Amendments to the "Tasneef Rules for the Classification of Yachts"

Effective from 1/1/2025

List of the amendments:

Part A – Classification and Surveys

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 2, [5.1.4] (new)	to clarify that the relaxations foreseen for short range yachts are also permitted for pleasure yachts
Ch 2, App.3, [8.3.2]	to clarify the definition of Manufacturer Affidavit
Ch 2, App 3, Table 1, Tab B	to add testing requirements for glazed bulwarks
Ch 2, App 3, Table 3, Tab D	to delete items not fitted on yachts
Ch 2, App 3, Table 3, Tab E	to align the requirements for internal combustion engines using gas as fuel with those of the Rules for Classification of Ships
Ch 2, App 3, Table 7, Tab J	to delete items not fitted on yachts
Ch 2, App 3, Table 10, Tab N	to clarify testing requirements for electrical installations (e.g. batteries) on battery powered yachts
Ch 2, App 3, Table 10, Tab Q	to clarify testing requirements for alarm, monitoring and control systems installations
Ch 2, App 3, Table 12, Tab P	to delete items not fitted on yachts

Part B - Hull and Stability

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 1, [5.1.2]	to correct inaccuracies resulted from merging previous yacht rules into these new rules
Ch 1, Sec 1, [5.6.2], [5.6.4]	to add requirements for walkable skylights and for underwater glazing; and to correct a typo
Ch 1, Sec 1, [5.6.7]	to add the possibility of using alternative standard for the calculation of the design pressure of glazing
Ch 1, Sec 1, [5.8.1]	to add alternatives to door coaming height
Ch 1, Sec 1, [5.12.3] (new)	to add the requirements for windows to be checked as glazed bulwarks
Ch 1, Sec 1, [5.13.1]	to align the formula for the dimensions of freeing port openings of bulwarks or guardrails with the requirements of the ILLC and extend to motor yachts the relaxation on bulwark already foreseen for sailing yacht
Ch 1, Sec 1, [5.17] (new) and Ch 5, Sec 4, [8.4] (deleted)	to extend the requirements for rigging of wooden yachts to vessels with hull made of other material
Ch 1, Sec 1, [5.18] (new)	to add the requirements for glazed swimming pools
Ch 1, Sec 1, [5.19] (new)	to add requirements for underwater glazing
Ch 1, Sec 2, [3.1.1]	to clarify the formula for keel and keel connections

Ch 1, Sec 3, [3.1.2]	to correct a typo
Ch 1, Sec 3, [6.6] (new)	to add the requirements for fairleads and bollards
Ch 1, Sec 3, [7.1.1]	to add requirements for equipment number for multihull and to correct a typo
Ch 1, Sec 6, [1.3.3], [1.5.2], Fig 1 (new), [3.1.6], [4.2.1], [5.3.2], [6.1.4], [7.3.1], [8.1.1]	to align the requirements for rudders with trunk with those in the Rules for Classification of Ships
Ch 1, App 1, [3] Ch 2, Sec 5, [3.1.1] Ch 2, Sec 7, [8.1.1] Ch 3, Sec 7, [8.1.1]	to correct inaccuracies resulted from merging previous yacht rules into these new rules
Ch 6, Sec 1, [2.3.1]	to clarify the application of stability requirements for sailing yachts

Part C - Machinery, Systems and Fire Protection

Chapter/Section/Paragraph amended	Reason
Ch 1, Sec 2, [1.1.1], Tab 4, Tab 5 and Tab 8	to align the requirements for engines components with those in the Rules for Classification of Ships
Ch 1, Sec 2, [1.6] (new), [6.1.1], [6.1.2] (new), [6.12] (new), [7.4.4]	to add requirement for light and medium duty engines
Ch 1, Sec 3, [2.3.9] Ch 1, Sec 5, [1.3.3], Tab 10 Ch 1, Sec 10, [1.3.1], Tab 3, Tab 4, Tab 16, [5.10.2], [5.10.3], [6.1.1], [6.1.3], [6.3.1], [6.6.7], [7.1.4], [8.3.1], [11.2.1], [11.2.2], [11.4.5], [15.1.1], [15.2.3], [15.2.4], [15.4.2], Tab 34 Ch 1, App 1, Tab 2 Ch 2, Sec 1, [3.3.1], [3.4.1], Tab 3, Tab 4 Ch 2, Sec 2, Tab 1, Tab 5 Ch 2, Sec 3, [2.3.8] Ch 3, Sec 3, [3.3.1] Ch 4, Sec 1, [3.1.1] Ch 4, Sec 2, [1.1.10]	to delete requirements for installations not applicable to yachts (boilers, heavy fuel oil, cargo, tanker, special category)
Ch 1, Sec 6, [1.3] (new)	to add requirement for light and medium duty gears
Ch 1, Sec 10, [6.6.3]	to correct inaccuracies resulted from merging previous yacht rules into these new rules and to correct a typo
Ch 1, Sec 10, [8.3.1]	to correct a reference
Ch 1, Sec 10, [8.6.1], [8.8.1], [8.9.2], Tab 22(deleted)	to align the requirements for overboard discharges with those in the Rules for Classification of Ships
Ch 1, Sec 10, [11.7.2], [11.9.3]	to align the requirements for fuel purifiers with those in the Rules for Classification of Ships
Ch 1, Sec 14, [2.3.3], [3.1.3], [3.2.2], [3.4.1],	to align the requirements for turbochargers with those in the Rules for Classification of Ships
Ch 1, App 1, [2.1.1] (new)	to correct inaccuracies resulted from merging previous yacht rules into these new rules
Ch 1, App 1, [2.2.2], Tab 1	to delete repetitions and correct inaccuracies resulted from merging previous yacht rules into these new rules
Ch 1, App 1, [5.8.3]	to correct a typo
Ch 2, Sec 3, Tab 3 to Tab 9	to align the requirements for cables current carrying capacity with those in the Rules for Classification of Ships
Ch 2, Sec. 3, [9.4]	to correct typos

Ch 2, Sec. 3, [9.5]	to extend the requirements for underwater lights to similar items, such as echo-sound or speed-log
Ch 2 Sec 8, [3.1.1]	to correct typos
Ch 2, Sec 15, [1.1.1]	to clarify that the requirements for testing are be read together with the requirements for testing in Pt A, Ch 2, App 3
Ch 3, App 1, [3.1.1]	to clarify the application of the new "Guidance for the application of Section 3 on Computer Based Systems" to yachts of less than 500GT
Ch 3, App 3(new)	to introduce the new "Guidance for the application of Section 3 on Computer Based Systems"
Ch 4, Sec 3, [3.2.3] (new)	to add requirements for dumb waiters
Ch 4, Sec 3, [3.4.3] Ch 4, App.1, [2.4]	to correct inaccuracies resulted from merging previous yacht rules into these new rules

Part D – Materials and Welding

Chapter/Section/Paragraph amended	Reason
Ch 4, Sec 1, [5.3.1], [5.4.4]	to eliminate specific requirements for synthetic fibre wires and the differences between steel wires/natural fibre ropes and synthetic fibre wires, as already done in the Rules for Classification of Ships

Part E – Service Notations

Chapter/Section/Paragraph amended	Reason
Ch 2, Sec 2, [1] (new)	to introduce the possibility of pleasure duty for engines
Ch 2, Sec 2, [2] (new)	to introduce the possibility of pleasure duty for gears
Ch 2, Sec 3, [2.2.2]	to correct typos
Ch 2, Sec 3, [3.1]	to clarify the application of requirements in Pt C, Ch 3, Sec 3 to pleasure yachts, particularly those below 300GT
Ch 2, Sec 4, [2.1.2] (new)	to add relaxations for dumb waiters' insulation on pleasure yachts

Part F – Additional Class Notations

Chapter/Section/Paragraph amended	Reason
Ch 8, App 2	to correct a typo
Ch 9, Sec 1, [1.1]	to clarify the requirements for the ice belt for ice class ID and to add the requirements for the installation of portlights and underwater lights

Chapter 1

GENERAL PRINCIPLES OF CLASSIFICATION

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. In particular, the classification notations are assigned according to the type, service and navigation of the yacht and other criteria which have been provided by the Interested Party, when applying for classification.

The Society 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 considered 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, as well as in the Register of Ships published by the Society.

1.1.3

Yachts and units, other than those covered in Parts B, C, D, E and F, are to comply with specific Rules published by the Society, which also stipulate the relevant classification notations.

1.1.4

The classification notations applicable to existing yachts conform to the Rules of the Society in force at the date of assignment of class, as indicated in Ch 2, Sec 1. However, the classification notations of existing Yachts may be updated according to the current Rules, as far as applicable.

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 notations with additional service features, as applicable

d) navigation notations

e) additional class notations (optional)

The different classification notations and their conditions of assignment are listed in [2] to [6] below, according to their types.

1.2.2

As an example, the classification notations assigned to a yacht may be as follows (the kind of notation shown in brackets does not form part of the classification notation indicated in the Register of Ships and on the Certificate of Classification):

- **C ✠ HULL ● MACH**
  (main class symbol, construction marks)
- **Y**
  (service notation)
- **Unrestricted navigation**
  (navigation notation)

5 Navigation notations

5.1

5.1.1
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 $\mathbf{Y_{ch}}$, 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)).

5.1.4 *(1/1/2025)*
The relaxations allowed for short range yachts **Ych** are applicable also to pleasure yachts **Y**.

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 F.

The different additional class notations which may be assigned to a yacht are listed in [6.2] to [6.25].

6.1.2
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 Automated machinery systems (AUT)

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

6.2.2 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 F, Ch 2.

6.2.3 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 F, Ch 2.

6.3 GREEN PLUS (Y)

6.3.1
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 F, Ch 3.

Chapter 2

ASSIGNMENT, MAINTENANCE, SUSPENSION AND WITHDRAWAL OF CLASS

APPENDIX 3 COMPULSORY TESTS ON MATERIALS, MACHINERY AND APPLIANCES

1 General

1.1 Materials and equipment to be assessed by Tasneef

1.1.1 As a general rule, all materials, machinery, auxiliary installations, equipment, items, etc. (generally referred to as "products"), which are covered by the class and used or fitted on board yachts surveyed by the Society during construction, are to be new and, where intended for essential services as defined in Ch 1, Sec 1, [1.2.1], tested by the Society".

1.1.2 Products which are required to be type approved by an Administration are also subject to Tasneef assessment, whenever and as far as Tasneef is recognised by or is acting on behalf of the yacht flag Administration.

1.2 Field of Application

1.2.1 These Section refer to products intended for arrangements or services in general considered "essential" in accordance with the intent of Ch 1, Sec 1, [1.2.1], as well as those for which testing requirements are stated in Statutory Standards or by other Standards applicable to the construction and outfitting of yachts.

1.2.2 In general, the testing operations and the inspections indicated in this Section are to be carried out in the Manufacturer's workshop. However, the testing operations and acceptance tests to be carried out on board during and/or after installation are also considered for those products which are completed on board or for which tests are to be carried out in connection with the final trials of the on board plants.

1.2.3 Non exclusive surveyors may be used for testing activities relevant to classification purposes, unless otherwise requested by the applicant.

1.3 Acceptance of workshop certificates and products already tested by recognised bodies

1.3.1 Where allowed, acceptance of Manufacturer's workshop certificates is subject to the originals, or identical copies, being produced and to the checking of their correspondence with the relevant products.

1.3.2 Products already tested by recognised bodies may be accepted on a case-by-case basis, using the relevant certificates and/or testing reports, provided that no additional tests are required according to the Rules and that the products correspond to the relevant certificates.

1.4 Acceptability of testing reports

1.4.1 For the purpose of product certification, the acceptability criteria of testing laboratories other than Tasneef's and relative testing reports are indicated in [6].

1.5 Identification Marking and Testing Documentation

1.5.1 Reference is to be made to [7].

1.6 Definitions

1.6.1 In addition to those in Ch 1, Sec 1, [1.2], a number of definitions of terms used for the purpose of these Section are grouped in alphabetical order in the following Tab 1. These terms are related to different aspects of the production process and product certification.

7.8.3 Testing report

When the testing is completed, the Manufacturer is to issue the testing report enclosing statement of the following:

a) the requirements for and the results of the tests;

b) the identification and testing marks stamped on the products; additionally, in the case of testing of materials:
   - the specifying designations of the heat and relevant chemical analysis;
   - the supply condition and the specification of heat treatment, as required;
   - the working and manufacturing procedure (for rolled products intended for hull, boilers and pressure vessels only).

For complicated or assembled products admitted to the alternative testing scheme, as an alternative to the above, the Manufacturer may issue a written statement that all the inspections and required tests have been performed as required by the Rules, provided it is possible to trace the associated documentation at the request of the Tasneef Surveyor. This documentation is to be kept for a period of at least 10 years after the date of the certificate.

This testing report will be attached to the testing certificate issued by the Society, or, alternatively, at the Soceity's discretion, directly confirmed by endorsement with the Tasneef stamp and the signature of the Surveyor of the Soceity in charge.

For materials manufactured in large quantities and tested by heats or by lot, the Manufacturer is to further state for the individual supplies that the material has been produced according to the Rules.

Where, following a special procedure, testing is entirely delegated to the Manufacturer, the latter is to issue its own certificate, containing all the information required in [2.2] and [2.3.1].

7.8.4 Certificates issued by Manufacturers

Where it is anticipated that the materials or products will be received with only the certificate of conformity issued by the Manufacturer, this document is to contain at least the following information:

- the kind and essential specification properties of the product, the weight and, in the case of materials, the type (working and manufacturing procedure), the nominal chemical analysis and mechanical properties or the reference standard, the dimensions and the supply condition;
- the identification marks on the products.

7.8.5 Delayed testing

Where, in special cases, at the request of the interested parties, testing is allowed to be performed after delivery, at the user’s works, such procedure is subject to the following conditions:

- the Manufacturer is to be recognised;
- the product is to be accompanied by a statement from the Manufacturer containing the information required in [2.4]and, in addition for materials, the ladle analysis.

In any event, the Surveyors of the Society have the right either to reject products with documentation missing or of dubious origin, or to demand further checks, such as the determination of the chemical composition on the product.

8 Requirements for inspection and testing of products at workshops

8.1 General

8.1.1 Purpose

The following tables list the equipment and materials which are likely to be used for the construction and outfit- ting of a yacht together with the minimum certification and testing required to be performed at the workshop before the delivery to the building shipyard.

8.1.2 Applicability

These tables are not to be considered as an alternative to or a substitute for the applicable Rule requirements. They are intended to summarise a large number of requirements located in various parts of different documents. In the event of discrepancy between the content of the tables and the applicable Rules and Standards, the latter are to be considered valid.

Products which are not considered in the following tables are to be dealt with as indicated in the applicable Rules and Standards and/or using the criteria stipulated in the tables for similar equipment, as agreed with the Society.

8.2 Content of the tables

8.2.1 Columns

The following tables have 13 columns, as follows:

- COLUMN 1:

  supplies an identification number for the equipment or material considered (referenced in Tasneef Rules for Testing NCC23/E)

- COLUMN 2:

  supplies a description of the equipment or material considered

- COLUMN 3:

  indicates whether the certification is required for the classification of the yachts by Tasneef Rules or by statutory regulations or by other Organisations, such as OIL

- COLUMN 4:

  indicates which type of certificate is required; for the meaning of the symbols used see [2]. Column 4 may be split in 2 or 4 sub column according to the gross tonnage and the class notation

- COLUMN 5:

  indicates whether the Rules require the submittal of technical documentation and design approval (see Chapter 2, [2.1] and [2.3]); whether type approval certification is required as a preliminary step towards the individual certification is also indicated

- COLUMN 6:

  indicates whether the Rules require the approval of the manufacturer and of the Manufacturing process (see [2])

- COLUMN 7:

  indicates whether the Rules require that all or part of material testing is attended by a Tasneef Surveyor (see [2]). When Workshop Certificates are normally accepted, the symbol XM is indicated in the column

- COLUMN 8:

  indicates whether the Rules require that all or part of the materials or welds are subjected to NDT in the presence of the Tasneef Surveyor's or under his control. When Workshop Certificates are normally accepted, the symbol **XM** is indicated in the column

- COLUMN 9:

  indicates whether the Rules require the Tasneef Surveyor's attendance at the workshop during certain steps of the manufacturing process (see [2])

- COLUMN 10:

  indicates whether the Rules require that a Tasneef Surveyor performs a final examination of the product (See para Chapter 2, [2.7]) or the verification of the conformity with the approved type and checking of compliance with approved drawings as applicable. The verification of conformity may also be performed at the shipyard in connection with the installation on board of the equipment (See [2]). When Workshop Certificates are normally accepted, the symbol XM is indicated in the column

- COLUMN 11:

  indicates whether the Rules require that final tests are carried out in the presence of a Tasneef Surveyor. In the case of hydrostatic testing carried out in batches, the test is performed and certified by the Manufacturer and checks may be carried out by the Surveyor. When Workshop Certificates are normally accepted, the symbol **XM** is indicated in the column

- COLUMN 12:

  indicates whether the completed equipment is to be subjected to a functioning and/or performance test in the presence of the Tasneef Surveyor (See [2]) in workshop or where possible on board. When Workshop Certificates are normally accepted, the symbol XM is indicated in the column

8.3 Symbols

8.3.1 The following symbols are used in Column 3:

- **C**

  to indicate that the certification is required by Tasneef Rules in connection with the yacht classification

- S

  to indicate that the certification is required following statutory requirements

- B

  to indicate that the certification is required both for Tasneef classification of the yacht and to comply with statutory requirements.

- O

  to indicate that the certification is required to comply with the requirements of other Organisations, for instance OIL.

8.3.2 *(1/1/2025)*

The following symbols are used in Column 4:

- CT

  individual inspection scheme (see [3])

- CA

  alternative inspection scheme (see [4])

- TA

  Tasneef type approval (see [5]). Where the Type Approval Certificate is supplemented by a Production Control Certificate, no additional certificate is required. Where the Type Approval Certificate is supplemented by a Production Control Certificate, no additional certificate is required.

  Where the Type Approval Certificate is required as a preliminary step of the individual certification, the symbol TA is indicated in column 5 in addition to the other requirements for the individual certification.

  TA issued by other IACS Societies may be taken into consideration as alternative to Tasneef Type Approval

- MED

  MED type approval (see [5])

- MA

  (Manufacturer’s affidavit). In general, the MA requires the examination of the available documentation (internal reports, certificates) by the Tasneef Surveyor and is in general carried out directly at the shipyard. Where the rules ask for product conformity to national or international standards, a Manufacturer's declaration of conformity of the product to those standards is to be sent.

8.4 Alternatives

8.4.1 In general, whenever a TA is required for a product, a CT may also be acceptable. In such cases, the tests to be carried out are to be agreed on a case-by-case basis with the Society taking into account the tests required for type approval.

9 Certification and testing

9.1 General

9.1.1 In the tables from 1 to 17 in Annex 1 are reported the required certification for the all the items fitted on board, when required by the rules, according to the service notation requested. The tables relevant to items not reported in class rules (e.g. statutory matters such as life saving appliances, radio etc) are reported for information only.

Annex 1

Table 1: Hull Structure and Equipment

		ORIGIN OF THE REQUIREMENT	TYPE OF CERTIFICATE		DRAWING OR DESIGN APPROVAL	MANUFACTURER AND/ OR MANUFAC-TURING PROCESS APPROVAL	MATERIAL TESTING	NDT	SHOP ATTENDANCE DURING FABRICA-TION	FINAL INSPECTION AND/OR CONFORM-ITY VERIFICATION	FINAL TESTS	FUNCTIONING TESTS
			> 500 GT	< 500 GT								
No.	**HULL STRUCTURE Tab A**											
2	Aluminium alloy plates, profiles and structural pipes	C	CT or CA	CT or CA		X (1)	X	X		X	X	
3	Bimetallic joints for connection of aluminium structures to steel structures	C	CT or CA	CT or CA		X (1)	X	X		X	X	
4	Cast or forged steel for engine foundation plates	C	CT or CA	CT or CA			X	X		X		
5	Cast or forged steel /alluminium /composite for stem, sternpost, rudder horn, rudder frames, shaft brackets, hawsepipes, stern tube	C	CT or CA	CT or CA	X	X	X	X		X		
6	Propeller nozzles	C	CT	CT	X		X	X	X	X		
7	Steel/alluminium /composite plates/panels, profiles and structural pipes	C	CT or CA	CT or CA		X (1)	X	X		X	X	
8	Welded profiles	C	CT or CA	CT or CA		X (1)		X		X	X	
9	GRP structures components (resins, reinforcements, sandwich materials …)	C	TA	TA			X					
10	Wooden structure (plywood …)	C	TA	TA			X					
(1) Not required for limited supplies with CT when additional tests are carried out												
	Hull Equipment and Fittings Tab. B											
1	Anchor windlasses	C	CT or CA	MA	X		XM	X (4)		X	X (1)	X (1)
2	Anchors	C	CT or CA	CT or CA	X	X	X	X		X	X (2) (7)	
3	Ball type air pipe closing devices	B	TA	TA						X		
4	Chain stoppers	C	CT or CA	MA	X (12)		XM			X	X (13)	X
5	Chain cables for anchors	C	CT or CA(***)	CT or CA (***)		X				X	X (3)	
6	Electric motors and electric apparatus for products 1, 8, 23, 26	SEE TABLE N										
7	Fittings for chain cables:links, shackles, end links, swivels,pendants	C	CT or CA	MA		X	X	X (4)		X	X (4)	

8	Shell and bottom doors	C	CT	CT	X		X	X	X	X (6)		
9	High/very high holding power anchors	C	CT or CA	CT or CA	TA	X	X	X		X	X (2) (7)	
10	Hull fittings for mooring or towing, without rotating components (bollards, bitts, chocks)	C	CT or CA	MA	X (12)		XM			X		
10A	Hull fittings for mooring or towing, with rotating components (fairleads, rollers)	C	CT or CA	MA	X (12)		XM			X	X (8)(13)	X
11	Hydraulic plants for products anchor windlass and WT doors	SEE TABLE L										
12	Scuppers	C	CT or CA	CT or CA	X					X	X	
13	Securing devices for hatch covers and shell doors (see item 8)	C	CT or CA	TA	X		X	X		X		
14	Glazings an relevant deadlight fitted on the hull or superstructure contributing to buoyancy with frame	C	TA	TA	X		X (14)			X	X (6)	
15	Glass for glazing	C	CT or CA	CT or CA			X (14)			X		
15A	Structural adhesive	C	TA	TA								
16	Steel bars for chains	C	CT or CA(***)	CT or CA (***)		X	X					
18	Steel, raw or synthetic fibre ropes for standing running rig- ging, mooring warping, towing	C	CT or CA (*)	MA		X (11)				X	X (9)	
19	Stem, sternpost, rudder horn, rudder frames, shoepieces, shaft brackets, hawsepipes, etc.	C	CT	CT	X		X	X	X	X	X	
21 tab.I	Sterntubes	C	CT or CA	CT or CA	X		X	X		X	XM (10)	
see tab C	Rudder trunk	C	CT	CT	X		X	X		X		
20	Tow hooks (if not intended for emergency towing)	C	CT or CA	CT or CA	X		XM			X	X (7)	
21	Towing winches (if not intended for emergency towing)	C	CT or CA	CT or CA	X		XM	X (4)		X	X	X
22	Valves for sea inlet and overboard discharge only DN>=80	B	CT or CA	CT or CA			X			X	X (10)	
22 bis	Valves for sea inlet and overboard discharge only DN<80	B	MA	MA			XM			X		
22 ter	Through hull fitting (any DN) for composite vessel	B	TA	TA	X		X				X (15)	
22A	Watertight cable transits (*)	B	TA	MA								
23	Watertight doors Structure	B	TA	TA								
25	Weathertight doors	B	MA	MA			XM			X	X	
25 new	Underwater lights and similar items	C	TA	TA	X		X				X	X
26 new	Glazed bulwarks	C	TA	TA	X		X (16)			X (16)		

(1) With verification of the disassembled parts after the test, as applicable

(2) Drop and hammering test on cast anchors may be omitted subject to preliminary agreement and additional tests.

