped and main inlets and outlets of the ventilation system closed from outside the spaces being served. This position is not to be readily cut off in the event of a fire in the spaces served.

4.1.2 *(1/7/2021)*

Ventilation ducts serving category A machinery spaces, galleys, spaces containing vehicles or craft with fuel in their tanks, or lockers containing fuel tanks are not to cross accommodation spaces, service spaces or control stations unless the trunking is constructed of steel (minimum thickness 4 mm). The ducting within the accommodation is to be fitted with fire insulation to A-30 (B-15 on short range yachts) to a point at least 5 metres from the machinery space or galley. A material other than steel duly insulated to reach the required A-30 (or B-15 on short range yachts) may be also acceptable.

For yachts of 500 GT and over, the above insulation is to be A-60 for the entire length of the duct within the accommodation spaces.

4.1.3 Where the trunking passes from the machinery space or galley into the accommodation, automatic fire dampers are to be provided in the deck or bulkhead within the accommodation.

The automatic fire dampers are also to be manually operable from outside the machinery space or galley.

4.1.4 The requirements in [4.1.2] and [4.1.3] also apply to ventilation ducts for accommodation spaces passing within category A machinery spaces.

4.1.5 Storerooms containing highly flammable products are to be provided with ventilation arrangements that are separate from other ventilation systems. Ventilation is to be arranged to prevent the build-up of flammable vapours at high and low levels. The inlets and outlets of ventilators are to be positioned so that they do not draw from or vent into an area which would cause undue hazard, and are to be fitted with spark arresters.

4.1.6 Enclosed spaces in which generating sets and freestanding fuel tanks are installed are to be ventilated independently of systems serving other spaces.

4.1.7 Ventilation systems serving category A machinery spaces are to be independent of systems serving other spaces.

4.1.8 Adequate means of ventilation are to be provided to prevent the accumulation of dangerous concentrations of flammable gas which may be emitted from batteries.