(3) Proof load and breaking strength test per lots

(4) If and when requested by Tasneef Surveyor

(5) To be in accordance with a recognised Standard, otherwise design is to be approved

(6) Hose tests

(7) Proof load test

(8) Hydrostatic test on sample products randomly selected plus other particular tests as required by the Rules

(9) Breaking strength test

(10) Hydrostatic test

(11) when required by the Rules

(12) Approval of drawings is not required if the equipment is made in accordance with a recognised industry standard (e.g. ISO)

(13) Proof load test is not required if the equipment is made in accordance with a recognised industry standard

(14) Hydrostatic or punch test for glass for glazings fitted into the hull or superstructure contributing to buoyancy, XM for other cases, X for frame materials

(*) MA in case of yachts of less than 500GT

(**) TA in case of yachts of less than 500GT

(***) for SL3, Q3 and Q2 when required in part D otherwise MA

(15) Test in accordance with ISO 9093

(16) When required in accordance to Pt B, Ch 1, Sec 1, [5.12]

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Table 3: Main and Aux Diesel Engines

		ORIGIN OF THE REQUIREMENT	TYPE OF CERTIFICATE				DRAWING OR DESIGN APPROVAL	MANUFACTURER AND/ OR MANUFAC- TURING PROCESS APPROVAL	MATERIAL TESTING	NDT	SHOP ATTENDANCE DURING FABRICA- TION	FINAL INSPECTION AND/OR CONFORM- ITY VERIFICATION	FINAL TESTS	FUNCTIONING TESTS
	Main and Aux Diesel Engines Tab D		**cross MACH any length any GT**	**new cross any length any GT**	**ball MACH applic only for < 500GT**	**ball MACH < 24m**								
1	Welded bedplate	C	CT or CA	MA			X	X (5)	XM (1) (2)	XM (3) (4)	X (6)	X		
2	Cast steel bearing transverse girders	C	CT or CA	MA					XM (1) (2)	XM (3) (4)		X		
3	Welded frame box	C	CT or CA	MA				X (5)	XM (1) (2)	XM (3) (4)	X (6)	X		
4	Gray cast iron cylinder block for engines having a power per cylinder greater than 400 kW/cyl	C	MA									XM	XM (16)(7)	
5	Spheroidal graphite cast iron cylinder block for engines having a power per cylinder greater than 400 kW/cyl	C	MA									XM	XM (16)(7)	
6	Welded cylinder frames for crosshead engines	C	CT or CA	MA				X (5)	XM (1) (2)	XM (3) (4)		X (6)	X	
7	Gray cast iron engine block for engines having a power per cylinder greater than 400 kW/cyl	C	MA									XM	XM (16)(7)	
8	Spheroidal graphite cast iron engine block for engines having a power per cylinder greater than 400 kW/cyl	C	MA					XM (2)				XM	XM (16)(7)	
9	Cylinder liner for engines having cylinder bore greater than 300 mm	C	MA					XM (1) (2)				XM	XM (16)(7)	
10	Gray cast iron cylinder head for engines having cylinder bore greater than 300 mm	C	MA										XM (16)(7)	
11	Spheroidal graphite cast iron cylinder head for engines having cylinder bore greater than 300 mm	C	MA										XM (16)(7)	

12	Cast steel cylinder head for engines having cylinder bore greater than 300 mm	C	CT or CA	MA				X	XM (1) (2)	XM (3) (4)		X	XM (16)(7)	
13	Forged cylinder head for engines having cylinder bore greater than 300 mm	C	CT or CA	MA				X	XM (1) (2)	XM (3) (4)		X	XM (16)(7)	
14	Cast steel piston crown for engines having cylinder bore greater than 400 mm	C	CT or CA	MA				X	XM (1) (2)	XM (3) (4)		X		
15	Forged piston crown for engines having cylinder bore greater than 400 mm	C	CT or CA	MA				X	XM (1) (2)	XM (3) (4)		X		
~~16~~	~~Crankshaft (made in one piece)~~	~~C~~	~~CT or CA~~	~~MA~~			~~X~~	~~X~~	~~XM (1) (2)~~	~~XM (3) (4)~~	~~XM (8)~~	~~X (9)~~		
~~17~~	~~Semi-built crankshaft (Crank throw, forged main journal and journals with flange)~~	~~C~~	~~CT or CA~~	~~MA~~			~~X~~	~~X~~	~~XM (1) (2)~~	~~XM (3) (4)~~	~~XM (8)~~	~~X (10)~~		
20	Exhaust gas valve cage for crosshead engines	C	MA										XM (16)(7)	
21	Piston rod for crosshead engines having cylinder bore greater than 400 mm	C	CT or CA	MA					XM (1) (2)	XM (3) (4)		X (11)		
23	Connecting rod with cap	C	CT or CA	MA					XM (1) (2)	XM (3) (4)	XM	X (17)		
24	Coupling bolts for crankshaft	C	CT or CA	MA					XM (1) (2)	XM (3) (4)	XM	X (18)		
25	Bolts and studs for main bearings for engines having cylinder bore greater than 300 mm	C	MA						XM (1) (2)	XM (3) (4)				
26	Bolts and studs for cylinder heads for engines hav- ing cylinder bore greater than 300 mm	C	MA						XM (1) (2)	XM (3) (4)				
27	Bolts and studs for connecting rods for engines hav- ing cylinder bore greater than 300 mm	C	MA						XM (1) (2)	XM (3) (4)	XM (12)			
28	Tie rod for crosshead engines	C	CT or CA	MA					XM (1) (2)	XM (3) (4)	XM (12)	X (11)		
29	High pressure fuel injection pump body for engines having cylinder bore greater than 300 mm	C	MA						XM (1) (2)				XM (16)(7)	
30	High pressure fuel injection pump body for engines having cylinder bore not greater than 300 mm	C	MA						XM (1) (2)				XM (15)(7)	

31	High pressure fuel injection valves (only for those not auto-fretted) for engines having cylinder bore greater than 300 mm	C	MA										XM (16)(7)	
32	High pressure fuel injection valves (only for those not auto-fretted) for engines having cylinder bore not greater than 300 mm	C	MA										XM (15)(7)	
33	High pressure fuel injection pipes including com- mon fuel rail for engines having cylinder bore great- er than 300 mm	C	MA						XM (1) (2)				XM (14)(16)(7)	
34	High pressure fuel injection pipes including com- mon fuel rail for engines having cylinder bore not greater than 300 mm	C	MA						XM (1) (2)				XM (14)(15)(7)	
35	High pressure common servo oil system for engines having cylinder bore greater than 300 mm	C	MA						XM (1) (2)				XM (16)(7)	
36	High pressure common servo oil system for engines having cylinder bore not greater than 300 mm	C	MA						XM (1) (2)				XM (15)(7)	
37	Cooler, both sides (13), for engines having cylinder bore greater than 300 mm	C	MA						XM (1) (2)				XM (16)(7)	
38	Accumulator (only for accumulators with capacity greater than 0,5 l)	C	MA						XM (1) (2)				XM (16)(7)	
39	Piping, pumps, actuators, etc. for hydraulic drive of valves for engines having a power per cylinder greater than 800 kW/cyl	C	MA						XM (1) (2)				XM (16)	
40	Engine driven pumps (oil, water, fuel, bilge), -other than injection pumps and pumps for hydraulic drive -, for engines having a power per cylinder greater than 800 kW/cyl	C	MA										XM (16)(7)	
41	Bearings for main and crankpin for engines having a power per cylinder greater than 800 kW/cyl	C	MA						XM (1) (2)	XM (4)(15)	XM (8)			

42	Diesel engines (complete) for non-essential service and diesel engines for essential auxiliary service of less than 110 kW	C	MA											
43	Diesel engines (complete) intended for main propulsion, or Diesel engines (complete) developping a power of 110 kW and over intended for: a) driving electrical generator; b) other auxiliary services essential for safety and navigation;	C	CT or CA	TA	MA	MA							X	X
44	Diesel engine control panels	see tab E												
45	Elastic couplings for electric generator groups	C	CT or CA	MA					XM				X	
46	Electric power generating sets	see tab N												
47	Injection plants for diesel engines intended for propulsion or power generation and other essential auxiliary services of 110 KW or greater	see tab E												
49	Chocking resins (pourable compounds for foundation chocking)	C	TA	MA										

(1) Chemical composition

(2) Mechanical properties

(3) Crack detection by MPI or liquid penetrant test

(4) Ultrasonic testing

(5) Approval of WPS

(6) Fit up + post welding

(7) Hydrostatic pressure test as required by the applicable rules

(8) Dimensional inspection, including surface condition

(9) Random check of fillets and oil bores

(10) Random check of fillets and shrink fittings

(11) Random check

(12) Manufacturer Test Report of thread making

(13) Charge air coolers need only be tested on the water side

(14) Required for those injection pipes that are not autofretted

(15) Review of Manufacturer Test Report

(16) Review of Manufacturer Work Certificate

(17) Random check of all surfaces, in particular those shot peened

(18) Random check of interfce fit

	Auxiliary component and accessories for Engines Tab.E													
1	Air, water and oil coolers	**FOR PRESSURE PARTS SEE TABLE J**												
2	Clutches	**SEE TABLE H**												
3	Control, monitoring and alarm systems	**SEE TABLE Q**												
4	Cooling water, lubricating oil, fuel oil injection and fuel oil transfer pumps	**C**	**CT or CA**	**MA**									**X (1)**	**X**
5	Ejectors for bilge in machinery spaces	**C**	**CT or CA**	**MA**									**X (1)**	
7	Electric panels and apparatus	**SEE TABLE N**												
8	Fuel oil and lubricating oil non-structural tanks	**C**	**CT or CA**	**MA**					**XM**			**X**	**X (1)**	
9	Fuel oil and lubricating oil purifiers	**C**	**CT or CA**	**MA**								**X**	**X (1)**	**X**
10	Injectors, buster pumps and injection pipes	**C**	**CT or CA**	**MA**					**XM**			**X**	**X (1)**	
10A	Oil mist detector	**C**	**TA**									**X**		**X**
11	Piping systems	**SEE TABLE K**												
12	Pressure filters	**FOR PRESSURE PARTS SEE TABLE J**												
15	Crankcase explosion relief valves for diesel engines **(3)**	**C**	**TA**											
16	Scavenge air main	**FOR PRESSURE PARTS SEE TABLE J**												
17	Scavenging pumps	**C**	**CT or CA**	**MA**								**X**	**X (1)**	**X**
18	Starting air compressors	**C**	**CT or CA**	**MA**								**X**	**X (1)**	**X**
19	Starting motors - electrical	**SEE TABLE N**												
20	Starting motors - hydraulic or pneumatic	**C**	**CT or CA**	**TA**	**MA**	**MA**						**X**	**X (1)**	
21	Turbochargers (Category A and B)	**C**	**MA (2)**											
22	Turbochargers (Category C)	**C**	**CT or CA**	**TA**	**MA**	**MA**			**X**	**X**		**X**	**X (1) (4)**	**X**
23	Electronic speed governors and their actuators	**C**	**TA**											
24	Explosion relief devices (ERD) for combustion air inlet and exhaust gas manifolds of i.c.engines using gas as fuel (4)	**C**	**TA**											

(1) Hydrostatic test

(2) For Category B the manufacturer is to adhere to a quality system designed to ensure that the designer's specifications are met, and that manufacturing is in accordance with the approved drawings
(3) Overspeed and balancing tests on completed rotor
(4) When required by the Rules

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Table 7: Pressure Vessels, Heat Exchanger

		ORIGIN OF THE REQUIREMENT	TYPE OF CERTIFICATE				DRAWING OR DESIGN APPROVAL	MANUFACTURER AND/ OR MANUFAC-TURING PROCESS	MATERIAL TESTING	NDT	SHOP ATTENDANCE DURING FABRICA-TION	FINAL INSPECTION AND/OR CONFORM-ITY VERIFICATION	FINAL TESTS	FUNCTIONING TESTS
	Pressure Vessels, Heat Exchanger Tab.J		cross MACH any length any GT	new cross any length any GT	ball MACH applic only for < 500GT	ball MACH < 24m								
1	Cast or forged parts for oil fired thermal oil heaters, and class 1 pressure vessels	C	CT or CA	MA				X	X	X (6)		X		
2	Cast or forged parts for class 2 pressure vessels	C	CT or CA	MA					XM	X (6)		X		
3	Cast or forged parts for class 3 pressure vessels	C	MA						XM					
4	**Class 1 pressure vessels and heat exchangers**	C	CT or CA	TA	TA	MA	X	X (1)	X (2)	X (3)	X	X	X (4)	
5	**Class 2 pressure vessels and heat exchangers**	C	CT or CA	TA	TA	MA	X	X (1)	X (9)	X (3)	X	X	X (4)	
6	Class 3 pressure vessels and heat exchangers	C	CT or CA	MA			X (6)	X	XM			X (12)	X (4)	
7	Condensers	AS REQUIRED DEPENDING ON THE CLASS OF THE PRESSURE VESSEL												
8	Control, monitoring and alarm systems	SEE TABLE Q												
9	Cylinders for hydraulic plants	SEE TABLE L												
~~10~~	~~Drums for watertube boilers~~	~~C~~	~~CT or CA~~	~~MA~~			~~X~~	~~X (1)~~	~~X (2)~~	~~X (3)~~		~~X~~	~~X (4)~~	
11	Flanges and nozzles for class 1 pressure vessels	C	CT or CA	MA				X (1)	X	X (3)		X		
12	Flanges and nozzles for class 2 pressure vessels	C	CT or CA	MA				X (1)	XM	X (3)		X		
13	Flanges and nozzles for class 3 pressure vessels	C	MA						XM					
14	Level indicators	C	CT or CA	MA			X		X (7)	X		X	X (4)	
~~15~~	~~Oil fired thermal oil heaters, exhaust gas thermal oil heaters~~	~~C~~	~~CT or CA~~	~~MA~~			~~X~~	~~X (1)~~	~~X (2)~~	~~X (3)~~	~~X~~	~~X~~	~~X (4)~~	
16	Pipes and valves	SEE TABLE K												
~~17~~	~~Plates, profiles and tubesheets for boilers, steam generators, oil fired thermal oil heaters, exhaust gas thermal oil heaters and class 1 pressure vessels~~	~~C~~	~~CT or CA~~	~~MA~~				~~X~~	~~X~~	~~X (6)~~		~~X~~		
18	Plates, profiles and tubesheets for class 2 pressure vessels	C	CT or CA (5)	MA				X	XM	X (6)		X		

19	Plates, profiles and tubesheets for class 3 pressure vessels	C	MA						XM					
20	Safety valves	SEE TABLE K												
21	Seamless bottles	C	CT or CA	MA			X	X	X (8)	X		X	X (10)	
~~22~~	~~Steam heated generators or steam generators heat- ed by another fluid~~	~~C~~	~~CT or CA~~	~~MA~~			~~X~~	~~X (1)~~	~~X (2)~~	~~X (3)~~	~~X~~	~~X~~	~~X (4)~~	
~~23~~	~~Steel bars for stays of boilers~~	~~C~~	~~CT or CA~~	~~MA~~					~~X~~			~~X~~		
24	Steering gear actuators	SEE TABLE C												
25	Tubes for class 3 heat exchangers	C	MA						XM					
~~26~~	~~Tubes for boilers, steam generators, oil fired thermal oil heaters, exhaust gas thermal oil heaters and class 1 pressure vessels~~	~~C~~	~~CT or CA~~	~~MA~~				~~X (11)~~	~~X~~	~~X (6)~~			~~X (4)~~	
27	Tubes for class 2 heat exchangers	C	CT or CA	MA				X (11)	XM	X (6)			X (4)	
28	Welded bottles	C	CT or CA	MA			X	X	X (8)	XM		X	X (10)	

(1) Welding procedures

(3) On the welded joints for the extension required by the Rules

(4) Hydrostatic test – as required by the Rules

(5) Document review in lieu of CT or CA for limited supplies

(6) As required by the applicable Rules

(7) It may be scheme II for small mass produced products

(8) XM for class 2 and 3

(9) Limited to tests on welded joint production samples, as required by the Rules

(10) Burst test on prototypes and hydrostatic tests on production as required by the Rules

(11) Only for welded tubes and for seamless tubes in low alloy steel

(12) Review of conformity certificate issued by the manufacturer

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Table 10: Electrical & Control Systems

		ORIGIN OF THE REQUIREMENT	TYPE OF CERTIFICATE				DRAWING OR DESIGN APPROVAL	MANUFACTURER AND/ OR MANUFAC- TURING PROCESS APPROVAL	MATERIAL TESTING	NDT	SHOP ATTENDANCE DURING FABRICA- TION	FINAL INSPECTION AND/OR CONFORM- ITY VERIFICATION	FINAL TESTS	FUNCTIONING TESTS
	Electrical Installations Tab.N		cross MACH any length any GT	new cross any length any GT	ball MACH applic only for < 500GT	ball MACH < 24m								
1	Batteries for essential and/or emergency services	C	MA	MA										
1A	**Batteries for battery powered ships (11) <= 20kWh**	~~C~~	~~CT or CA~~MA	MA	MA	MA	~~TA~~					X	X	X
1B	**Batteries for battery powered ships (11) > 20kWh**	C	CT or CA	CT or CA	CT or CA	MA	TA					X	X	X
1C~~B~~	Control, monitoring and alarm systems for battery powered ships	SEE TABLE Q												
1D~~C~~	Fuel cells	C	CT or CA	MA	MA	MA	TA					X	X	X
1E~~D~~	Control, monitoring and alarm systems for fuel cells	SEE TABLE Q												
2	Battery chargers having rated power of 50 kVA and above	C	CT or CA	MA	MA		X					X	X (1)	X
3	Cables intended for propulsion	C	CT or CA	MA	MA	MA	TA						X	
3A	Cables not intended for propulsion system	C	MA	MA	MA		TA							
4	Circuit-breakers, contactors, etc., with nominal current greater than 100 A	C	CT or CA (5)	MA			TA					X (5)	X (5)	
4A	Disconnectors with nominal current greater than 100 A	C	CT or CA	MA								X	X	
5	Circuit-breakers, contactors, etc., with nominal current of 100 A or less	C	MA				TA							
5A	Disconnectors with nominal current of 100 A or less	C	MA											
6	Cold weather starting of generator sets (starting de- vices)	SEE TABLE P												
7	**Complete power generation sets**	C	CT or CA	~~TA~~ CT or CA	MA		X (3)					X (2)	X (4)	X (4)
8	Distribution panels and single starters of voltage greater than 1000 V	C	CT	~~MA~~CT	~~MA~~CT		X						X	X

9	**Electric motors intended for propulsion**	C	CT or CA	~~TA~~ MA	MA	MA	TA (6)					X	X	X
10	Electric safety lamps	SEE TABLE P												
11	Electrical appliances for hazardous areas	C	MA											
11A	Miscellaneous electric equipment (lighting fittings, heating and cooking appliances, plug and socket connection, accessories)	C	MA											
12	Electronic components and computers	SEE TABLE Q												
13	Instrumentation	SEE TABLE Q												
14	Low voltage distribution panels and single starters having nominal current greater than 100 A	C	CT	CT	CT		X (8)						X (4)	X (4)
15	Low voltage distribution panels and single starters having nominal current of 100 A or less except those intended for steering gear motors	C	MA											
16	Low-locating lighting systems	SEE TABLE O												
17	**Main and emergency switchboards**	C	CT	CT	CT	CT (12)	X						X	
18	Navigation lights	S	TA (10)	TA (10)	TA (10)	TA (10)								
19	Navigation light switchboards	C	CT or CA	MA			X						X	
20	Rotating machines for essential services of 100 kW and over (100 kVA for generators)	C	CT or CA	MA	MA		TA (6)					X	X (9)	X
21	Rotating machines for essential services of less than 100 kW (100 kVA for generators)	C	MA (7)	MA (7)	MA (14)							XM	XM	XM
22	Semiconductor converters having nominal power of 50 kVA and over	C	CT or CA	MA	MA	MA (13)	~~X~~ TA (6)					X (1)		X
23	Shafts for rotating machines intended for essential services (not for propulsion) other than those indicated below	C	MA						XM					
24	Shafts for rotating machines intended for propulsion and power generation whose rotors are part of the shafting lines	C	CT or CA				X		X			X		
25	Shafts for rotating machines intended for propulsion of 100 kW and over (100 kVA for generators) others than those indicated above	C	CT or CA						X			X		
26	Sound signal appliances	S	TA										X (5)	
27	Starters for steering gear motors	C	CT				X						X	
28	Switchboards and panels related to alarm systems	C	CT				X						X	
29	Switchboards for watertight door, side door and fire door control, monitoring and alarm	C	CT				X						X	

30	Transformers for essential services of 100 kVA and over (60 kVA for single phase transformers)	C	CT or CA	MA	MA		TA (6)						X	
31	Transformers for essential services of less than 100 kVA (60 kVA for single phase transformers)	C	MA (7)											
31A	Uninterruptible power system (UPS) units of 50 kVA and over	C	CT	MA										
32	Electronic devices for alarm, safety and control of electrical convertors for primary essential services	C	CT	MA			TA							
33	Cable trays/protective casings of plastic materials	C	TA (6)											
34	Busbar trunking system (outside of switchboards, distribution boards)	C	CT				TA					X	X	
35	Harmonic filters	C	CT or CA	MA								X	X	X
36	HVSC (high voltage shore connection, cold ironing, shore side electricity)	C	CT or CA	MA				X				X	X	X
37	Internal communication device (automatic exchange telephone, common battery telephone, sound powered telephone)	S	CT or CA	MA								X	X	X

(1) Including type tests (if any)
(2) For components
(3) Drawing approval is required in respect of Torsional Vibration Calculation (engine power 110 kW and above)
(4) May be postponed on board upon agreement of all interested parties
(5) If production control is not integrated in the TA
(6) Type approval or type test as required by the Rules
(7) Manufacturer's type test according to Tasneef Rules reports are to be submitted
(8) Above 100 kW
(9) In case of motors cooled with water jacket, hydrostatic pressure test to be carried as required by the Rules.
(10) For ships flying non-European Community Administration flags, whose Administrations recognise the certificates issued by Tasneef or authorise Tasneef to issue certificates on their behalf, MED for yachts flying and Administration requiring Marine Equipment Directive also for yachts
(11) Only in case of Lithium Batteries
(12) Only for Main Switchboard
(13) Only for electrical propulsion
(14) Declaration of Conformity to IEC 60034 to be submitted
(15) Only when required by Tasneef

	Control, Monitoring and Alarm Systems Tab.Q													
1	Actuators (electrical/electronic)	C	TA											
2	**Alarm system (complete)**	C	CT	TA (7)	MA (4)		X					X	X (1)	X (1)
3	Computers of Category II, III	C	TA	TA (5)										
3A	Computers of Category I	C	MA											
4	Consoles	C	CT				X					X	X (1)	X (1)

5	Control devices to computers of Category II, III	C	TA												
5A	Control devices to computers of Category I	C	MA												
6	**Control system (complete)**	C	CT	~~MA~~	~~MA (4)~~		X					X	X (1)	X (1)	
7	Electrical cables and apparatus	SEE TABLE N													
8	Hydraulic system	SEE TABLE L													
8A	Pneumatic system	SEE TABLE K													
9	Loading instruments	S	TA (3)											X (1)	
10	Indicators, Instruments to computers of Category II, III	C	TA												
10A	Indicators, Instruments to computers of Category I	C	MA												
11	**Monitoring system (complete)**	C	CT	~~MA~~	~~MA (4)~~		X					X	X (1)	X (1)	
12	Peripherals to computers of Category II, III (keyboard, mouse, VDU, etc.)	C	TA												
12A	Peripherals to computers of Category I (keyboard, mouse, VDU, etc.)	C	MA												
13	Sensors	C	TA												
14	Software	C	~~CT~~ MA (4)	MA (4)			~~TA~~ X								X (1)(2)

(1) May be performed on board

(2) Review of software validation documentation and functional test of the whole system

(3) For ~~ships~~ yachts whose Administrations recognise the certificates issued by Tasneef or authorise Tasneef to issue certificates on their behalf

(4) To be evaluated on the scope of the software

(5) ~~Only for category III systems~~ Including computers used for the vessel automation/monitoring system which functioning is not necessary for vessel proper operation and safety.

(6) ~~When the monitoring system is necessary for the proper operation of the yacht~~ only for category III systems and automation systems which correct functioning is necessary for vessel proper operation and safety.

~~(7) only for programmable equipment~~

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Table 12: Fire Protection

		ORIGIN OF THE REQUIREMENT	TYPE OF CERTIFICATE	DRAWING OR DESIGN APPROVAL	MANUFACTURER AND/ OR MANUFAC- TURING PROCESS APPROVAL	MATERIAL TESTING	NDT	SHOP ATTENDANCE DURING FABRICA- TION	FINAL INSPECTION AND/OR CONFORM- ITY VERIFICATION	FINAL TESTS	FUNCTIONING TESTS
	Passive Fire Protection Tab.O										
1	"A" and "B" class divisions, fire integrity: a) 'A' class division, b) 'B' class division	S	MED (1) - TA (2)								
2	Bedding components	S	MED (1) - TA (2)								
3	"C " class divisions	S	MED (1) - TA (2)								
4	fire door control systems components **(4)**	S	MED (1) - TA (2)								
7	Draperies, curtains and other suspended textile mate- rials and films	S	MED (1) - TA (2)								
8	Electrical cables and apparatus for hazardous areas	SEE TABLE N									
9	Fire dampers	S	MED (1) - TA (2)								
11	Fire doors	S	MED (1) - TA (2)								
17	Materials other than steel for pipes conveying oil or fuel oil: a) Plastic pipes and fittings, b) Valves, c) Flexible pipe assemblies and compensators, d) metallic pipe components with resilient and elastomeric seals	S	MED (1) - TA (2)						X (3)		
19	Non-combustible materials	S	MED (1) - TA (2)								
20	Penetrations through “A” class divisions a) Electric cable transits, b) Pipe, duct, trunk, etc. penetrations	SC (4)	MED (1) - TA (2) (5)								
21	Penetrations through “B” class divisions; a) Electric cable transits, b) Pipe, duct, trunk, etc. penetrations	SC (4)	MED (1) - TA (2) (5)								
22	Penetrations through “C” class divisions Electrical cable transits, Non-combustible duct penetrations	SC (4)	MA TA (5)								

24	Primary deck coverings	S	MED (1) - TA (2)								
24A	Sanitary boxes	C	CT or CA								
25	Surface materials and floor coverings with low flame spread characteristics: a) Decorative veneers, b) Paint systems, c) Floor coverings, d) Pipe insulation covers, e) Adhesive used in the construction of “B” & “C” class divisions, f) Combustible ducts membrane	S	MED (1) - TA (2)								
26	Upholstered furniture: a) complete piece of furniture (including cover mate- rial, filling material and non-flammable rack), b)cover material for any filling material, c) cover material for flame-retardant filling material (tested in specific combination as intended for further application), d) flame-retardant filling material	S	MED (1) - TA (2)								
27	“A” and “B” class fire proof windows and sidescuttles	S	MED (1) - TA (2)								
(1) For yachts flying flags that recall marine equipment directive in their Safety Codes fro yachts											
(2) For yachts not flying flags that recall marine equipment directive in their Safety Codes fro yachts											
(3) Flexible hoses to be Type Approved and individually tested according to Pt C, Ch 10, in case of ball mach MA certificate is accetable											
(4) Watertight Cable Transits are to be additionally type approved by Tasneef (see Table B)											
	Active Fire Protection Tab.P										
1	Compressed air line breathing apparatus	S	MED (1) - TA (2)								
1B	Fire alarm devices (sounders)	S	MED (1) - TA (2)								
2	Nozzles for equivalent watermist fire extinguish- ing systems for machinery spaces	S	MED (1) - TA (2)								
3	Cold weather starting of generator sets (starting devices)	S	MA								
4	Concentrate for fixed high expansion foam fire-extinguishing systems for machinery spaces	S	MED (1) - TA (2)								
5	Nozzles for deep-fat cooking equipment fire-extinguishing systems (automatic or manual type)	S	MED (1) - TA (2)								

7	Dual purpose type nozzles (spray/jet type): a) Hand-held branch pipes for fire service use -	S	MED (1) - TA (2)								
8	Electric safety lamp	S	TA (2)								
9	Emergency escape breathing devices (EEBD): a) self-contained open-circuit compressed air breathing apparatus with full mask or mouthed piece assembly for escape, b) self-contained open-circuit compressed air breathing apparatus with a hood for escape, c) self-contained closed-circuit compressed air breathing apparatus	S	MED (1) - TA (2)								
10	Equivalent fixed gas fire-extinguishing system components (extinguishing medium, head valves and nozzles) for machinery spaces	S	MED (1) - TA (2)								
11	Equivalent fixed gas fire-extinguishing systems for machinery spaces (aerosol systems)	S	MED (1) - TA (2)								
13	Fire-fighting hoses: - non-percolating lay flat firefighting hoses (range of the inside diameter from 25 mm to 52 mm)	S	MED (1) - TA (2)								
14	Fixed firefighting hose systems: - hose reels with semi-rigid hose	S	MED (1) - TA (2)								
15	Fire-fighter's outfit: protective clothing (close proximity clothing): a) protective non reflective clothing for firefighting, b) reflective clothing for specialised fire-fighting, c) protective clothing with a reflective outer surface	S	MED (1) - TA (2)								
16	Fire-fighter's outfit: boots	S	MED (1) - TA (2)								
17	Fire-fighter's outfit: gloves	S	MED (1) - TA (2)								
18	Fire-fighter's outfit: helmet	S	MED (1) - TA (2)								
19	Fire-fighter's outfit: lifeline	S	MED (1) - TA (2)								
20	Fixed oxygen analysis and gas detection equipment: a) category 4: (safe area), b) category 3: (explosive gas atmospheres)	S	MED (1) - TA (2)								

21	Fixed fire detection and fire alarm systems com- ponents for control stations, service spaces, accommodation spaces, cabin balconies, machinery spaces and unattended machinery spaces a)control and indicating equipment b)power supply equipment c)heat detectors - point detectors d)smoke detectors: point detectors using scat- tered light, transmitted light or ionization e)flame detectors: point detectors f)manual call points g)short circuit isolators h)input/output devices i)cables	S	**MED (1) - TA (2) (3)**								
23	Fixed low expansion foam fire-extinguishing system components **(3)** for machinery spaces	S	**MED (1) - TA (2)**								
25	Fixed water based local application fire-fighting system components **(3)** for use in category “A” machinery spaces	S	**MED (1) - TA (2)**								
27	Galley exhaust duct fixed fire-extinguishing systems components **(3)**	S	**MED (1) - TA (2)**								
29	Helicopter facility foam firefighting appliances	S	**MED (1) - TA (2)**								
30	Inert gas system: a)Whole system b)single components: inert gas scrubbers c)single components: inert gas blowers	S	**MED (1) - TA (2)**								
~~30A~~	~~a) Inside air high expansion foam systems for the protection of machinery spaces, vehicle and ro-ro spaces, , b) Outside air high expansion foam systems for the protection of machinery spaces, cargo pump rooms, vehicle and ro-ro spaces, special category spaces and cargo spaces~~	~~S~~	~~MED (1) – TA (2) (5)~~								
~~31A~~	~~Medium expansion foam fire extinguishing sys- tems components (3) fixed deck foam for tankers~~	~~S~~	~~MED (1) – TA (2)~~								
32	Non-portable and transportable extinguishers	S	**MED (1) - TA (2)**								

34	Fixed water-based fire-fighting systems for roro spaces, vehicle spaces and special category spaces: a) prescriptive-based systems as per IMO MSC.1/Circ.1430, b) performance-based systems as per IMO MSC.1/Circ. 1430	S	MED (1) - TA (2)								
35	Nozzles for fixed pressure water-spraying fire-extinguishing systems for machinery spaces	S	MED (1) - TA (2)								
35A	Nozzles for fixed pressure water-spraying fire-extinguishing systems for cabin balconies	S	MED (1) - TA (2)								
36	Portable oxygen analysis and gas detection equipment: a) category 1: (safe area), b) category 2: (explosive gas atmospheres)	S	MED (1) - TA (2)								
38	Portable fire extinguishers	S	MED (1) - TA (2)								
39	Portable fire extinguishers for lifeboats and rescue boats	S	MED (1) - TA (2)								
40	Portable foam applicator units	S	TA (4)								
41	Pressure bottles and vessels	SEE TABLE J									
42	Protective clothing resistant to chemical attack	S	TA (4)								
43	Pumps and compressors for fixed fire extinction systems	SEE TABLE K									
44	Sample extraction smoke detection system components : control and indicating equipment. Electrical installations in ships b) power supply equipment, c) aspiring smoke detectors	S	MED (1) - TA (2)								
45	Self-contained compressed-air-operated breathing apparatus	S	MED (1) - TA (2)								
46	Self-contained compressed-air-operated breathing apparatus for entry and work in gas-filled space	S	MED (1) - TA (2)								
47	Sprinkler systems (limited to sprinkler heads)	S	MED (1) - TA (2)								
48	Sprinkler systems components for accommodation spaces, service spaces and control stations equivalent to that referred to in SOLAS 74 Reg.	S	MED (1) - TA (2)								
49	Dry chemical powder extinguishing systems	S	MED (1) - TA (2)								

50	Fixed hydrocarbon gas detection system	**S**	**MED (1) - TA (2)**								
52	Fire-fighting hoses: — semi-rigid hoses for fixed systems	**S**	**MED (1) - TA (2)**								
53	Fixed firefighting hose systems — hose systems with lay-flat hose	**S**	**MED (1) - TA (2)**								
54	Paint lockers and flammable liquid lockers fire extinguishing systems components **(3)**	**S**	**TA (4)**								
55	Gaseous Fuel Systems Used for Domestic Purposes (components) **(3)**	**S**	**TA (4)**								
56	Fixed Gas Fire Extinguishing Systems (CO_2) components **(3)**	**S**	**TA (4)**								
57	Water Spraying Hand Operated System	**S**	**TA (4)**								
58	Fire hoses with diameter > 52 mm	**S**	**TA (4)**								

(1) For yachts flying flags that recall marine equipment directive in their Safety Codes fro yachts

(2) For yachts not flying flags that recall marine equipment directive in their Safety Codes fro yachts

(3) Applicable to a single component or a group of components or a whole system which needs to be tested to ensure that the applicable requirements are fulfilled.

(4) For ships flying flags whose Administrations recognise the certificates issued by Tasneef or authorise Tasneef to issue certificates on their behalf

(5) Inside/Outside air high expansion foam systems for the protection of machinery spaces vehicle and ro-ro spaces, shall be tested with the approved concentrate to the satisfaction of the Administration.

...OMISSIS...

Chapter 1
GENERAL

SECTION 1 GENERAL REQUIREMENTS

1 Rule application

1.1

1.1.1 Part B consists of the following Chapters:

- Ch.1 General
- Ch.2 Steel
- Ch.3 Alluminium
- Ch.4 Composite
- Ch.5 Wood
- Ch.6 Stability

Chapter 3, 4 and 5 are applicable to yachts with the hull made of materials other than steel.

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.

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 Tasneef 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.

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 *(1/1/2025)*

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 suitable in the opinion of Tasneef. For yachts of more than 500 GT Ddetails relevant to these devices and their installation on board are to be sent to Tasneef for approval.

In any case, lead or other sensitive materials are not accepted in systems which penetrate watertight subdivision bulkheads where deterioration of such systems in the event of fire would impair the watertight integrity of the bulkheads.

In general, when the pipe passing through the bulkhead is non-metallic, the above device is to be a pipe of the same material as the bulkhead with a suitable thickness, fitted in a way to restore the structural integrity of the bulkhead, having a length of 10 D, where D is the external diameter of the pipe; the length of the above pipe is not required to be more than 400 mm. In case of composite bulkhead the penetration of non metallic pipe may be done with a steel sleeve with a thickness of at least 3mm.

Doors in watertight bulkheads are to be approved watertight doors; additional characteristics regarding these doors are set out in Part E.

5.1.3

a) *The collision bulkhead may be pierced below the bulkhead deck by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a screw-down valve capable of being operated from above the bulkhead deck, the valve chest being secured inside the forepeak to the collision bulkhead. The Society may, however, authorise the fitting of this valve on the after side of the collision bulkhead provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space.*

   All valves are to be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable.

b) *If the forepeak is divided to hold two different kinds of liquids the Society may allow the collision bulkhead to be pierced below the bulkhead deck by two pipes, each of which is fitted as required in a), provided the Society is satisfied that there is no practical alter-native to the fitting of such a second pipe and that, having regard to the additional subdivision provided in the forepeak, the safety of the ship is maintained.*

c) The remote operation device of the valve referred to in a) is to include an indicator to show whether the valve is open or shut.

5.1.4 Watertight bulkheads and doors

The strength of watertight bulkheads is to be in conformity with Ch 2. Doors in watertight bulkhead has to be sliding type.

Approved hinged doors may be accepted for infrequently used openings in watertight compartments where a crew member will be in immediate attendance when the door is open at sea. Audible and visual alarms are to be provided on the bridge. Procedures for the operation of watertight doors are to be agreed and posted in suitable locations. Watertight doors are to be normally closed with the exception of sliding watertight doors providing normal access to frequently used living and working spaces. For matters not explicitly dealt with in this paragraph, compliance is required with the requirements given in Appendix 3.

5.1.5 Compartment below the freeboard deck to be used for recreational activities or other services having access openings in the hull

Compartment below the freeboard deck to be used for recreational activities or other services having access openings in the hull are to be enclosed in watertight boundaries.

means of closure is to be provided. The system is to be of equivalent construction to the hull on the outboard side to the closure. For short range yachts it may be accepted that the exhaust piping is looped up above the waterline on the outboard side of the system to a minimum height of 1000 mm and is of equivalent construction to the hull.

5.4 Stern and side doors below the weather deck

5.4.1 Side/shell doors

Side/shell doors are to comply with the requirements given in Appendix 3.

5.4.2 Drawings

Drawings representing the structure of the side/shell doors, their locking devices and their height above the waterline are to be sent to Tasneef for approval, with a general arrangement enclosed showing the intended use of the compartment which the doors give access to and the machinery and/or sports craft fitted therein.

5.4.3 Other fittings

Recesses for wells, gangways, winches, platforms, etc are to be watertight and of strength equivalent to that of the adjacent structures. Any penetrations for electrical wiring and piping are to ensure watertight integrity. Discharges are to be provided to prevent the accumulation of water in the normal foreseeable situations of transverse list and trim. See also [5.13.4].

5.5 Hatch on the weather deck

5.5.1 Hatches on the weather deck and deck above are to have a strength equivalent to that of the adjacent structures to which they are fitted and are to be weathertight. In general, hatches are to be hinged on the foreword side.

5.5.2 Where the hatches may be required to be used as a means of escape the securing arrangements are to be operable from both sides and in the direction of escape they are to be openable without a key. All handles on the inside are to be non removable. An escape hatch is to be readily identified and easy and safe to use, having due regard to its position.

5.5.3 Flush hatches on the weather deck are generally not to be fitted. Where they are foreseen they are to:

- be closed at sea;
- be fitted in a protected location close to the center line;
- have at least two drains in the aft part leading overboard;
- be fitted with gaskets;
- have at least 4 clips for size 600 x 600 mm;
- have non-oval hinges which can be considered as clips.
- be provided with open/close indication at the navigating bridge.

Flush hatches not satisfying all the above requirements have to be tested watertight

For dimensions bigger than 600 x 600 mm, the acceptance is at the discretion of Tasneef. Drawings representing the hatches, their position on deck, their coamings and their system of closure are to be sent for approval.

5.5.4 In general, hatches are to be kept closed at sea.
However, hatchways which may be kept open for access at sea are to be as small as practicable (a maximum of 1 square metre in clear area). Hatchways are to be as near to the centreline as practicable, especially on sailing vessels. Covers of hatchways are to be permanently attached to the hatch coamings.

5.5.5 Hatches, which are required to be watertight are to be tested according to the requirements given in Pt B, Ch 1, App 2.

5.6 Scantling of glazing

5.6.1 General

L is the scantling length in m.

L_{LL} Load line length.

T is the scantling draught in m (see [4.2.1]).

In this paragraph the word "window" is used alternatively with "portlight" and "glazing". These may have frame or not, deadlight or not depending on the context where they are used.

Only in [5.6.15] the word window is used for the larger fixed glazing that include one or more portlights (smaller not easy openable glazing).

Not easy openable means that the windows need a key or a mechanical mean or tool to be opened and that may keep it closed. For windows and door fitted in superstructure not contributing to buoyancy also redundant electrical means may be considered.

Other definitions are given below. In every subparagraph are defined the symbols used, the same symbol may have different meaning in different subparagraph.

For references see also ISO 11336-1 and 11336-2.

5.6.2 Limitations and general requirements *(1/1/2025)*

This paragraph is intended to be used on yachts with restricted and unrestricted navigation.

This standard does not give a limit in the windows dimensions provided that all its parts are fully satisfied and the scantling of the hull is in accordance with the applicable rules without consider the structural contribution of the glazing.

The following limitations on the location of glazed openings are given.

~~Glazed openings have to be located at least:~~

- ~~200 mm above maximum load water line~~
- ~~100 mm aft from the stem post~~

Glazing located less than 100mm for from the stem post ~~in other positions and in particular submerged glazings~~ will be evaluated on a case-by-case basis

Glazing located less than 200mm above the maximum waterline have to be designed according to [5.19].

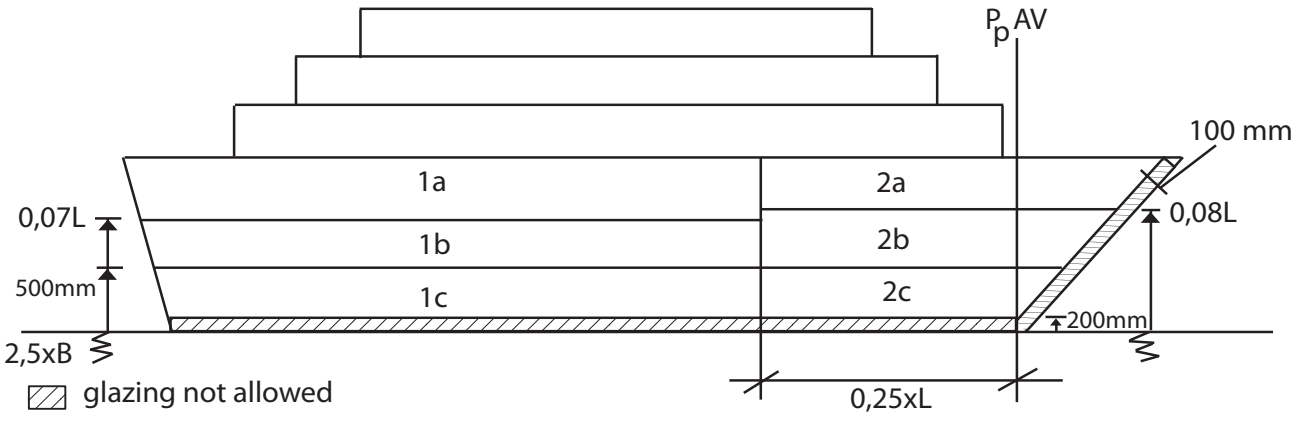
The following limitations on the use of glazing material and in the type of glazing in some locations are applicable:

- Hull and superstructure contributing to the buoyancy

  The following Zones are defined:

  - Zone 1a: the glass is located more than 0.07L mm from the design waterline and is totally aft of 0,25L
  - Zone 1b: the glass is located more than 500 mm or 2,5%B whichever is greater and less than 0.07L from the design waterline and is totally aft of 0,25L
  - Zone 1c: the glass is located less than 500 mm or 2,5%B whichever is greater from the design waterline and is totally aft of 0,25L
  - Zone 2a: the glass is located more than 0.08L from the design waterline and is totally or partially fore of 0,25L
  - Zone 2b: the glass is located more than 500 mm or 2,5%B whichever is greater but less than 0,08L from the design waterline and is totally or partially fore of 0,25L
  - Zone 2c: the glass is located less than 500 mm or 2,5%B whichever is greater from the design waterline and is totally or partially fore of 0,25L.

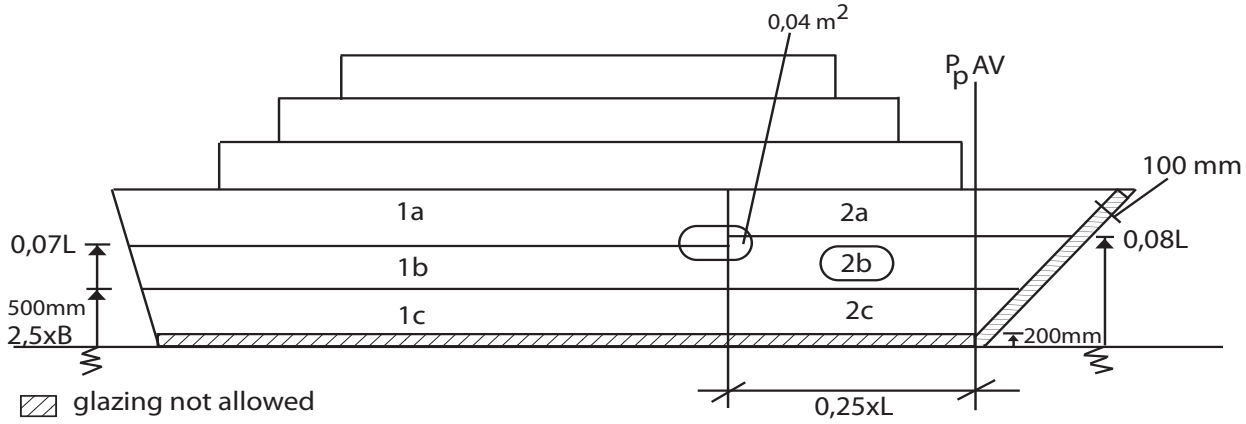
Figure 2 : Definition of hull and superstructure contributing to buoyancy zones



If a windows is located partially for more than 0,04 m^2 in more than one Zone the heavier scantling is to be considered.

As an example in Fig 3 the glazing is to be considered as it is located in zone 2b.

Figure 3 : Definition of the zone when the glazing is located in more than one



- Superstructure not contributing to the buoyancy

  This paragraph is intended also for the scantling of glazing located in superstructure not contributing to the buoyancy, for such glazing no zones are defined, their position is taken into consideration only for the calculation of the design pressure (see [5.6.7]).

  For yachts subject to load line assignment when a superstructure is considered giving a reduction to the tabular required freeboard it has to be considered as a superstructure contributing to buoyancy.

  If the windows fitted in superstructure have a frame it has to be done in general according to [5.6.14]

  If an openable window is not fitted with mechanical means (or an approved redundant electrical mean) to keep it closed in emergency after a single failure it is to be treated as an easy openable window.

  Openable windows of dimensions larger than 2.5 m^2 are to be made with laminated glass.

- Skylights

  This paragraph may be used also for the scantling of glazing skylights fitted on the weather deck provided that skylights fitted abaft 0,25L are considered as windows fitted in Zone 1a or 1b depending on their height above the WL and those fore of 0,25L as windows fitted in Zone 2a or 2b.

  Skylights fitted in superstructure not contributing to the buoyancy may be treated as a windows located in aft facing in the deck immediately below the one where the skylight is fitted.

  Such skylights are not intended to walk on. Skylights where it is possible to walk on shall have non slip surface and have scantling that consider the weight of the persons walking on (considering not less than 4 persons of 75 kg per square meter), laminated glass with structural interlayer at least 3mm is suggested.~~Skylights where it's possible to walk on will be considered on a case by case base.~~

  When used as means of escape they have to satisfy the same requirements as the hatches used as means of escape. If they are flush they have to satisfy the same requirement of flush hatches so be watertight.

- Bulwark

  Portions of bulwark intended as means to prevent the fall overboard may be realized with glazing material provided that provisions of para 5.12 are complied with.

- Doors

  As far as the scantling of the glazing material, glazing doors may be treated as windows located in the same position.

  The doors in general have to be made of laminated glass.

  In general aft doors may have monolithic glass.

  For lateral glazed doors fitted in the first tier of superstructure one of the following solutions may be adopted:

- laminated glass with thickness increase of at least 30% with an interlayer of 3 mm of polycarbonate or equivalent material
- laminated glass and one of the solutions indicated as alternative to the storm cover
- laminated glass protected by a solid bulwark of at least the required height.

The use of monolithic glass for lateral doors in first tier of superstructure will be evaluated on a case by case base taking into account:

- the dimension of each door panel (if more or less than 2 m^2)
- ts transversal position (if located at least 0.1B inboard)
- if protected by a solid bulwark higher than the minimum required, and
- the increase of thickness (at least 50%)

~~the dimension of each door panel (if more or less than 2m2)~~ i~~ts transversal position (if located at least 0.1B inboard) and if protected by a solid bulwark higher than the minimum required and the increase of thickness (at least 50%)~~.

If the doors fitted in superstructure not contributing to buoyancy have a frame it has to be done in general according to [5.6.14] a) and if glued [5.6.14] b).

See also para [5.8].

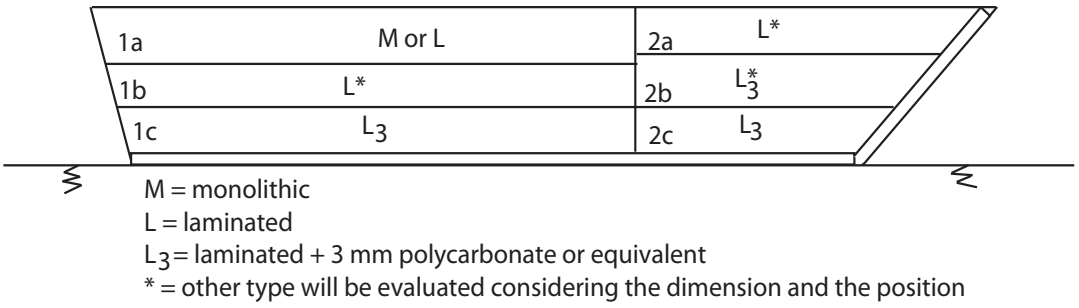
Type of glazing depending on the Zone:

- In Zone 1.a monolithic or laminated glass is acceptable. The use of monolithic polycarbonate or polymetilmetacrylate is also acceptable.
- In Zone 1.b and 2a in general only laminated glass is acceptable, the use of monolithic glass (or monolithic polycarbonate or polymetilmetacrylate) will be evaluated on a case by case base considering the dimension of the glazing and the use of deadlights.
- In Zone 2b laminated glass with at least 3mm polycarbonate or equivalent material as interlayer in general is to be used, the use of laminated with thinner interlayer or monolithic glass (or monolithic polycarbonate or polymetilmetacrylate) will be evaluated on a case by case base considering the dimension of the glazing and the use of deadlights. Normally monolithic glazing is acceptable only if the glazing is smaller than 0,125m^2 and for glazing of more than 0,025Lx0.07L the use of laminated glass with 3mm of polycarbonate is mandatory.
- In Zone 1c, and 2c only laminated glass with at least 3mm polycarbonate, or equivalent material as interlayer, is acceptable.

As far as the test for the equivalence between polycarbonate and other interlayer materials see [5.6 17].

The windows fitted in superstructure not contributing to buoyancy may be treated as the windows fitted in zone 1a.

Figure 4 : Type of glazing



Type of opening depending on the Zone:

- In Zone 1a, and 1b and 2a the windows may be fixed or not easily openable type. When a not easy openable glazing unit of more than 0,2m^2 with the lower edge at a distance of less than 1,5m from the internal finished floor is located on the hull, or in the widebody or in a superstructure where, if accidentally passing through it, it is possible to fall into the sea or on a deck located at more than 1m from the lower edge of the glazed opening, means are to be provided to reduce the effective free area of the glazed opening when open to a maximum of 0,2m^2. The effective free area may be increased its maximum dimension is not more than 230mm. See Fig 5

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; different values may be accepted if the glazing is to be tested in accordance with EN 1288-3.

The characteristic of superficial compression (S_c x N/mm^2) and of depth of compression layer l_{CD} (mm) 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].

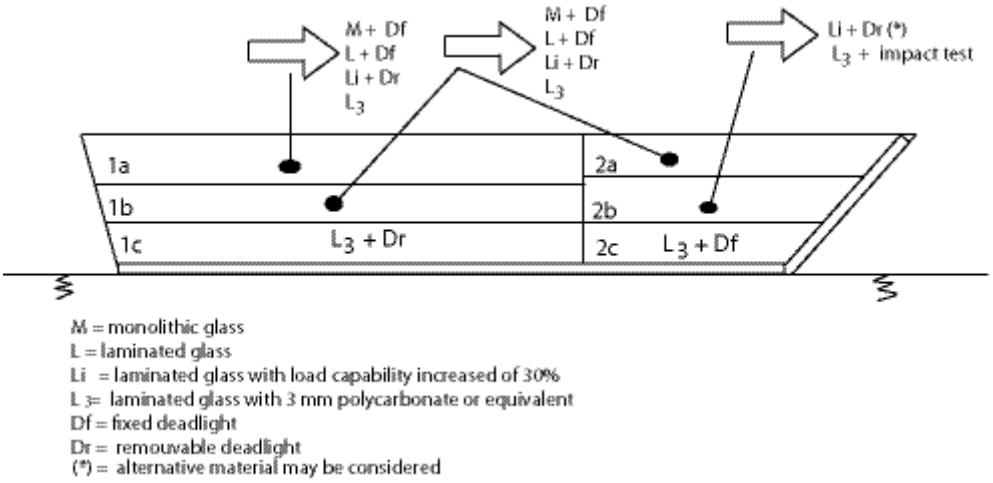
5.6.4 Deadlights and storm covers *(1/1/2025)*

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. As an alternative [5.19] may be applied.
- In Zone 2c a fixed deadlight is to be ~~in any case~~ foreseen. As an alternative [5.19] may be applied.

Figure 8 : Deadlights



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].

~~Deadlight made of other materials such as for example glazed deadlight will be considered on a case by case base.~~

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. Also in these location the use of an interlayer of 3mm of polycarbonate or equivalent material may be accepted as an alternative to traditional deadlights. For windows in other locations ~~O~~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.

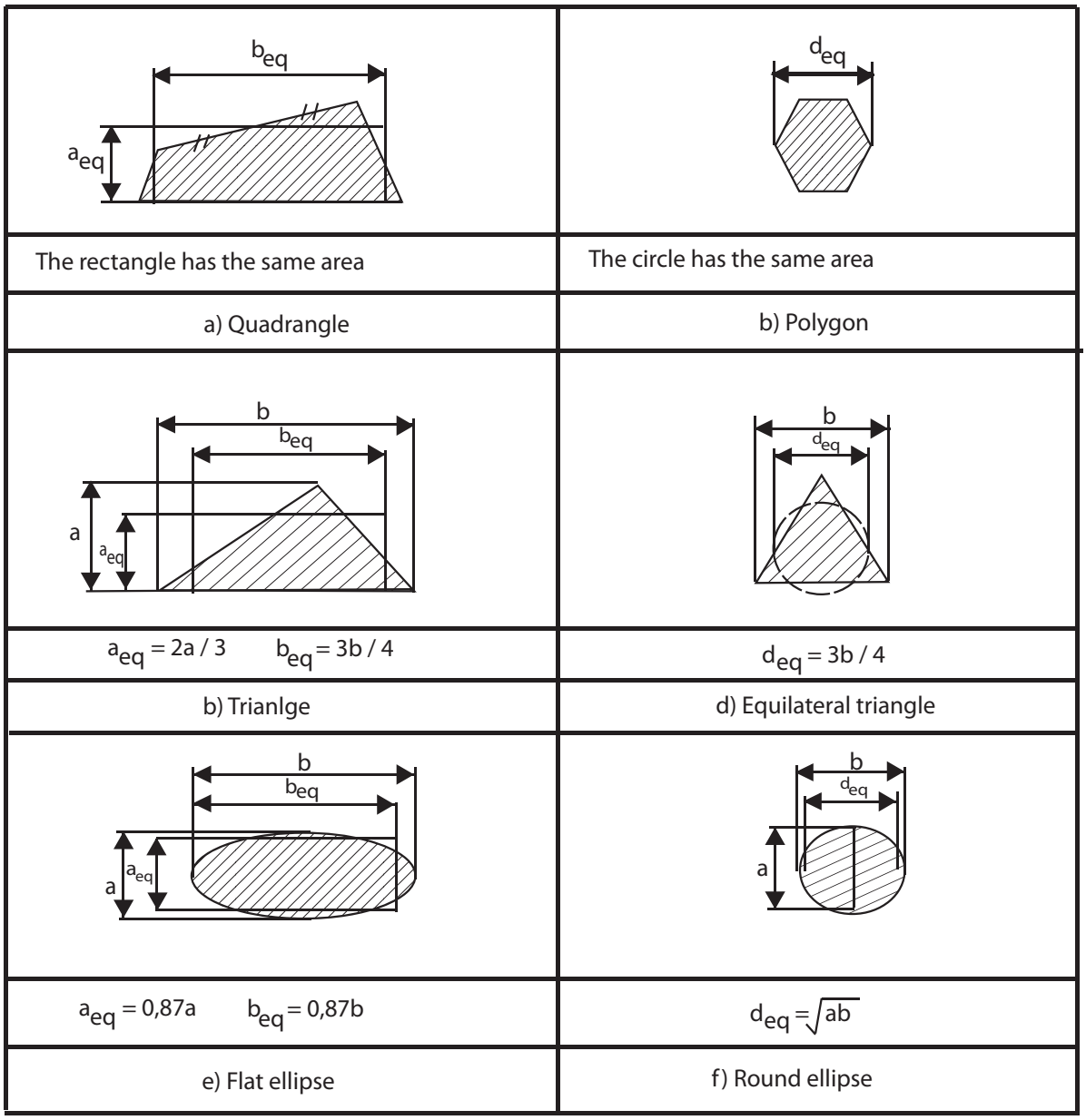
Storm shutters shall be dimensioned such that when loaded by the design pressure the yield deformation stress is not exceeded. The storm shutter shall be designed considering the same design pressure as required for the glazing. Subject to this pressure the stress in storm shutter and all load carrying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

Figure 10



5.6.7 Calculation of the pressure to be used for the scantling of the glazing *(1/1/2025)*

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/m^2, 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 ref is to be taken from the following Table 3.~~.~~ For the superstructure contributing to the buoyancy the pressures indicated in Tab 3 may be divided by 2.

Table 3

L m	Motor yachts kN/m^2	Cruising sailing yachts kN/m^2
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 $p_{1\ ref}$

In case p1 calculated with the above formula is more than 200 kN/m2 Tasneef may evaluate the possibility to accept the scantling of the glazing done using 200 kN/m2

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 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

Length of ship, in m	f
L < 150	$\frac{L}{10}e^{-L/300} - \left[1 - \left(\frac{L}{150}\right)^2\right]$
150 £ L < 300	$\frac{L}{10}e^{-L/300}$
L > 300	11,03

h, in m, is the distance from the lower edge of the windows to the design waterline

For the hull p1 is to be taken not less than $p1_{ref}$

In no cases p1 for superstructure not contributing to buoyancy to be taken less than:

L < 50m p_D min front 1st tier forward from 0,25L 21 kN/m², lateral 1st tier if in the widebody forward of 0,25L 15 kN/m².

When the front 1st tier window is located more than 0,25L aft from forward perpendicular the value of p_D may be reduced to 15 kN/m².

p_D lateral 1st tier not in the widebody or in the widebody but aft from 0,25L from forward perpendicular = 12.5 kN/m^2.

p_D aft 1st tier = 12.5 kN/m^2.

p_D min elsewhere = 10 kN/m^2.

L>50m p_D min front 1st tier forward from 0,25L 16+L/10 kN/m^2, lateral 1st tier if in the widebody forward of 0,25L to 10+ L/10 kN/m^2.

When the front 1st tier window is located more that 0,25L aft from forward perpendicular the value of p_D may be reduced to 10+ L/10 kN/m^2.

p_D lateral 1st tier not in the widebody or in the widebody but aft from 0,25L from forward perpendicular = 10+L/20 kN/m^2.

p_D aft 1st tier = = 10+L/20 kN/m^2.

p_D min elsewhere = 7.5 + L/20 kN/m^2.

Small reductions to this value may be taken into consideration taking into account the length of the yacht or the service.

Where the Flag requires different values these have to be used.

b) P2 is to be taken equal to half of the pressure of the bottom calculated in accordance with Sec 5, [5.3]

c) P3 is to be taken equal to the pressure of the side calculated in accordance with Sec 5, [5.4]

d)

$$P_4 = K_{su} \cdot \left(1 + \frac{x_1}{2 \cdot L(C_B + 0,1)}\right)(1 + 0,045 \cdot L - 0,38 \cdot$$

where:

K_{su} is to be taken equal to 6 for lateral and frontal windows at the first tier of superstructure

K_{su} is to be taken equal to 5 frontal windows at the second tier of superstructure

K_{su} is to be taken equal to 3 for other windows

z_1 is the distance in m of the lower edge of the windows to the waterline

x_1 is the distance in m from frontal windows or from the forward edge of lateral windows to midship perpendicular. For frontal and lateral windows aft of midship and for aft windows is to be taken equal to 0.

C_B and L as before in this paragraph.

In case the pressure calculated with an international standard accepted by the Society is less than the pressure calculated with this paragraph, special considerations will be done.

5.6.8 Calculation of the thickness required

Once the pressure P_D id known it is possible to calculate the minimum thickness t_o, in mm, required depending on the area of the glass and its shape:

Rectangular windows:

$$t_o = b \cdot \sqrt{\frac{\beta \cdot p_D}{1000 \cdot \sigma_A}}$$

Circular windows:

$$t_o = 0,5 \cdot d \sqrt{\frac{3 \cdot (3 + \nu) \cdot p_D}{8000 \cdot \sigma_A}}$$

NB: This equation is coming from linear plate theory and it is strictly valid for small deflection of the pane (less than $t_O/2$). A more accurate structural analysis may be based on non-linear FEM calculation. Nevertheless this simplified linear approach has been found to be consistent and conservative for scantling determination of plates when comparing results of hydrostatic tests with the more accurate non-linear FEM calculations.

Where:

d = diameter of the glazing, in mm

b = short side of the glazing, in mm

n = Poisson's Coefficient

5.7 Skylights

5.7.1 The relevant locking devices are to be the same as required for flush hatches (see [5.5.3]).

For the scantling of the glazing see [5.6]..

5.7.2 A minimum of one portable cover for each size of glazed opening is to be provided which can be assessed rapidly and efficiently secured in the event of breakage of the skylight.

5.7.3 Skylights which are designated for escape purposes are to be openable from either side and in the direction of escape they are to be openable without a key.

All handles on the inside are to be non-removable. An escape skylight is to be readily identified and easy and safe to use, having due regard to its position.

5.8 Outer doors

5.8.1 Doors in the superstructure's side *(1/1/2025)*

Doors of exposed bulkheads of superstructures are to be of adequate dimensions and construction such as to guarantee their weathertight integrity and to be hinged in the forward edge.

The use of FRP for doors on the weather deck other than machinery spaces may be accepted, providing the doors are sufficiently strong.

For glazed doors see [5.6.2].

Where the doors may be required to be used as a means of escape, the securing arrangements are to be operable from both sides.

Where the doors may be required to be used as a means of escape, and are electrically operated they have to be also manually operable from both sides of the door in case of failure of the electrical system.

If the door is not fitted with mechanical means (or an approved redundant electrical mean) to keep it closed in emergency after a single failure it is to be treated as an easy openable window.

Doors to be kept closed during navigation and if openable out of the harbor indication in the wheelhouse of the door open is to be foreseen.

The height of the sills of doors above the exposed deck that give access to compartments below the deck is to be not less than the following value:

	Deck position 1	Deck position 2
Outer doors	100 mm	75 mm
Companionways	100 mm	75 mm

Doors on the weather deck which give direct access to machinery spaces are to have a minimum of six clips and to be outward opening.

Doors on the weather deck to 1st tier accommodation or other spaces protecting access below may have four clips.

Companionway have to be built using deck head.

Reverse sill may be accepted provided that the following conditions are satisfied:

a) Are Generally in way only of lateral and aft facing doors

b) The door is not normally used during navigation in bad weather conditions

c) The yacht is to have an increased freeboard

The design of the negative sill is to be as follow:

A negative sill to be realized with the following minimum dimensions (lxbxh).

l = at least the lower door edge

b (width) = at least the required sill height.

H (depth) = at least (h req - h off) where h req is the required sill height and h off is the offered sill height of the door (if h off = 0 then h to be at least h req).

h off = 0 then h to be at least h req).

The lower and lateral sides of the recess done to have the negative sill is to be made with a suitable scantling, and the upper side may be done with a grid of the same material of the deck finishing (teak).

The free area of the grid to be at least 50% of its total area.

Different dimensions may be evaluated based on equivalence of volume when the depth can not be satisfied but the depth to be at least 100mm for unrestricted and 75mm for short range.

At least 1 scupper sb and 1 pb with a diameter capable of granting the performance required during the test on board are to be fitted. The scuppers (material thickness and means of closure) are to be made in accordance with the requirement of pt C and discharge overboard.

Alternative solution may be accepted based on the satisfaction of the following test.

A pump of a capacity of about 30m3/h with its outlet left free (no pipes connected) is to discharge its maximum capacity of water on the recess and it is to be verified that:

- the recess is emptied for at least 80% of its volume in approximately less than 30 sec.
- the grid receives the water entirely without regurgitation on the deck around it

The application of the requirements of other rules equivalent to those of this section may be evaluated by the Society.

5.9 Drawings

5.9.1 A plan showing the position portlights, windows, skylights, external doors and glass walls is to be submitted; their dimensions, their sills is to be clearly indicated.

5.10 Ventilation ducts

5.10.1 General

Accommodation spaces are to be protected from gas or vapour fumes from machinery, exhaust and fuel systems. The yacht is to be adequately ventilated throughout all spaces. The accommodation is to be protected from the entry of gas and/or vapour fumes from machinery, exhaust and fuel systems.

Ventilation ducts are to be of efficient construction and, generally, when serving any spaces below the freeboard deck or an enclosed superstructure are to have a coming of a minimum height as indicated in Tab 11.

Table 11

Location	Coming height (mm) Short range navigation	Coming height (mm) Unrestricted navigation
Forward quarter length	450	900
Elsewhere	380	760

Ventilation ducts are to be kept as far inboard as practicable and the height above the deck of the ventilation ducts openings is to be sufficient to prevent the ingress of water when the vessel heels.

Machinery spaces are to be adequately ventilated so as to ensure that, when machinery therein is operating at full power in all weather conditions, an adequate supply of air is maintained to the spaces for safety and for the operation of the machinery, according to the Manufacturer's instructions.

The design and positioning of ventilation duct openings are to be considered with care, above all in zones of high stress or in exposed zones. The deck plating in way of the coamings is to be adequately stiffened.

The scantlings of ventilation ducts exposed to the weather are to be equivalent to those of the adjacent deck or bulkhead.

Ventilation ducts are to be adequately stayed.

Ventilation ducts which, for any reason, can be subjected to liquid pressure are to be made watertight and have scantlings suitable for withstanding the foreseen pressure.

For engine exhaust outlets, reference is to be made to [5.3.3].

					-	impact test ISO 13049	interlayer 3mm structural material and top rail z>20cm^3, if stanchions are spaces up to 1,5m and 40cm^3 if stanchions are spaced up to 2,2m s > 315N/mm^2 and stanchions z>30cm^3 up to 1,5m or 40cm^3 up to 2,2m s > 315N/mm^2, weather load less than 30kN/m^2?
							yes/no
							-/impact test ISO 13049

5.12.2 Scantling of stanchions and rails for yacht

- For bulwark without glazing material:

  The personnel load is to be taken at least equal to 1 KN and is to be considered concentrated, in the center of the top rail length for the scantling of the top rail and on top of the stanchions for the scantling of the stanchions.

  The top rail is assumed simply supported, the stanchions are assumed clamped to the deck.
- For bulwark with glazing material (in addition to what above):

  The weather load is to be added to the personnel load above mentioned.

  The weather load is considered distributed in the area included by the top rail the stanchions and the deck. (i.e. even when a gap is foreseen between the glazing and the deck and/or the top rail the area of the glazing is assumed equal to the area included between stanchions top rail and deck).

When the upper part of the glazing is not connected to the top rail with double side continuous line the weather load is assumed supported all by the stanchions and the top rail support only the personnel load.

When the upper part of the glazing is connected to the top rail the weather load aging on the glazing is assumed supported half by the stanchions half by the top rail.

5.12.3 *(1/1/2025)*

When more than 0,2m^2 of the clear light of an external window is located below 1m from the finished floor this part of the window is to be verified as a glazed bulwark.

5.13 Freeing ports

5.13.1 *(1/1/2025)*

Any bulwarks or guardrails are to be provided with freeing port openings having dimensions for each side not less than the value given from formula:

$A = 0,7+0.035\ l$ when $l \leq 20m$

$A = 0,07\ l$ when $l>20m$

Where:

A (m^2) = freeing port area for each side;

l (m) = length of bulwark on one side, but need not exceed 0,7 L_{II}

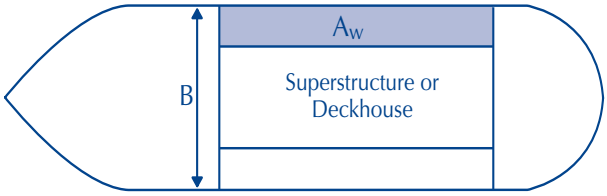
The value given from the above formula is to be corrected for the height of the bulwarks according to the following criteria.

If the bulwark height exceeds 1,2 m, the freeing port area is to be increased by 0,004 m^2 per metre of bulwark length for each 0,1 m difference in height. Where the bulwark height is less than 0,9 m, the freeing port area is to be decreased by the same ratio.

On a flush deck ship with a deckhouse amidships having a breadth at least 80% of the beam of the ship and the passageways along the side of the ship not exceeding 1.5 m in width, two wells are formed. Each shall be given the required freeing port area based upon the length of each well.

Additionally, where a well is created on each side of the vessel between a superstructure or deckhouse, and the bulwark in way of that superstructure or deckhouse, the following formula may be used to determine the required freeing port areas on each side of the vessel for the well concerned:

Figure 34



$FP_{REQ} = 0,28 \times A_w / B$

A_w = Area of well in way of superstructure or deckhouse

B = Full beam at deck

~~On sailing vessels, w~~Where the solid bulwark height does not exceed 150 mm, specific freeing ports, as defined above, are not required.

5.13.2 In individual cases, when Tasneef considers that the above requirements cannot be met, alternative arrangements to achieve adequate safety standards may be considered and approved.

In general to accepts smaller area than that require by the formula what follows may be considered:

- The stability verification with the well flooded may allow a reduction of 50% of the required area
- The real area of the well in respect of the length of the well multiplied by the breath of the well allow a reduction
- The distance from the freeboard deck if more than a superstructure height allows a reduction of 50% of the required area, for decks located less than hs above the freeboard deck a reduction factor equal to 0,5*(hs/hv), where hv is the actual height of the deck above the freeboard deck.

5.13.3 For superstructure deck higher than the first tier, the value given in the formula above may be multiplied by 0,5 and unsymmetric arrangement may be accepted based on an increase of at least 50% of the total area required.

5.13.4 Freeing ports are not required for decks located more than 2 superstructure height above the freeboard deck.

5.13.5 In any case, the freeing ports arrangement must take into account the sloping deck, by avoiding, as far as possible, the positioning of freeing ports with a major area in the bow zone.

5.13.6 Recesses

Any recess in the weather deck is to be of weathertight construction and is to be self draining under all normal conditions of heel and trim of the vessel.

A swimming pool or spa bath open to the elements is to be treated as a recess.

The means of drainage provided is to be capable of efficient operation when the vessel is heeled to an angle of 10° in the case of a motor vessel, and 30° in the case of a sailing vessel.

The drainage arrangements is to have the capability of draining the recess (when fully charged with water) within 3 minutes (see Note 1) when the vessel is upright and at the load line draught. Means are to be provided to prevent the backflow of sea water into the recess.

When it is not practical to provide drainage which meets the above requirements, alternative safety measures may be considered by Tasneef.

Where the above requirements for quick drainage cannot be met, the effect on intact and damage stability is to be considered taking into account the mass of water and its free surface effect.

Note 1: Regardless the drainage time, the effect of the swimming pool full of water with maximum free surfaces correction is to be taken into consideration at least in intact stability calculations.

5.14 Tanks

5.14.1 "Tanks" means the structural tanks that are part of the hull and intended to contain liquids (water, fuel oil or lube oil). In order to contain fuel oil with a flashpoint 55° C, the use of non structural tanks is required.

As far as non structural fuel tanks see Sec 4.

The tanks have to be tested in accordance with Appendix 5.

5.15 Cofferdam arrangement

5.15.1 Cofferdams are to be provided between compartments intended for liquid hydrocarbons (fuel oil, lubricating oil) and those intended for fresh water (drinking water, water for propelling machinery and boilers) as well as tanks intended for the carriage of liquid foam for fire extinguishing.

5.15.2 Cofferdams separating fuel oil tanks from lubricating oil tanks and the latter from those intended for the carriage of liquid foam for fire extinguishing or fresh water or boiler feed water may not be required when deemed impracticable or unreasonable by the Society in relation to the characteristics and dimensions of the spaces containing such tanks, provided that:

- the thickness of common boundary plates of adjacent tanks is increased, with respect to the thickness required by 2 mm in the case of tanks carrying fresh water or boiler feed water, and by 1 mm in all other cases
- the sum of the throats of the weld fillets at the edges of these plates is not less than the thickness of the plates themselves
- the structural test is carried out with a head increased by 1 m with respect to the required pressure head.

5.15.3 Cofferdams are only required between fuel oil double bottoms and tanks immediately above where the inner bottom plating is subjected to the head of fuel oil contained therein, as in the case of a double bottom with its top raised at the sides.

Where a corner to corner situation occurs, tanks are not be considered to be adjacent.

5.16 Inflatable gasket

5.16.1 Inflatable gasket may be accepted only for doors located in superstructure not contributing to buoyancy.

5.17 Mast and Rigging on Sailing yachts

5.17.1 *(1/1/2025)* Unless a specific notation is required the scantlings of masts and rigging are left to the experience of the builder. Surveyor, however, have to verify that the attachments of shrouds and stays to the hull are such as to withstand at least twice the load expected on such rigging. The mast step is to be of strong construction, and is to be extended so as not to be connected to the transverse and longitudinal framing of the bottom of the hull. The wedging on deck is to be provided with watertight means. When the mast rests on deck, the underlying structure is to be strengthened in way such as to avoid giving way. If the mast rests on a coachroof, the hull is to be strengthened in way by means of a bulkhead or a stiffened frame. For shrouds and stays in wire and not in rod, the breaking loads of wires in galvanised steel 160 UNI 4434, in spiral shape, 1x19 wires (col. 1) and in stainless steel AISI 316 18/10 (ASTM-A 368-55), in spiral shape, 1x19 wires (col. 2) are included below for information purposes.

5.18 Glazing on Swimming pools and similar items

5.18.1 General *(1/1/2025)*

This paragraph is applicable when glazing constitutes the lateral sides or the bottom side of a swimming pool or similar items.A detailed calculation is to be send for approval taking into consideration the following requirements.Glazing

Swimming pools and similar items have to be designed and verified considering as a minimum the following loads to be combined in direction, duration and magnitude:

- Sea loads
- Self-weight of the glazing
- Yacht's accelerations
- Weight of the water included in the swimming pool
- Live load (only for walkable glazing)
- Maintenance load (only for restricted access glazing, such as skylights)
- Barrier load (only if the glass is acting as barrier)

Other loads (such as sloshing, wind …) may be considered if deemed necessary. The temperature at which each load acts and the duration may also be considered. The relevant values to be taken from a national or international standard accepted by the Society.

5.18.2 Sea Loads *(1/1/2025)*

The sea load is to be taken as distributed orthogonal to the surface of magnitude at least 70 kN/m2 if the glazing protects buoyant volumes, in other cases the magnitude to be evaluated considering the value for windows in the same location according to [5.6.7] or another national or international standard accepted by the Society.

5.18.3 Self Weight *(1/1/2025)*

The self-weight depends on the density and the volume of the glazing (and interlayers).If sacrificial plies are used, they have not to be considered as contributing to the strength but the relevant self-weight to be considered.

5.18.4 Accelerations *(1/1/2025)*

The Yacht's accelerations to be considered may be taken from Section 5. Vertical and horizontal accelerations have to be considered.

5.18.5 Weight of the water included in the swimming pool *(1/1/2025)*

For the calculation of the glazing it is to be assumed the swimming pool filled with seawater. The magnitude of this load is to be taken at least equal to:

ρgh

Where:

ρ: density of sea water

g: Acceleration of gravity

h: height of the water

5.18.6 Live Loads *(1/1/2025)*

The live load is to be considered acting as a pressure plus a concentrated load perpendicular to the surface. The relevant magnitude to be taken from a national or international standard accepted by the Society.

5.18.7 Maintenance Loads *(1/1/2025)*

The maintenance load is to be considered acting as a pressure plus a concentrated load perpendicular to the surface. The relevant magnitude to be taken from a national or international standard accepted by the Society.

5.18.8 Barrier Load (for glazing of swimming pool constituting protection from falling) *(1/1/2025)*

If the glazing of the swimming pool constitutes also a protection from falling the glazing is to be subject also to the requirements in [5.12] or another national or international standard accepted by the Society (ideally point load and distributed load).

5.18.9 Gluing *(1/1/2025)*

Gluing calculations may be carried out considering [5.6.14], by direct calculation or by FEM calculation.

5.18.10 Safety factors and Allowable Stress *(1/1/2025)*

Safety factors and allowable stress to be taken from [5.6.8] or another national or international standard accepted by the Society.

5.19 Underwater glazing

5.19.1 General requirements *(1/1/2025)*

Underwater glazed openings have to be made by at least two laminated glasses independently and permanently connected to the hull. For the external laminated glass the design pressure is to be at least equal to the distance of the lower edge of the glazing and the freeboard deck or 200 kN/m2 whichever is the greater. The internal laminated glass, provided to make the function of a traditional deadlight, is to be tested according to [5.19.2] on a prototype.

5.19.2 Testing of equivalent glazing deadlight *(1/1/2025)*

Test conditions and support of the underwater glazing and its glazed deadlight shall reflect the situation as mounted on board. Both the dimensions of the prototype to be longer than the dimensions of the arrangement installed on board.

The impact test shall be able to deliver an impact energy of 1800J at a terminal velocity in a range between 5 to 10 m/s. The impactor head shall be arranged in such a way to present a hexagonal bolt, head M12, grade 8.8. Under the bolt head a steel spacer, length 80 mm, outer diameter 18 mm, inner diameter 12.5 mm shall be provided to ensure penetration is achieved before the main body of the impactor reaches the surface of the glass.

After the impact test the sample shall be hydrostatically tested to prove watertightness with water at a pressure of 75 kPa, with the pressure from the external side.

As a result of the impact tests no full penetration is allowed on 3 representative samples.

As an alternative a test on 1 sample only may be accepted provided that:

- Impact test is repeated 3 times on the same sample with the same passing criteria.
- Hydrostatic test after the impact test is performed at a pressure of at least 43% of the design pressure of the external glazing
- Scantling of the glazed deadlight at the same pressure of the external glazing

Full penetration is defined when, after the impact, a passing through hole is formed with a diameter of 25mm or more.

After reaching the maximum test pressure, this shall be maintained for at least 5 minutes. Leakage from the glazed surface and from the fixing joints/elements shall be recorded. Leakage is allowed at maximum pressure with an overall limit of 2.5 litres within the 5 minutes of pressure hold.

Acceptance is based on the same construction cross section both in terms of mechanical properties of materials and thickness and the same fixing arrangements.

SECTION 2 HULL OUTFITTING

1 Rudders and steering gear

1.1 General

1.1.1 Reference is to be made to Sec 6.

For sailing vessels special considerations may be done.

These requirements apply to ordinary profiles rudders without any special arrangement for increasing the rudder force, such as fins or flaps, steering propellers, etc.

Unconventional rudders of unusual type or shape and those with speeds exceeding 45 knots will be the subject of special consideration by the Society.

In such cases, the scantlings of the rudder and the rudder stock will be determined by means of direct calculations to be agreed with Tasneef as regards the loads and schematisation.

1.2 Steering gear and associated apparatus

1.2.1 Premise

These requirements apply to the most commonly used types of steering gear, which are dealt with below; any different types will be specially considered by the Society in each case.

1.2.2 Steering gear with hydraulic or electro-hydraulic type remote control

The parts of such steering gear are to comply with the specific requirements of Part C, Ch 1, Sec 10.

2 Propeller shaft brackets

2.1 Double arm brackets

2.1.1 Double arm propeller shaft brackets consist of two arms forming an angle as near as practicable to 90°, and converging into a propeller shaft bossing.

Arms having elliptical or trapezoidal section with round fairing are to have each an area A, in mm^2, at the root not less than that given by the following relationship:

$$A = 8,7 \cdot 5\ 10^{-3} d_P^2 \left(\frac{1600 + R_{ma}}{R_{ma}}\right)$$

where:

d_p : Rule diameter of the propeller shaft made of steel with ultimate tensile strength R_m = 400 N/mm^2 measured inside the liner, if any, in mm,

R_{ma} : minimum ultimate tensile strength, in N/mm^2, of the material of the brackets.

The maximum thickness in way of the above section is to be not less than 0,4 d_p.

Considering the diameter (d) of the shaft propellers calculated according to the formula given in Pt C, Ch 1, Sec 6, [2.2.3] or [2.2.4] as applicable taking in account the effective material mechanical characteristics the boss is to have length not more than 4 d, but in no case may a length less than 3 d be accepted.

The boss is to have thickness of not less than 0,25 d when the diameter shaft propeller is calculated according Pt C, Ch 1, Sec 6, [2.2.3] and not less than 0,35 d, when the diameter of the propeller shaft is calculated according to Pt C, Ch 1, Sec 6, [2.2.4].

When the brackets are connected by means of palms, the latter are to have thickness not less than 0,2 dp and are to be connected to the hull by means of bolts with nuts and lock nuts on the internal hull structures, which are to be suitably stiffened to the satisfaction of Tasneef.

The thickness of the plating in the vicinity of the connection is to be increased by 50%.

In the case of metal hulls and brackets of the same material, the connection between bracket and hull is to be carried out by means of welding.

The brackets are to be continuous through the plating and to be connected internally to suitable transverse or longitudinal structures.

The plating in way of the bracket connection is to be suitably increased and connected to the arm bracket with full penetration welding.

2.2 Single arm brackets

2.2.1 Single arm shaft brackets are to have a section modulus at ship plating level, in cm^3, of not less than:

$W = (30 / R_{ma}) \ 10^{-3} \ l \ d^2_{so} \ (n \ d_{so})^{0,5}$

where:

l : length of the arm, in m, measured from the shell plating to the centreline of the shaft boss,

n : shaft revolutions per minute,

d_{so} : rule diameter, in mm, of the propeller shaft, for carbon steel material, using R_m = 400 N/mm^2

R_{ma} : minimum tensile strength, in N/mm^2, of arms, with appropriate metallurgical temper.

Boss thickness and length are to be calculated as for the double arm brackets.

3 Sailing yacht appendages and component fastenings

3.1 Keel and keel connection

3.1.1 *(1/1/2025)*

The scantling of the sailing keel indicated in this paragraph is based on the assumption that the yacht is operated by sail only in deep waters far from shore; in particular the scenario of the grounding and pounding considered here are assumed occurring only when the yacht is propelled by the propulsion engine and not by the sails.

The ballast may be internal or external to the hull.

In the first case, the ballast is to be permanently secured, by clips or equivalent means, to the resistant structures of the hull (floors, frames, etc) but in no case to the plating, on which it is never to bear, so as not to shift even during rolling or pitching.

In the second case, the connection to the hull is to be effected by means of bolts long enough to incorporate the height of the ballast, either wholly or in part; such bolts are to pass through the hull, with a head (or nut and lock nut) at one end and a nut and lock nut at the other, towards the inside of the hull. The surface of the ballast keel head is to be flush with the surface of the hull, the bolt holes are to be fashioned with equipment designed to achieve an almost complete absence of play between bolt and hole, and the locking of the nuts is to be uniform. The nuts are to rest on plates or large washers and to be left uncovered so that they may be easily examined.

The load cases indicated below have to be considered.

The following design loads are for fixed, lifting and canting keel.

The below loads apply to lifting keel in fully up fixed or fully down fixed position. Lifting and lowering have to be performed only in calm waters, at zero speed and overground. For canting keel the assessment is to be performed at different angles, at least 4 angular positions.

The following cases may be assessed separately.

The material factor k is to be taken as follows:

$$k_1 = \left(\frac{235}{R_{eH}}\right)^n$$

where:

n : coefficient to be taken equal to:

- n = 0,75 for $R_{eH} > 235$ N/mm^2
- n = 1,00 for $R_{eH} \leq 235$ N/mm^2.

It is to be verified that the keel and its connection to the hull are strong enough to withstand heeling, punding (vertical) and the grounding (longitudinal) loads. It is assumed that the conventional loads are the following:

a) Longitudinal load (grounding) loads acting in the aft direction and parallel to the longitudinal hull axis. The load is to be applied to the bottom edge of the keel with boat in upright situation and canting keel in 0° and maximum degree.

The value of the longitudinal loads ~~in Newton~~ may be calculated according to the following formula:

$L_{GL\,(x)}$ = - 1.8 *g* (Δ - mk_{bulb})

$L_{GL\,(y)}$ = + 0.2 * L_{GL} (x)

b) Vertical load (pounding) VGL, ~~in tons,~~ acting upward on the bulb bottom in line with total keel center of gravity with the boat upright, canting keel with keel in 0° cant position.

$V_{GL\,(z)}$ = 1.6 *g* (Δ - mk_{tot})

c) Heeling (lateral) the load is to be applied to the bottom edge of the keel with boat in upright situation and canting keel in 0° and maximum degree.

H = + *g* mk_{tot} * c_D

c_D : = 1,0 for fixed keel or lifting keel with the boat heeled 90° or lifting keel in fully up position, when not used for sailing, with boat heeled of 30°,

= 1,4 for canting keel with keel at maximum canting angle and boat heeled to 30° and 45°.

Where:

mkbulb = mass of the keel bulb

mktot = total mass of the keel

D = displacement of the yacht at full load

Where the keel have a large rake angle the centre of gravity of the bulb/fin can be located a significant distance aft or forward of the fin or bolt group longitudinal centre at the root. This will introduce a torsional moment in addition to bending about the fore and aft axis equal to the weight of the fin/bulb multiplied by the horizontal distance between the fin/bulb longitudinal centre of gravity and root/bolt group longitudinal centre of gravity. In this case is necessary to combine direct stresses owing to bending with shear stresses due to the torque.

For the determination of the structural response on keel deign force, relevant value of mk_{tot} or mk_{mob} occurring at pertinent centre of gravity shall be taken to assess structural aspects at different locations, e.g. keel root, keel box, half span of fin or bulb attachment.

For fixed keels the use of the formula for bolts given above may be used as an alternative to verify the keel connection.

The safety factors for structures are to be in accordance with the following factors. For specific particular situations different values may be agreed with Tasneef.

Table 1

Structures	Load Case a)		Load Case b)		Load Case c)	
	to yield	to ultimate	to yield	to ultimate	to yield	to ultimate
σ_V	1.8	2.3 **(1)**	2	2.5 **(2)**	2.5	3
σ	2	2.5 **(2)**	3 **(2)**	3.5 **(2)**	3	3.5
τ	3.5 **(2)**	4.5 **(2)**	4 **(2)**	5 **(2)**	4	4.5

(1) For composite structure this value may be taken equal to 1,8.
(2) For composite structure this value may be taken equal to 2.

Direct calculations have to be carried out according to a recognized international standard and the maximum degree of locking of bolts have to be taken into account. The safety factor indicated below have to be applied to the external load only. The degree of locking is to be indicated in the drawings.

Table 2

Bolts	Load Case a)		Load Case b)		Load Case c)	
	to yield	to ultimate	to yield	to ultimate	to yield	to ultimate
σ_V	2.3	2.8	2.5	3	3	4

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 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.

In case the second ("spare") anchor is fitted in place at the bow and ready for use, the chain length for each anchor is to be at least the total length of the chain reported in the Table 1 divided by the number of anchors.

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.

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 replacement of one anchor fit in place with two anchors both fit in place and used simultaneously is acceptable only in case of EN less than 110.

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 50% of the total length indicated in the table.

2.1.3 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 preferably not to be used and Grade Q2 or Q3 chain cables are generally 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.

Studless chain cables are not allowed.

2.1.4 Test for high holding power anchors approval

For approval and/or acceptance as a HHP anchor, comparative tests are to be performed on various types of sea bottom.

Such tests are to show that the holding power of the HHP anchor is at least twice the holding power of an ordinary stockless anchor of the same mass.

For approval and/or acceptance as a HHP anchor of a whole range of mass, such tests are to be carried out on anchors whose sizes are, as far as possible, representative of the full range of masses proposed. In this case, at least two anchors of different sizes are to be tested. The mass of the maximum size to be approved is to be not greater than 10 times the maximum size tested. The mass of the smallest is to be not less than 0,1 times the minimum size tested.

2.1.5 Test for very high holding power anchors approval

For approval and/or acceptance as a VHHP anchor, comparative tests are to be performed at least on three types of sea bottom: soft mud or silt, sand or gravel and hard clay or similar compounded material. Such tests are to show that the holding power of the VHHP anchor is to be at least four times the holding power of an ordinary stockless anchor of the same mass or at least twice the holding power of a previously approved HHP anchor of the same mass.

The holding power test load is to be less than or equal to the proof load of the anchor, specified in Pt D, Ch 4, Sec 1, [1.6].

For approval and/or acceptance as a VHHP anchor of a whole range of mass, such tests are to be carried out on anchors whose sizes are, as far as possible, representative of the full range of masses proposed. In this case, at least three anchors of different sizes are to be tested. relevant to the bottom, middle and top of the mass range.

2.1.6 Specification for test on high holding power and super high holding power anchors

Tests are generally to be carried out from a tug. Shore based tests may be accepted by the Society on a case-by- case basis.

Alternatively, sea trials by comparison with a previous approved anchor of the same type (HHP or VHHP) of the one to be tested may be accepted by the Society on a case by-case basis.

For each series of sizes, the two anchors selected for testing (ordinary stockless and HHP anchors for testing HHP anchors, ordinary stockless and VHHP anchors or, when ordinary stockless anchors are not available, HHP and SHHP anchors for testing VHHP anchors) are to have approximately the same mass.

The length of chain cable connected to each anchor, having a diameter appropriate to its mass, is to be such that the pull on the shank remains practically horizontal. For this purpose a value of the ratio between the length of the chain cable paid out and the water depth equal to 10 is considered normal. A lower value of this ratio may be accepted by the Society on a case-by-case basis.

Three tests are to be carried out for each anchor and type of sea bottom.

The pull is to be measured by dynamometer; measurements based on the RPM/bollard pull curve of tug may, however, be accepted instead of dynamometer readings.

Note is to be taken where possible of the stability of the anchor and its ease of breaking out.

3 Chain cables for anchors

3.1

3.1.1 Chain cables are to have proportions in accordance with recognised unified standards and to be of the steel grade given in Table 1.

Grade 1 chain cables are generally not to be used in association with "high holding power" and "very high holding power" anchors.

3.1.2 For yachts of more than 120m reference is to be made to Pt B, Ch 10~~4~~, Sec 4~~10~~, [3.3] and [3.4] of Tasneef Rules for the Classification of Ships.

4 Mooring lines

4.1

4.1.1 Mooring lines may be of wire, natural or synthetic fibre, or a mixture of wire and fibre.

Where steel wires are used, they are to be of the flexible type.

Steel wires to be used with mooring winches, where the wire is wound on the winch drum, may be constructed with an independent metal core instead of a fibre core.

The breaking loads shown in Table 1 refer to steel wires or natural fibre ropes.

Where synthetic fibre ropes are adopted, their size will be determined taking into account the type of material used and the manufacturing characteristics of the rope, as well as the different properties of such ropes in comparison with natural fibre ropes.

The equivalence between synthetic fibre ropes and natural fibre ropes may be assessed by the following formula:

$$CR_S = 7,4 \cdot \frac{\delta \cdot CR_M}{CR_M^{1/9}}$$

dove:

δ: elongation to breaking of the synthetic fibre rope, to be assumed not less than 30%;

CR_S : breaking load of the synthetic fibre rope, in kN;

CR_M : breaking load of the natural fibre rope, in kN;

Where synthetic fibre ropes are used, rope diameters under 20 mm are not permitted, even though a smaller diameter could be adopted in relation to the required breaking load.

4.1.2 For yachts of more than 120m reference is to be made to Pt B, Ch 4, Sec 10, [3.1] and [3.5] of Tasneef Rules for the Classification of Ships.

5 Hawse pipes

5.1

5.1.1 Hawse pipes are to be built according to sound marine practice. Their position and slope are to be so arranged as to create an easy lead for the chain cables and efficient housing for the anchors, where the latter are of the retractable type, avoiding damage to the hull during these operations. For this purpose chafing lips of suitable form with ample lay-up and radius adequate to the size of the chain cable are to be provided at the shell and deck. The shell plating in way of the hawse pipes is to be reinforced as necessary.

5.1.2 In order to obtain an easy lead of the chain cables, the hawse pipes may be provided with rollers. These rollers are to have a nominal diameter not less than 10 times the size of the chain cable where they are provided with full imprints, and not less than 12 times its size where provided with partial imprints only.

5.1.3 All mooring units and accessories, such as thimble, riding and trip stoppers are to be securely fastened to the Surveyor's satisfaction.

6 Windlass, Chain stoppers and relevant supporting structures, chain lockers, Fairleads and bollards

6.1 Windlass

6.1.1 General

The windlass, which is generally single, is to be power driven and suitable for the size of chain cable and the mass of the anchors. Windlass is also to comply with requirements given in Pt C, Ch 1, Sec 15.

The windlass is to be fitted in a suitable position in order to ensure an easy lead of the chain cables to and through the hawse pipes. The deck in way of the windlass is to be suitably reinforced.

b) For strength assessment by means of finite element analysis:

- Von Mises stress: 1.0 ReH

For strength assessment by means of finite element analysis the mesh is to be fine enough to represent the geometry as realistically as possible. The aspect ratios of elements are not to exceed 3. Girders are to be modelled using shell or plane stress elements. Symmetric girder flanges may be modelled by beam or truss elements. The element height of girder webs must not exceed one-third of the web height. In way of small openings in girder webs, the web thickness is to be reduced to a mean thickness over the web height. Large openings are to be modelled. Stiffeners may be modelled using shell, plane stress, or beam elements. The mesh size of stiffeners is to be fine enough to obtain proper bending stress. If flat bars are modeled using shell or plane stress elements, dummy rod elements are to be modelled at the free edge of the flat bars and the stresses of the dummy elements are to be evaluated. Stresses are to be read from the centre of the individual element. For shell elements the stresses are to be evaluated at the mid plane of the element.

Where ReH is the specified minimum yield stress of the material.

6.4 Chain locker

6.4.1 The capacity of the chain locker is to be adequate to stow all chain cable equipment and provide an easy direct lead to the windlass.

6.4.2 Where two chains are used, the chain lockers are to be divided into two compartments, each capable of housing the full length of one line.

6.4.3 The inboard ends of chain cables are to be secured to suitably reinforced attachments in the structure by means of end shackles, whether or not associated with attachment pieces.

Generally, such attachments are to be able to withstand a force not less than 15% of the breaking load of the chain cable.

In an emergency, the attachments are to be easily released from outside the chain locker.

6.5 Working test on windlass

6.5.1 The working test of the windlass is to be carried out on board at the presence of the Surveyor.

6.5.2 The test is to demonstrate that the windlass works adequately and has sufficient power to simultaneously weigh the two bower anchors (excluding the housing of the anchors in the hawse pipe) when both are suspended to 55 m of chain cable, in not more than 6 min.

6.5.3 Where two windlasses operating separately on each chain cable are adopted, the weighing test is to be carried out for both, weighing an anchor suspended to 82,5m of chain cable and verifying that the time required for the weighing (excluding the housing of the anchors in the hawse pipe) does not exceed 9 min. Where the depth of water in the trial area is inadequate, or the anchor cable is less than 82,5 m, suitable equivalent simulating conditions will be considered as an alternative.

6.6 Fairleads and bollards

6.6.1 *1/1/2025*

Fairleads and bollards of suitable size and design are to be fitted for towing, mooring and warping operations.

7 Equipment Number and equipment

7.1 *(1/1/2025)*

7.1.1 All yacths are to be provided with anchors, chain cables and ropes based on their Equipment Number **EN**, as shown in Table ~~3~~1.

The equipment Number **EN** is to be calculated as follows:

$$EN = \Delta^{2/3} + 2h \cdot B + 0,1A$$

where:

Δ : yacht displacement, in tonnes, as defined in Section 1

Δ : yacht displacement, in tonnes, as defined in Section 1

h : $a + \Sigma h_n$

a : distance, in m, from the summer load waterline amidships to the weather deck

h_n : height, in m, at the centreline of each tier n of superstructures or deckhouses having a breadth greater than B/4.

A : area, in m^2, in profile view, of the parts of the hull, superstructures and deckhouses above the summer load waterline which are within the length L of the yacht and also have a breadth greater than B/4.

For yachts that have superstructures with the front bulkhead with an angle of inclination aft, the equipment number can be calculated as follows:

$$EN = k\Delta^{2/3} + 2(aB + \sum b_n h_n \sin\theta_n - St) + 0,1A$$

θ_n : angle of inclination with the horizontal axis aft of each front bulkhead

k = : cofficient depending on the number of hulls, to be taken as 1 for monohull, 1,26 for cathamarans and 1,44 for trimarans.

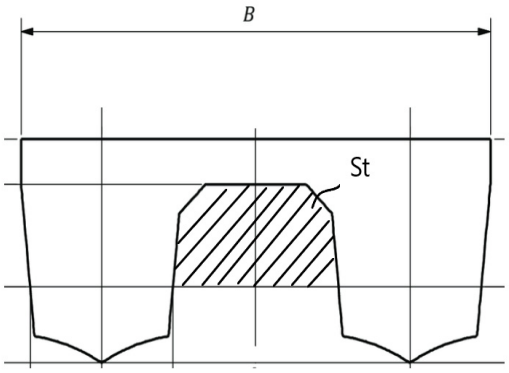
St : Transverse area, amidships, of the tunnel(s) existing between the hulls and the waterline. For monohull St is to be taken as zero. See Fig 3 for multihull.

b_n : greatest breadth, in m, of each tier n of superstructures or deckhouses having a breadth greater than B/4.

B : Maximum breath of the vessel. For multihull see Fig 3.

For **EN** > 1060 the anchors, chain cables and ropes will be fixed by Tasneef depending on the case.

Figure 3 : B and St for multihull *(1/1/2025)*



7.1.2 When calculating h, sheer and trim are to be disregarded, i.e. h is to be taken equal to the sum of freeboard amidships plus the height h_n (at the centreline) of each tier of superstructures and deckhouses having a breadth greater than B/4.

Where a deckhouse having a breadth greater than B/4 is above another deckhouse with a breadth of B/4 or less, the upper deckhouse is to be included and the lower ignored.

Screens or bulwarks 1,5 metres or more in height are to be regarded as parts of deckhouses when determining h and A.

In determining the area A, when a bulwark is more than 1,5 metres in height the area above such height is to be included.

7.1.3 For multihull with N identical hulls the Equipment number may be calculated as follows:

$$EN = k_m\Delta^{2/3} + 2[aB + \sum(b_i h_i \sin\theta_i) - s_t] + 0,1A$$

where:

K_m = N1/3

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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, for the rudder trunk, 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

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

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

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

1.1.4 Special rudder types

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 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 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 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 *(1/1/2025)*

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 at scantling draught (without trim) two separate watertight seals / stuffing boxes are to be provided.

1.4 Materials

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

1.4.2 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 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 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 contained in the requirements of this Section are to be modified, as indicated, depending on the material factor k_1, to be obtained from the following formula:

$$k_1 = \left(\frac{235}{R_{eH}}\right)^n$$

where:

R_{eH} : yield stress, in N/mm^2, of the steel used, and not exceeding the lower of 0,7 R_m and 450 N/mm^2,

R_m : minimum ultimate tensile strength, in N/mm^2, of the steel used,

n : coefficient to be taken equal to:

- n = 0,75 for $R_{eH} > 235$ N/mm^2,
- n = 1,00 for $R_{eH} \leq 235$ N/mm^2.

1.4.5 Significant reductions in rudder stock diameter due to the application of steels with yield stresses greater than 235 N/mm^2 may be accepted by the Society subject to the results of a check calculation of the rudder stock deformations.

Large rudder stock deformations are to be avoided in order to avoid excessive edge pressures in way of bearings.

1.4.6 Welded parts of rudders are to be made of approved rolled hull materials. For these members, the material factor k defined in Ch 2, Sec 2, [2.3] is to be used.

1.5 Welding and design details

1.5.1 Slot-welding is to be limited as far as possible. Slot welding is not to be used in areas with large in-plane stresses transversely to the slots.

When slot welding is applied, the length of slots is to be minimum 75 mm with breadth of 2 t, where t is the rudder plate thickness, in mm. The distance between ends of slots is not to be more than 125 mm. The slots are to be fillet welded around the edges and filled with a suitable compound, e.g. epoxy putty. Slots are not to be filled with weld.

Continuous slot welds are to be used in lieu of slot welds. When continuous slot welding is applied, the root gap is to be between 6-10 mm. The bevel angle is to be at least 15°.

1.5.2 *(1/1/2025)*

Welds in the rudder side plating subjected to significant stresses from rudder bending and welds between plates and heavy pieces (solid parts in forged or cast steel or very thick plating) are to be made as full penetration welds. In way of highly stressed areas e.g. upper part of spade rudder, cast or welding on ribs is to be arranged. Two sided full

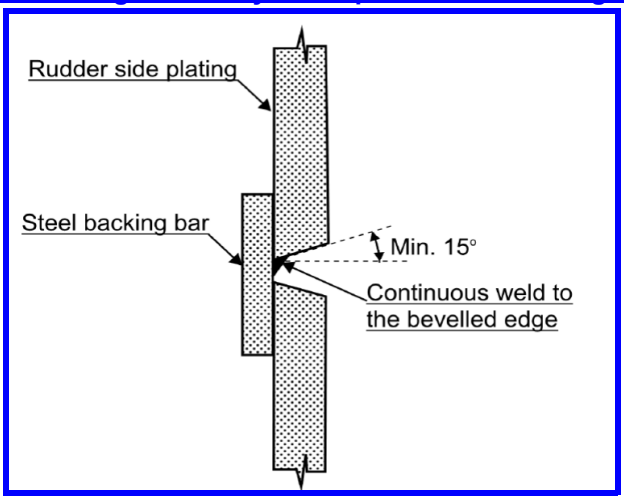
penetration welding is normally to be arranged. Where back welding is impossible welding is to be performed against ceramic backing bars or equivalent. Steel backing bars may be used and are to be fitted with continuous~~ly~~ welded~~ed~~ on one side to the ~~heavy piece~~ bevelled edge, see Fig 1. The bevel angle is to be at least 15° for one sided welding.

1.5.3 Requirements for welding and design details when the rudder stock is connected to the rudder by horizontal flange coupling are described in [5.1.1].

1.5.4 Requirements for welded connections of blade plating to vertical and horizontal webs are given in [7.3.6].

1.5.5 Requirements for welding and design details of rudder trunks are described in [8.1].

Figure 1 : Use of steel backing bar in way of full penetration welding of rudder side plating



2 Force and torque acting on the rudder

2.1 Rudder blade without cut-outs

2.1.1 Rudder blade description

A rudder blade without cut-outs may have trapezoidal or rectangular contour.

2.1.2 Rudder force

The rudder force C_R is to be obtained, in N, from the following formula:

$$C_R = 132\, n_t\, A\, V^2\, r_1\, r_2\, r_3$$

where:

n_t : yacht's type coefficient, to be taken equal to 1,

V : V_{AV}, or V_{AD}, depending on the condition under consideration (for high lift profiles see [1.1.2]),

r_1 : shape factor, to be taken equal to:

$$r_1 = \frac{\lambda + 2}{3}$$

λ : coefficient, to be taken equal to:

$$\lambda = \frac{h^2}{A_T}$$

and not greater than 2,

A_T : area, in m^2, to be calculated by adding the rudder blade area A to the area of the rudder post or rudder horn, if any, up to the height h,

h : mean height, in m, of the rudder area to be taken equal to (see Fig 2~~1~~):

$$h = \frac{z_3 + z_4 - z_2}{2}$$

r_2 : coefficient to be obtained from Tab 1,

r_3 : coefficient to be taken equal to:

- $r_3 = 0,8$ for rudders outside the propeller jet (centre rudders on twin screw ships, or similar cases),
- $r_3 = 1,15$ for rudders behind a fixed propeller nozzle,
- $r_3 = 1,0$ in other cases.

Table 1 : Values of coefficient r_2

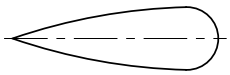
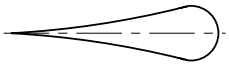
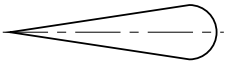
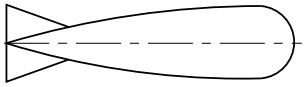
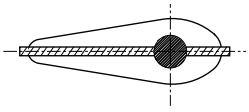
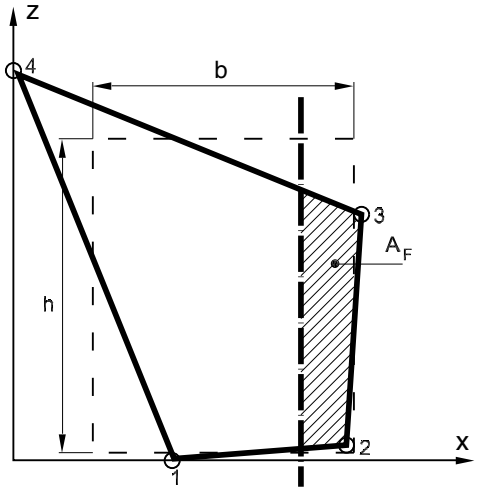
Rudder profile type	r_2 for ahead condition	r_2 for astern condition
NACA 00 - Goettingen 	1,10	0,80
Hollow 	1,35	0,90
Flat side 	1,10	0,90
High lift 	1,70	To be specially considered; if not known: 1,30
Fish tail 	1,40	0,80
Single plate 	1,00	1,00
Mixed profiles (e.g. HSVA)	1,21	0,90

Figure 2 : Geometry of rudder blade without cut-outs



2.1.3 Rudder torque

The rudder torque M_{TR}, for both ahead and astern conditions, is to be obtained, in N.m, from the following formula:

$M_{TR} = C_R\, r$

where:

r : lever of the force C_R, in m, equal to:

$$r = b\left(\alpha - \frac{A_F}{A}\right)$$

and to be taken not less than 0,1 b for the ahead condition,

b : mean breadth, in m, of rudder area to be taken equal to (see Fig ~~1~~2):

$$b = \frac{x_2 + x_3 - x_1}{2}$$

α : coefficient to be taken equal to:

- $\alpha = 0{,}33$ for ahead condition,
- $\alpha = 0{,}66$ for astern condition,

A_F : area, in m^2, of the rudder blade portion afore the centreline of rudder stock (see Fig ~~1~~2).

3 Loads acting on the rudder structure

3.1 General

3.1.1 Loads

The force and torque acting on the rudder, defined in [2], induce in the rudder structure the following loads:

- bending moment and torque in the rudder stock,
- support forces,
- bending moment, shear force and torque in the rudder body.

3.1.2 Direct load calculations

The bending moment in the rudder stock, the support forces, and the bending moment and shear force in the rudder body and the loads in the rudder horn are to be determined through direct calculations to be performed in accordance to the static schemes and the load conditions specified in [3.1.3].

The other loads (i.e. the torque in the rudder stock and in the rudder body and the loads in the solepieces) are to be calculated as indicated in the relevant requirements of this Section.

3.1.3 Criteria for direct calculation of the loads acting on the rudder structure

These requirements provide the criteria for calculating the following loads:

- bending moment M_B in the rudder stock,
- support forces F_A,
- bending moment M_R and shear force Q_R in the rudder body.

3.1.4 Load calculation

The loads in [3.1.3] are to be calculated through direct calculations depending on the type of rudder.

They are to be used for the stress analysis required in:

- [4], for the rudder stock,
- [7] for the rudder blade
- [8] for the rudder trunk.

3.1.5 Forces per unit length

The force per unit length p_R (see Fig ~~2~~3) acting on the rudder body is to be obtained in N/m, from the following formula:

$$p_R = \frac{C_R}{\ell_{10}}$$

3.1.6 Moments and forces *(1/1/2025)*

The loads in [3.1.3] may therefore be obtained from the following formulae (See Fig ~~2~~3):

- maximum bending moment M_B in the rudder stock, in N.m:

$$M_B = C_R\left(\ell_{20} + \frac{\ell_{10}(2C_1 + C_2)}{3(C_1 + C_2)}\right)$$

  where C_1 and C_2 are the lengths, in m, defined in Fig 1,

- support forces, in N:

$$F_{A3} = \frac{M_B}{\ell_{30}}$$

$$F_{A1} = C_R + F_{A3}$$

- maximum shear force in the rudder body, in N:

  $Q_R = C_R$

The maximum moment, MC, in top of the cone coupling as shown in Fig 1 is applicable for the connection between the rudder and the rudder stock.

4 Rudder stock scantlings

4.1 Bending moment

4.1.1 General

The bending moment M_B in the rudder stock for spade rudders is to be determined according to [3.1.2] through a direct calculation.

4.2 Scantlings

4.2.1 Rudder stock subjected to combined torque and bending *(1/1/2025)*

For rudder stocks subjected to combined torque and bending, it is to be checked that the equivalent stress σ_E induced by the bending moment M_B and the torque M_{TR} is in compliance with the following formula:

$\sigma_E \sigma \leq_{E,ALL}$

where:

σ_E : equivalent stress to be obtained, in N/mm^2, from the following formula:

$$\sigma_E = \sqrt{\sigma_B^2 + 3\tau_T^2}$$

σ_B : bending stress to be obtained, in N/mm^2, from the following formula:

$$\sigma_B = 10^3 \frac{10{,}2 M_B}{d_{TF}^3}$$

τ_T : torsional stress to be obtained, in N/mm^2, from the following formula:

$$\tau_T = 10^3 \frac{5{,}1 M_{TR}}{d_{TF}^3}$$

$\sigma_{E,ALL}$: allowable equivalent stress, in N/mm^2, equal to:

$\sigma_{E,ALL} = 118/k_1$ N/mm^2

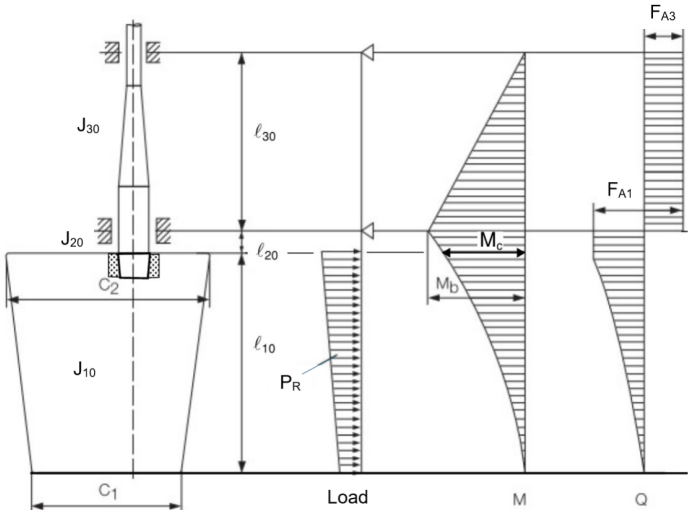
For this purpose, the rudder stock diameter is to be not less than the value obtained, in mm, from the following formula:

$$d_{TF} = 4,2(M_{TR}k_1)^{1/3}\left(1 + \frac{4}{3}\left(\frac{M_B}{M_{TR}}\right)^2\right)^{1/6}$$

In general, the diameter of a rudder stock subjected to torque and bending may be gradually tapered above the upper stock bearing so as to reach the value of d_T in way of the quadrant or tiller, where d_T is the rudder stock diameter subject to torque only calculated as below:

$d_T = 4,2\ (M_{TR}\ k_1)^{1/3}$

Figure 3 : Spade rudders *(1/1/2025)*



For a spade rudder with trunk extending inside the rudder, the rudder stock scantlings are to be checked against the two cases defined in Pt B Ch 10 App 1 of Tasneef Rules for the Classification of Ships

5 Rudder stock couplings

5.1 Horizontal flange couplings

5.1.1 General

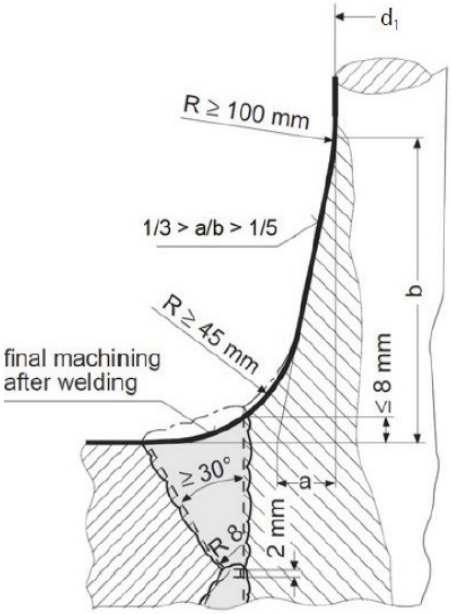
In general, the coupling flange and the rudder stock are to be forged from a solid piece. A shoulder radius as large as practicable is to be provided for between the rudder stock and the coupling flange. This radius is to be not less than 0,13 d_{TF} or 45 mm, whichever is the greater.

The coupling flange may be welded onto the stock provided that its thickness is increased by 10%, and that the weld extends through the full thickness of the coupling flange and that the assembly obtained is subjected to heat treatment. This heat treatment is not required if the diameter of the rudder stock is less than 75 mm.

Where the coupling flange is welded, the grade of the steel used is to be of weldable quality, particularly with a carbon content not greater than 0,25% and the welding conditions (preparation before welding, choice of electrodes, pre and post heating, inspection after welding) are to be defined to the satisfaction of the Society. The welded joint between the rudder stock and the flange is to be made in accordance with Fig ~~5~~6. The throat weld at the top of the flange is to be

concave shaped to give a fillet shoulder radius as large as practicable. This radius is to be not less than 45 mm (see Fig 34).

Figure 4 : Welded joints between rudder stock and coupling flange



5.1.2 Bolts

Horizontal flange couplings are to be connected by fitted bolts having a diameter not less than the value obtained, in mm, from the following formula:

$$d_B = 0{,}62\sqrt{\frac{d_{TF}^3 k_{1B}}{n_B e_M k_{1S}}}$$

where:

k_{1S} : material factor k_1 for the steel used for the rudder stock,

k_{1B} : material factor k_1 for the steel used for the bolts,

e_M : mean distance, in mm, from the bolt axes to the longitudinal axis through the coupling centre (i.e. the centre of the bolt system),

n_B : total number of bolts, which is to be not less than 6.

Non-fitted bolts may be used provided that, in way of the mating plane of the coupling flanges, a key is fitted having a section of ($0{,}25d_T$ x $0{,}10d_T$) mm^2 and keyways in both the coupling flanges, and provided that at least two of the coupling bolts are fitted bolts.

The distance from the bolt axes to the external edge of the coupling flange is to be not less than 1,2 d_B.

5.1.3 Coupling flange

The thickness of the coupling flange is to be not less than the value obtained, in mm, from the following formula:

$$t_P = d_B\sqrt{\frac{k_{1F}}{k_{1B}}}$$

where:

d_B : bolt diameter, in mm, calculated in accordance with [5.1.2], where the number of bolts n_B is to be taken not greater than 8,

k_{1F} : material factor k_1 for the steel used for the flange,

k_{1B} : material factor k_1 for the steel used for the bolts.

In any case, the thickness t_P is to be not less than 0,9 d_B.

5.1.4 Locking device

A suitable locking device is to be provided to prevent the accidental loosening of nuts.

5.2 Couplings between rudder stocks and tillers

5.2.1 Application

The requirements in Pt C, Ch 1, Sec 10 apply.

5.2.2 General

The entrance edge of the tiller bore and that of the rudder stock cone are to be rounded or bevelled.

The right fit of the tapered bearing is to be checked before final fit up, to ascertain that the actual bearing is evenly distributed and at least equal to 80% of the theoretical bearing area; push-up length is measured from the relative positioning of the two parts corresponding to this case.

The required push-up length is to be checked after releasing of hydraulic pressures applied in the hydraulic nut and in the assembly

5.2.3 Keyless couplings through special devices

The use of special devices for frictional connections, such as expansible rings, may be accepted by the Society on a case-by-case basis provided that the following conditions are complied with:

- evidence that the device is efficient (theoretical calculations and results of experimental tests, references of behaviour during service, etc.) are to be submitted to the Society
- the torque transmissible by friction is to be not less than 2 M_{TR}
- design conditions and strength criteria are to comply with [5.2.1]
- instructions provided by the manufacturer are to be complied with, notably concerning the pre-stressing of the tightening screws.

5.3 Cone couplings between rudder stocks and rudder blades with key

5.3.1 General

For cone couplings without hydraulic arrangements for assembling and disassembling the coupling, a key is to be fitted having keyways in both the tapered part and the rudder gudgeon.

The key is to be machined and located on the fore or aft part of the rudder. The key is to be inserted at half-thickness into stock and into the solid part of the rudder.

5.3.2 Tapering and coupling length

Cone couplings without hydraulic arrangements for mounting and dismounting the coupling should have a taper on diameter in compliance with the following formula:

$$\frac{1}{12} \leq \frac{d_U - d_0}{t_S} \leq \frac{1}{8}$$

where:

d_U, t_S, d_0,: geometrical parameters of the coupling, in mm, defined in Fig 45.

The cone shapes are to fit exactly. The coupling length t_S , in mm, is to be, in general, not less than $1,5d_U$.

5.6.2 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 See Pt C, Ch 1, Sec 1, [5.7] of Tasneef Rules for the Classification of Ships.

6 Rudder stock bearings

6.1 General

6.1.1 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/mm^2, 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/mm^2, defined in Tab 2.

Values greater than those given in Tab 2 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/mm^2.

The minimum height is to be at least d_m.

Table 2 : Allowable bearing pressure

Bearing material	$p_{F,ALL}$, in N/mm^2
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 An adequate lubrication of the bearing surface is to be ensured.

6.1.3 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 / 2 0 2 5)*** Liners and bushes are to be fitted in way of bearings. For rudder stocks and pintles having diameter less than 200 mm, liners in way of bushes may be provided optionally. The minimum thickness of liners and bushes is to be equal

- 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

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

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

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

For the generic horizontal section of the rudder blade it is to be checked that the bending stress σ, in N/mm^2, induced by the loads defined in [3.1], is in compliance with the following formula:

$\sigma \leq \sigma_{ALL}$

where:

σ_{ALL} : allowable bending stress, in N/mm^2, specified in Tab 3.

Table 3 : Allowable stresses for rudder blade scantlings

Allowable bending stress σ_{ALL} in N/mm^2	Allowable shear stress τ_{ALL} in N/mm^2	Allowable equivalent stress $\sigma_{E,ALL}$ in N/mm^2
110/k	50/k	120/k

7.2.2 Shear stresses

For the generic horizontal section of the rudder blade it is to be checked that the shear stress τ, in N/mm^2, induced by the loads defined in [3.1], is in compliance with the following formula:

$\tau \leq \tau_{ALL}$

where:

τ_{ALL} : allowable shear stress, in N/mm^2, specified in Tab 3.

7.2.3 Combined bending and shear stresses

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:

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

where:

σ_E : equivalent stress induced by the loads defined in [3.1], to be obtained, in N/mm^2, from the following formula:

$$\sigma_E = \sqrt{\sigma^2 + 3\tau^2}$$

Where unusual rudder blade geometries make it practically impossible to adopt ample corner radiuses or generous tapering between the various structural elements, the equivalent stress s_E is to be obtained by means of direct calculations aiming at assessing the rudder blade areas where the maximum stresses, induced by the loads defined in [3.1], occur,

σ : bending stress, in N/mm^2,

τ : shear stress, in N/mm^2,

$\sigma_{E,ALL}$: allowable equivalent stress, in N/mm^2, specified in Tab 3.

7.3 Rudder blade plating

7.3.1 Plate thickness *(1/1/2025)*

The thickness of each rudder blade plate panel is to be not less than the value obtained, in mm, from the following formula:

$$t_f = \left(5{,}5s\beta\sqrt{kT + \frac{C_R 10^{-4}}{A}}\right)\sqrt{k} + 2{,}5$$

where:

β : coefficient equal to:

$$\beta = \sqrt{1{,}1 - 0{,}5\left(\frac{s}{b_L}\right)^2}$$

to be taken not greater than 1,0 if $b_L/s > 2{,}5$

s : length, in m, of the shorter side of the plate panel,

b_L : length, in m, of the longer side of the plate panel

T : ~~moulded~~ scantling draught, in m.

7.3.2 Thickness of the top and bottom plates of the rudder blade

The thickness of the top and bottom plates of the rudder blade is to be not less than the thickness t_F defined in [7.3.1], without being less than 1,2 times the thickness obtained from [7.3.1] for the attached side plating.

Where the rudder is connected to the rudder stock with a coupling flange, the thickness of the top plate which is welded in extension of the rudder flange is to be not less than 1,1 times the thickness calculated above.

7.3.3 Web spacing

The spacing between horizontal web plates is to be not greater than 1,20 m.

Vertical webs are to have spacing not greater than twice that of horizontal webs.

7.3.4 Web thickness

Web thickness is to be at least 70% of that required for rudder plating and in no case is it to be less than 8mm except for the upper and lower horizontal webs, for which the requirements in [7.3.2] apply.

When the design of the rudder does not incorporate a mainpiece, this is to be replaced by two vertical webs closely spaced, having thickness not less than 1,4 t_f and the thickness of rudder plating to be at least 1,3 t_f. One vertical web only may be accepted provided its thickness is at least twice that of normal webs.

7.3.5 Thickness of side plating and vertical web plates welded to solid part or to rudder flange

The thickness, in mm, of the vertical web plates welded to the solid part where the rudder stock is housed, or welded to the rudder flange, as well as the thickness of the rudder side plating under this solid part, or under the rudder coupling flange, is to be not less than the value obtained, in mm, from [7.3.4].

7.3.6 Welding

The welded connections of blade plating to vertical and horizontal webs are to be in compliance with the applicable requirements of Part D of the Rules.

Where the welds of the rudder blade are accessible only from outside of the rudder, slots on a flat bar welded to the webs are to be provided to support the weld root, to be cut on one side of the rudder only.

7.4 Connections of rudder blade structure with solid parts in forged or cast steel

7.4.1 General

See Pt B, Ch 10, Sec 1, [7.4] of Tasneef Rules for the Classification of Ships.

7.5 Connection of the rudder blade with the rudder stock by means of horizontal flanges

7.5.1 Minimum section modulus of the connection

The section modulus of the cross-section of the structure of the rudder blade which is directly connected with the flange, which is made by vertical web plates and rudder blade plating, is to be not less than the value obtained, in cm^3, from the following formula:

$w_S = 1,3\ d_{TF}^3\ 10^{-4}$

where d_{TF}, in mm, is to be calculated in compliance with the requirements in [4.2], taken k_1 equal to 1.

7.5.2 Actual section modulus of the connection

The section modulus of the cross-section of the structure of the rudder blade which is directly connected with the flange is to be calculated with respect to the symmetrical axis of the rudder.

For the calculation of this actual section modulus, the length of the rudder cross-section equal to the length of the rudder flange is to be considered.

7.5.3 Welding of the rudder blade structure to the rudder blade flange

The welds between the rudder blade structure and the rudder blade flange are to be full penetrated (or of equivalent strength) and are to be 100% inspected by means of non-destructive tests.

Where the full penetration welds of the rudder blade are accessible only from outside of the rudder, a backing flat bar is to be provided to support the weld root.

The external fillet welds between the rudder blade plating and the rudder flange are to be of concave shape and their throat thickness is to be at least equal to 0,5 times the rudder blade thickness.

Moreover, the rudder flange is to be checked before welding by non-destructive inspection for lamination and inclusion detection in order to reduce the risk of lamellar tearing.

7.5.4 Thickness of side plating and vertical web plates welded to the rudder flange

The thickness of the vertical web plates directly welded to the rudder flange as well as the plating thickness of the rudder blade upper strake in the area of the connection with the rudder flange is to be not less than 1.4 t_f and 1,3 t_f respectively.

7.6 Single plate rudders

7.6.1 Mainpiece diameter

The mainpiece diameter is to be obtained from the formulae in [4.2].

In any case, the mainpiece diameter is to be not less than the stock diameter.

For spade rudders the lower third may taper down to 0,75 times the stock diameter.

7.6.2 Blade thickness

The blade thickness is to be not less than the value obtained, in mm, from the following formula:

$$t_B = 1,5 s V_{AV} \sqrt{k} + 2,5$$

where:

s : spacing of stiffening arms, in m, to be taken not greater than 1 m (see Fig ~~5~~6).

7.6.3 Arms

The thickness of the arms is to be not less than the blade thickness.

The section modulus of the generic section is to be not less than the value obtained, in cm^3, from the following formula:

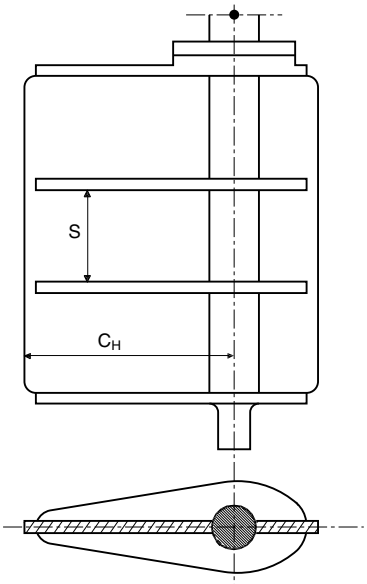
$$Z_A = 0,5 s C_H^2 V_{AV}^2 k$$

where:

C_H : horizontal distance, in m, from the aft edge of the rudder to the centreline of the rudder stock (see Fig ~~5~~6),

s : defined in [7.6.2].

Figure 6 : Single plate rudder



8 Rudder trunk

8.1 Materials, welding and connection to the hull

8.1.1 *(1/1/2025)* This requirement applies to both trunk configurations (extending or not below stern frame).

The steel grade used for the rudder trunk is to be of weldable quality, with a carbon content not exceeding 0,23% on ladle analysis and a carbon equivalent C_{ER} not exceeding 0,41.

Plating materials for rudder trunks are in general not to be of lower grade than corresponding to class II as defined in Ch 2 Sec 2.

In general, for rudder trunks extending below shell or skeg, the fillet shoulder radius r, in mm, is to be as large as practicable (see Fig 67) and to comply with the following formulae:

r = 60 mm when $\sigma_B \geq 40/k$ N/mm^2,

r = 0,1 d_{TF} /k when $\sigma_B < 40/k$ N/mm^2,

without being less than:

r = 60 mm when $\sigma_B > 40/k$ N/mm^2

r = 30 mm, when $\sigma_B < 40/k$ N/mm^2

where:

d_{TF} : rudder stock diameter, in mm,

σ_B : bending stress in the rudder trunk, in N/mm^2.

The radius may be obtained by grinding. If disk grinding is carried out, score marks are to be avoided in the direction of the weld.

The radius is to be checked with a template for accuracy. Four profiles at least are to be checked. A report is to be submitted to the Surveyor.

Rudder trunks comprising of materials other than steel are to be specially considered by the Society.

The rudder trunk is to be of adequate thickness (in general equivalent to the thickness of the hull in that area) and duly connected to the hull to the satisfaction of the Surveyor.

If the rudder stock is lined in way of the trunk bearing (for instance with stainless steel brush), the lining is to be shrunk on.

APPENDIX 1 ALTERNATIVES, RELAXATIONS AND ADDITIONAL CONSIDERATIONS FOR YACHTS OF LESS THAN 500 GT

1 Subdivision, integrity of hull and superstructure (Sec 1)

1.1 Number of watertight bulkheads

1.1.1 Openings in watertight bulkheads and decks

With reference to Sec 1, [5.1.2].

The details relevant to these electrical penetrations devices and their installation on board may be only checked on board.

The collision bulkhead may be penetrated by more than two pipes provided that the passages are located inside a suitable metallic plate.

Such plate is to be installed above the maximum water line in the central position of the bulkhead and the relevant dimensions are to be the minimum compatible with the bore of pipes.

In any case such dimension are to be not more than an equivalent area of 22500 mm^2.

The relevant pipes are to be fitted with valves as above stated.

1.1.2 With reference to Sec 1, [5.1.3].

As far as the collision bulkhead is concerned, in general a maximum of two pipes may pass through the collision bulkhead below the freeboard deck. Such pipes are to be fitted with suitable valves operable from above the freeboard deck and the valve chest is to be secured at the bulkhead inside the fore peak. Such valves may be fitted on the after side of the collision bulkhead provided that they are readily accessible under all service conditions. All valves are to be of steel, bronze or other approved ductile material. As a general rule, no access is to be fitted in the collision bulkhead. Special consideration will be given in the case of yachts of particular design, provided the access is positioned as far above the design waterline as possible and its closing appliances are watertight.

For GRP yachts the collision bulkhead may be penetrated by more than two pipes provided that the passages are located inside a suit-able metallic plate. Such plate is to be installed above the maximum water line in the central position of the bulkhead and the relevant dimensions are to be the minimum compatible with the bore of pipes.

In any case such dimensions are to be not more than an equivalent area of 22500 mm^2.

The relevant pipes are to be fitted with valves as above stated.

1.1.3 With reference to Sec 1, [5.1.4].

The strength of watertight bulkheads is to be in conformity with Ch 2, Ch 3 and Ch 4, according to the hull material. Doors in watertight bulkhead has to be sliding type. Tasneef may accept approved hinged doors provided that for such doors an audible and visual alarm is fitted on the bridge indicating when the door is open. The doors are to be kept closed at sea and marked accordingly.

1.1.4 With reference to Sec 1, [5.1.5].

The rudder wheel and windlass shall be securely fastened to a column or equivalent support provided for the purpose, and it shall be possible, in general, to rotate the rudder up to the maximum side angle with no more than 5 turns of the rudder wheel.

Alternative arrangements will be subject of special consideration by Tasneef.

3 Equipment (Sec.3)

3.1 ~~Windlass~~ Equipment number

3.1.1 As an alternative to Sec 3, Tab 1 the following Tab 1 may be applied.

Table 1

EN		Stockless bower anchors		Chain cables for anchors					Mooring lines		
A<EN≤B		No.	Mass per anchor (kg)	Total length (m)	Diameter (mm)				No.	Length (m)	Breaking load kN
A	B				Studless chain cable	Chain cables with stud					
						Grade Q1 steel	Grade Q2 steel	Grade Q3 steel			
50	70	1	100	165	11	-	-	-	2	42	26
70	90	1	120	192,5	12,5	11	-	-	2	50	31
90	110	1	140	192,5	12,5	11	-	-	2	62	35
110	130	2	160	220	14,5	14	12,5	-	3	70	35
130	150	2	180	220	14,5	14	12,5	-	3	74	39
150	175	2	200	220	17,5	16	14	11	3	77	43
175	205	2	230	220	17,5	16	14	11	3	80	47
205	240	2	260	220	19	17,5	16	12,5	4	85	51
240	280	2	310	220	19	17,5	16	12,5	4	90	55
280	320	2	360	247,5	20,5	19	17,5	14	4	95	59
320	360	2	410	247,5	22	20,5	17,5	14	4	100	62
360	400	2	460	247,5	24	22	19	16	4	105	70
400	450	2	520	275	-	22	19	16	4	110	78
450	500	2	580	275	-	24	20,5	17	4	110	86
500	550	2	640	275	-	26	22	20,5	4	130	98
550	600	2	700	302,5	-	26	22	20,5	4	130	105
600	660	2	770	302,5	-	28	24	22	4	130	118
660	770	2	840	302,5	-	30	26	24	4	130	126
720	780	2	910	330	-	30	26	24	4	140	138
780	840	2	980	330	-	32	28	24	4	140	150
840	910	2	1060	357,5	-	32	28	24	4	140	160
910	980	2	1150	357,5	-	34	30	26	4	140	173
980	1060	2	1260	357,5	-	36	32	28	4	140	184

3.1.2 As an alternative to Sec 3, [6.1] what below may be applied.

Windlasses are to be power driven and suitable for the size of chain cable and is to have the characteristics below.

The windlass is to be fitted in a suitable position in order to ensure an easy lead of the chain cables to and through the hawse pipes; the deck in way of the windlass is to be suitably reinforced.

A suitable stopping device is to be fitted in order to prevent the anchor from shifting due to movement of the yacht.

3.1.3 With reference to Sec 3, the following requirements need not to be applied: [6.2], [6.3] and [6.4].

4 Non structural fuel tank (Sec 4)

4.1 General

4.1.1 With reference to Ch 1, Sec 4 special consideration may be done.

Chapter 2
STEEL HULLS

SECTION 5 PLATING

1 Definitions and symbols

1.1

1.1.1

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

p : scantling pressure, in kN/m^2, given in Ch 1, Sec 5

K : factor defined in Sec 2.

2 Keel

2.1 Sheet steel keel

2.1.1 The keel plating is to have a width b_{CH}, in mm, throughout the length of the yacht, not less than the value obtained by the following equation:

$$b_{CH} = 4,5 \cdot L + 600$$

and a thickness not less than that of the adjacent bottom plating increased by 2 mm.

2.2 Solid keel

2.2.1 The height and thickness of the keel, throughout the length of the yacht, are to be not less than the values h_{CH} and t_{CH}, in mm, calculated with the following equations:

$$h_{CH} = 1,5 \cdot L + 100$$

$$t_{CH} = (0,35 \cdot L + 6) \cdot K^{0,5}$$

Lesser heights and thicknesses may be accepted provided that the effective area of the section is not less than that of the Rule section.

Lesser heights and thicknesses may also be acceptable if a centre girder is placed in connection with the solid keel.

3 Bottom and bilge

3.1

3.1.1 Bottom plating is the plating up to the chine or to the upper turn of the bilge.

The thickness of the bottom plating and the bilge is to be not less than the greater of the values t_1 and t_2, in mm, calculated with the following formulae:

$$t_1 = k_1 \cdot k_2 \cdot k_a \cdot s \cdot (p \cdot K)^{0,5}$$

$$t_2 = 8 \cdot s \cdot (T \cdot K)^{0,5}$$

where:

k_1 : 0,~~11~~09, assuming $p=p_1$

: 0,07, assuming $p=p_2$.

k_a : coefficient as a function of the ratio S/s given in Tab 1 below, where S is the greater dimension of the plating, in m.

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 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 satisfies 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:

$$t_m = (0,008h_{df} + 0,5)k^{0,5}$$

Watertight floors are also to have thickness not less than that required in Sec 10 for tank bulkheads.

6.2

6.2.1 When the height of a floor exceeds 900 mm, vertical stiffeners are to be arranged.

In any event, solid floors or equivalent structures are to be arranged in longitudinally framed double bottoms in the following locations:

- under bulkheads and pillars
- outside the machinery space at an interval no greater than 2 m
- in the machinery space under the bedplates of main engines
- in way of variations in height of the double bottom.

Solid floors are to be arranged in transversely framed double bottoms in the following locations:

- under bulkheads and pillars
- in the machinery space at every frame
- in way of variations in height of the double bottom
- outside the machinery space at 2 m intervals.

7 Bracket floors

7.1

7.1.1 At each frame between solid floors, bracket floors consisting of a frame connected to the bottom plating and a reverse frame connected to the inner bottom plating are to be arranged and attached to the centre girder and the margin plate by means of flanged brackets with a width of flange not less than 1/10 of the double bottom depth.

The frame section modulus Z_c, in cm^3, is to be not less than:

$$Z_c = k_1 \cdot s \cdot S^2 \cdot p \cdot K$$

where:

k_1 : 0,83 assuming $p=p_1$

: 0,36 assuming $p=p_2$

S : frame span, in m, equal to the distance between the mid-spans of the brackets connecting the frame/reverse frame.

The reverse frame section modulus is to be not less than 85% of the frame section modulus.

Where tanks intended for liquids are arranged above the double bottom, the frame and reverse frame section moduli are to be no less than those required for tank stiffeners as stated in Sec 10.

8 Bottom and inner bottom longitudinals

8.1

8.1.1 The section modulus of bottom stiffeners is to be no less than that required for single bottom longitudinals stipulated in Sec 6.

The section modulus of inner bottom stiffeners is to be no less than ~~8~~7<u></u>5% of the section modulus of bottom longitudinals.

Where tanks intended for liquids are arranged above the double bottom, the section modulus of longitudinals is to be no less than that required for tank stiffeners as stated in Sec 10.

Chapter 3
ALUMINIUM HULLS

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 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 satisfies 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:

$$t_m = (0,008h_{df} + 0,5) \cdot k^{0,5}$$

Watertight floors are also to have thickness not less than that required in Sec 10 for tank bulkheads.

6.2

6.2.1 When the height of a floor exceeds 900 mm, vertical stiffeners are to be arranged.

In any event, solid floors or equivalent structures are to be arranged in longitudinally framed double bottoms in the following locations.

- under buklheads and pillars
- outside the machinery space at an interval no greater than 2 m
- in the machinery space under the bedplates of main engines
- in way of variations in height of the double bottom.

Solid floors are to be arranged in transversely framed double bottoms in the following locations:

- under bulkheads and pillars
- in the machinery space at every frame
- in way of variations in height of the double bottom
- outside the machinery space at 2 m intervals.

7 Bracket floors

7.1

7.1.1 At each frame between solid floors, bracket floors consisting of a frame connected to the bottom plating and a reverse frame connected to the inner bottom plating are to be arranged and attached to the centre girder and the margin plate by means of flanged brackets with a width of flange not less than 1/10 of the double bottom depth.

The frame section modulus Z_c, in cm^3, is to be not less than:

$$Z_c = k_1 \cdot s \cdot S^2 \cdot p \cdot K$$

where:

k_1 : 1,6 assuming $p=p_1$

: 0,68 assuming $p=p_2$

S : frame span, in m, equal to the distance between the mid-spans of the brackets connecting the frame/reverse frame.

The reverse frame section modulus is to be not less than 85% of the frame section modulus.

Where tanks intended for liquids are arranged above the double bottom, the frame and reverse frame section moduli are to be no less than those required for tank stiffeners as stated in Sec 10.

8 Bottom and inner bottom longitudinals

8.1

8.1.1 The section modulus of bottom stiffeners is to be no less than that required for single bottom longitudinals stipulated in Sec 6.

The section modulus of inner bottom stiffeners is to be no less than ~~8~~75% of the section modulus of bottom longitudinals.

Where tanks intended for liquids are arranged above the double bottom, the section modulus of longitudinals is to be no less than that required for tank stiffeners as stated in Sec 10.

Chapter 5
WOOD HULLS

SECTION 4 STRUCTURAL SCANTLINGS OF SAILING YACHTS WITH OR WITHOUT AUXILIARY ENGINES

1 General

1.1

1.1.1 The scantlings in this Section apply to hulls of length L not exceeding 30 metres with round bottom of shape similar to that shown in Fig 1 and Fig 2, and fitted with fixed ballast or drop keel. Subject to Tasneef authorisation the value of the structural scantlings for yachts more than 30 metres but not more than 40 metres in length may be calculated by linear interpolation of the results for yachts not more than 30 metres, given in this Section.

Yachts of length L exceeding 30 metres or hull shapes other than the above will be considered in each case on the basis of equivalence criteria.

2 Keel

2.1

2.1.1 The scantlings of wooden keels are given in Tab 1.

The keel thickness is to be maintained throughout the length, while the width may be gradually tapered at the ends so as to be faired to the stem and the sternpost.

The breadth of the rabbet on the keel for the first plating strake is to be at least twice the thickness and not less than 25 mm.

The wooden keel is to be made of a minimum number of pieces; scarf joints may be permitted with scarf 6 times as long as the thickness and tip 1/4 to 1/7 of the thickness of the hooked or tabled type, if bolted, or of the plain type, if glued. It is recommended that scarfs should not be arranged near mast steps or ends of engine foundation girders.

Where the keel is cut for the passage of a drop keel, the width is to be increased.

Where the mast is stepped on the keel, it is to be arranged aft of the forward end of the ballast keel. Where this is not practicable, effective longitudinal stiffeners are to be arranged extending well forward and aft of the mast step and effectively connected to the keel.

Bolted scarfs are to be made watertight by means of softwood stopwaters.

3 Stempost and sternpost

3.1

3.1.1 The stempost is to be adequately scarfed to the keel and increased in width at the heel as necessary so as to fit the keel fairing.

Stempost scantlings are given in Tab 1.

The sternframe is shown in Fig 3 and sternpost scantlings are given in Tab 1.

The lower portion of the sternpost is to be tenoned or otherwise attached to the keel. The connection is completed by a stern deadwood and a large bracket fastening together false keel, keel and post by means of through bolts.

The counter stern is to be effectively connected to the sternpost; where practicable, such connection is to be effected by scarfs with through bolts.

The cross-sectional area of the counter stern at the connection with the sternpost is to be not less than that of the latter; such area may be reduced at the upper end by 25%.

Bulkheads of adequate scantlings, connected to the beam and frame, can be considered as substitutes for knees.

At the ends of the hull, the length of knee arms may be not more than one third of the span of the beam or frame.

In the above-mentioned table, the scantlings of forged plate knees are given; the depth at the throat is to be not less than 1,6 h for naturally curved wooden knees and not less than 1,4 h for laminated wooden knees, h being the depth at heel of a grown frame.

Horizontal knees are to be fitted in way of hatch-end beams and beams adjacent to mast wedgings. These knees need not be arranged when plywood deck planking is adopted.

7.3 Local strengthening

7.3.1 The beams and decks are to be locally strengthened at the attachments of halliards, bollards and cleats, at skylight ends, and in way of foundations of winches.

In way of mast weldings, four strong beams are to be fitted, with scantlings as prescribed in Tab 7, but constant section equal to that indicated for amidships. The beams are to be arranged, as far as practicable, in proximity of the web frames dealt with in [4.2].

All openings on deck are to be properly framed so as to constitute an effective support for half beams.

7.4 Lower deck and associated beams

7.4.1 In hulls with depth measured from the upper side of the wooden keel to the weather deck beam at side > 3, metres, a lower deck or cabin deck is to be arranged and fitted with beams having scantlings not less than 60% of those of the weather deck.

When the depth, measured as specified above, exceeds 4,3 metres, vertical knees are to be arranged no smaller in scantlings than prescribed in Table 8 as a function of the beam span, and in number equal to half of those required for the weather deck.

8 Planking

8.1 Shell planking

8.1.1 The basic thickness of shell planking is given in Tab 9.

Such thickness is to be modified as follows.

If the frame spacing is other than that indicated in Tab 2, the thickness is to be increased where there is greater spacing, or may be reduced where there is smaller spacing, by:

- 6 mm for every 100 mm of difference if Type I framing is adopted;
- 4 mm for every 100 mm of difference if Type II or III framing is adopted.

After correction for spacing as indicated above, and for the weight of the timber, where necessary, the planking thickness may be reduced: by 10% if arranged in diagonal or longitudinal double skin; by 10% if laminated and cold moulded in situ, when the frames are reduced in scantlings by 25% in respect of the value given in Tab 2; the thickness may be decreased by 25% where the frames have not been reduced in respect of the requirements of the table.

When plywood is employed, the thickness may be reduced in relation to the type of framing adopted; the maximum reduction permitted is 25%.

Sheathing of the hull is not required; where envisaged, e.g. in copper or reinforced plastics, it will be considered by Tasneef on a case-by-case basis (see Sec 6, [1.8]).

8.2 Deck planking

8.2.1 Deck planking may be:

- constituted by planks parallel to the gunwale limited by a stringer board at side and by a kingplank at the centreline;
- plywood;
- plywood with associated planks as above.

Depth of yacht D m	Diameter of bolts			
	at throat		in the arms	
	Grown, or laminated, or steel frames mm	Bent frames mm	Grown, or laminated, or steel frames mm	Bent frames mm
Length of yacht L m	Diameter of bolts			
	Centreline structures of yachts mm		Scarfs and breasthook arms mm	Beam shelves and beam knees mm
24	20		14	11
26	20		14	11
28	22		16	12
30	22		18	14

8.3 Superstructures - Skylights

8.3.1 When coachroofs are adopted, the opening on deck is to be well framed and the coaming on the weather deck is to be not less in thickness than that required in Tab 9.

The coachroof deck is to have sheathing as prescribed in Tab 9, though such sheathing may be reduced in thickness in accordance with the specifications in [8.2] for the weather deck. If the beam spacing is other than that indicated in Table 5, the thickness is to be modified by 3 mm for every 100 mm of difference in spacing.

When deckhouses are adopted, they are to have a coaming fastened to the beams and carlings by means of through bolts.

The structure of deckhouses is to be similar to that required for coachroofs. Depending on their size, deckhouses are to be adequately stiffened to the satisfaction of Tasneef.

Deck openings for skylights are to be well framed and provided with shutters of adequate thickness.

8.4 ~~Masts and rigging~~

8.4.1 ~~Each yacht is to be provided with masts, rigging and sails sufficient in number and in good condition. The scantlings of masts and rigging are left to the experience of builders and shipowners. Care will be taken by the Tasneef Surveyor, however, in verifying that the attachments of shrouds and stays to the hull are such as to withstand at least twice the load expected~~ on such rigging.

~~The mast step is to be of strong construction, and is to be extended so as not to be connected to the transverse and longitudinal framing of the bottom of the hull. The wedging on deck is to be provided with watertight means.~~

~~When the mast rests on deck, the underlying structure is to be strengthened in way such as to avoid giving way. If the mast rests on a coachroof, the hull is to be strengthened in way by means of a bulkhead or a stiffened frame.~~

~~For shrouds and stays in wire and not in rod, the breaking loads of wires in galvanised steel 160 UNI 4434, in spiral shape, 1x19 wires (col. 1) and in stainless steel AISI 316 18/10 (ASTM A 368-55), in spiral shape, 1x19 wires (col. 2) are included below for information purposes.~~

Chapter 6
STABILITY

SECTION 1 STABILITY

1 General

1.1

1.1.1 Each yacht is to be provided with a stability booklet, approved by the Society, which contains sufficient information to enable the Mas-ter to operate the yacht in compliance with the applicable requirements contained in this Section Where any alterations are made to a yacht so as to materially affect the stability information supplied to the Master, amended stability information is to be provided. If necessary the yacht is to be re-inclined. Stability data and associated plans are to be drawn up in the working language of the yacht and any other language the Administration the flag of which the yacht is entitled to fly may require. The format of the trim and stability booklet and the information included are specified in App 2.

1.1.2 This Section outlines the minimum requirements for intact stability for both motor and sailing vessels. This Section deals with the standards for intact stability.

1.1.3 An intact stability standard proposed for assessment of a vessel type not covered by the standards defined in this Section is to be submitted to Tasneef for approval at the earliest opportunity.

1.1.4 If curves or tables of minimum operational metacentric height (GM) or maximum centre of gravity (VCG) are used to ensure compli-ance with the relevant intact stability criteria those limiting curves are to extend over the full range of operational trims, unless the Society agrees that trim effects are not significant. When curves or tables of minimum operational metacentric height (GM) or maxi-mum centre of gravity (VCG) versus draught covering the operational trims are not available, the Master is to verify that the operating condition does not deviate from a studied loading condition, or verify by calculation that the stability criteria are satisfied for this load-ing condition taking into account trim effects.

1.1.5 If used, permanent ballast is to be located in accordance with a plan approved by Tasneef and in a manner that prevents shifting of position. Permanent ballast is not to be removed from the yacht or relocated within the vessel without the approval of Tasneef. Permanent ballast particulars are to be noted in the yacht's stability booklet. Attention is to be paid to local or global hull strength requirements arising from the fitting of additional ballast.

2 Intact Stability Standards

2.1 General

2.1.1 Application

The intact stability criteria specified in [2.2], [2.3] are to be complied with for the loading conditions mentioned in App 4, [2.1].

However, the lightship condition not being an operational loading case, the Society may accept that part of the above-mentioned criteria are not fulfilled.

These criteria set minimum values, but no maximum values are recommended. It is advisable to avoid excessive values of metacentric height, since these might lead to acceleration forces which could be prejudicial to the yacht and its equipment.

2.2.6 Vessels operating as Short Range Yachts

Where Short Range Yachts are unable to meet the criteria above, the following criteria may be used:

a) the area under the righting lever curve (GZ curve) should not be less than 0.07 metre-radians up to 15° angle of heel, when maximum GZ occurs at 15°, and 0.055 metre-radians up to 30° angle of heel, when maximum GZ occurs at 30° or above. Where the maximum GZ occurs at angles of between 15° and 30°, the corresponding area under the GZ curve, A_{req} should be taken as follows: - A_{req} = 0.055 + 0.001(30o - θ_{max}) metre.radians where θ_{max} is the angle of heel, in degrees, where the GZ curve reaches its maximum;

b) the area under the GZ curve between the angles of heel of 30° and 40° or between 30° and the angle of downflooding if this is less than 40o, should not be less than 0.03 metre-radians;

c) the righting lever (GZ) should be at least 0.20 metres at an angle of heel equal to or greater than 30°;

d) the maximum GZ should occur at an angle of heel not less than 15°

e) after correction for free surface effects, the initial metacentric height (GM) should not be less than 0.15 metres.

2.3 Sailing vessels *(1/1/2025)*

2.3.1 Monohull

a) Curves of static stability (GZ curves) are to be produced or at least the Loaded Departure with 100% consumables and the Loaded Arrival with 10% consumables.

b) The GZ curves required by a) should have a positive range of not less than 90º. For vessels of more than 45 m, a range of less than 90º may be considered but may be subject to agreed operational criteria.

c) In addition to the requirements of b), the angle of steady heel is to be greater than 15 degrees (see Fig 1). The angle of steady heel is obtained from the intersection of a 'derived wind heeling lever' curve with the GZ curve required by a).

In the figure:

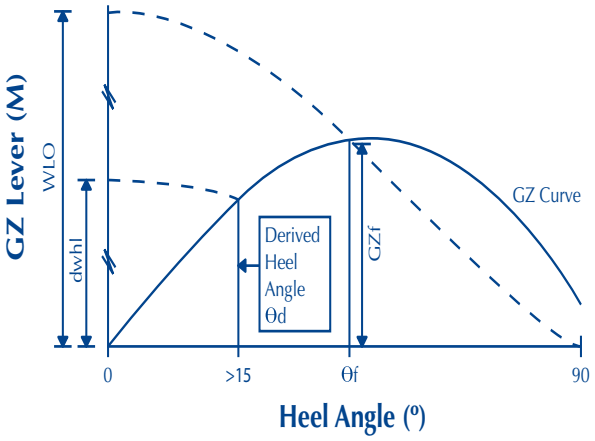
'dwhl' = the 'derived wind heeling lever' at any angle θ

$$dwhl = 0,5 \times WLO \times Cos^{1,3}\theta$$

where:

$$WLO = \frac{GZ_f}{Cos^{1,3}\theta_f}$$

Figure 1



Noting that:

WLO is the magnitude of the actual wind heeling lever at 0º which would cause the vessel to heel to the 'downflooding angle' θ_f or 60º, whichever is the lesser.

GZf is the lever of the vessel's GZ at the downflooding angle (θ_f) or 60º, whichever is the lesser.

θ_d is the angle at which the 'derived wind heeling' curve intersects the GZ curve. (If θ_d is less than 15º the vessel will be considered as having insufficient stability).

θ_f the 'downflooding angle' is the angle of heel causing immersion of the lower edge of openings having an aggregate area, in square metres, greater than:

$$\frac{\Delta}{1500}$$

where Δ = vessel's displacement in tonnes.

All regularly used openings for access and ventilation are to be considered when determining the downflooding angle. No opening, regardless of size, which may lead to progressive flooding is to be immersed at an angle of heel of less than 40º. Air pipes to tanks can, however, be disregarded.

If, as a result of immersion of openings in a superstructure, a vessel cannot meet the required standard, those superstructure openings may be ignored and the openings in the weather deck used instead to determine θ_f. In such cases the GZ curve is to be derived without the benefit of the buoyancy of the superstructure.

d) It might be noted that provided the vessel complies with the requirements of [2.3] as applicable and is sailed with an angle of heel which is no greater than the 'derived angle of heel', it should be capable of withstanding a wind gust equal to 1,4 times the actual wind velocity (i.e. twice the actual wind pressure) without immersing the 'downflooding openings' or heeling to an angle greater than 60º.

~~It might be noted that provided the vessel complies with the requirements of [2.1.1], [2.1.2] and [2.1.3] and is sailed with an angle of heel which is no greater than the 'derived angle of heel', it should be capable of withstanding a wind gust equal to 1,4 times the actual wind velocity (i.e. twice the actual wind pressure) without immersing the 'downflooding openings' or heeling to an angle greater than 60º.~~

2.3.2 Multi-hull

a) Curves of static stability in both roll and pitch are to be prepared for at least the Loaded Arrival with 10% consumables. The VCG is to be obtained by one of the three methods listed below:

1) inclining of complete craft in air on load cells, the VCG being calculated from the moments generated by the measured forces, or

2) separate determination of weights of hull and rig (comprising masts and all running and standing rigging), and subsequent calculation assuming that the hull VCG is 75% of the hull depth above the bottom of the canoe body, and that the VCG of the rig is at half the length of the mast (or a weighted mean of the lengths of more than one mast), or

3) detailed calculation of the weight and CG position of all components of the vessel, plus a 15% margin of the resulting VCG height above the underside of canoe body.

b) If naval architecture software is used to obtain a curve of pitch restoring moments, then the trim angle is to be found for a series of longitudinal centre of gravity (LCG) positions forward of that necessary for the design waterline. The curve can then be derived as follows:

GZ in pitch = CG' x cos (trim angle)

$$\text{trim angle} = \tan^{-1}\left(\frac{T_{FP} - T_{AP}}{L_{BP}}\right)$$

where:

CG' = shift of LCG forward of that required for design trim, measured parallel to base line

T_{FP} = draught at forward perpendicular

T_{AP} = draught at aft perpendicular

L_{BP} = length between perpendiculars

Approximations to maximum roll or pitch moments are not acceptable.

c) Data is to be provided to the user showing the maximum advised mean apparent wind speed appropriate to each combination of sails, such wind speeds being calculated as the lesser of the following:

Chapter 1
MACHINERY

SECTION 2 DIESEL ENGINES

1 General

1.1 Application

1.1.1 *(1/1/2025)*

Diesel engines listed below are to be designed, constructed, installed, tested and certified in accordance with the requirements of this Section, under the supervision and to the satisfaction of the Society's Surveyors and in accordance with the relevant Table of Pt A, Ch 2, App 3:

a) main propulsion engines

b) engines driving electrical generators and other auxiliaries essential for safety and navigation ~~and cargo pumps in tankers~~, when they develop a power of 110 kW and over.

All other engines are to be designed and constructed according to sound marine practice, with the equipment required in [4.3.4], [4.5.2], [4.7.2] [4.7.3], [4.7.5] and [4.7.8] and delivered with the relevant works' certificate (see Pt D, Ch 1, Sec 1, [4.2.3]).

Additional requirements for control and safety systems for dual fuel engines supplied with high pressure methane gas are given in App 2 of Tasneef Rules for the Classification of Ships.

Additional requirements for ~~trunk piston~~ internal combustion engines supplied with low pressure natural gas are given in App 12 and App 17 of Tasneef Rules for the Classification of Ships.

In addition to the requirements of this Section, those given in Sec 1 apply.

1.2 Type approval certificate

1.2.1

For each type of engine that is required to be certified, a type approval certificate is to be obtained by the engine designer.

The type approval process consists of:

- drawing and specification approval,
- conformity of production,
- approval of type testing programme,
- type testing of engines,
- review of the obtained type testing results,
- evaluation of the manufacturing arrangements,
- issue of a type approval certificate upon satisfactorily meeting the Rule requirements.

1.3 Engine certificate

1.3.1

Each diesel engine manufactured for a shipboard application per [1.1.1] is to have an engine certificate:

The certification process consists of:

- the engine builder/licensee obtaining design approval of the engine application specific documents, if any, by submitting a comparison list of the production drawings to the previously approved engine design drawings referenced in [1.2.1]
- forwarding the relevant production drawings and comparison list for the use of the Surveyors at the manufacturing plant and shipyard if necessary
- engine's components testing and engine works trials
- the issuance of an engine certificate upon satisfactorily meeting the Rule requirements.

1.6 Light and Medium Duty

1.6.1 Operative profile *(1/1/2025)*

The yachts with limited use of machinery may have engines certified for one of the following operative profiles:

- light duty
- medium duty

The operative profile is determined by means of the specification of the following parameters: :

- $O_{A\,MAX}$, maximum number of running hours per year expected for the yacht;
- $O_{P\,MAX}$, maximum number of running hours per year expected for the vessel with the main engines running at maximum power;

The engines have to be capable of:

- delivering the maximum power, at nominal maximum speed, for a number of running hours per year ($O_{A\,MAX}$) in the range defined below ,

- being capable to operate, even not continuously at themaximum power, for a number of running hours per year ($O_{P\,MAX}$) in the range defined below

- Light duty: 1000 <= $O_{A\,MAX}$ >= 3000 hours, 100 <=$O_{P\,MAX}$ >= 750 hours
- Medium duty: $O_{A\,MAX}$ >= 3000 hours, $O_{P\,MAX}$ >= 750 hours

Light duty and medium duty engines are not required to be capable to sustain overload power.

The maximum and continuous power, speed and the period of time between two consecutive overhauls are to be stated by the Manufacturer and agreed by the Society. Manufacturer is also required to provide a complete and detailed operative profile of the engine with the indication of every limitation at intermediate powers.

1.6.2 Light duty e medium duty engines *(1/1/2025)*

In yachts with light duty or medium duty operating profile, ad defined in [1.6.1] engines set for intermittent duty which maximum power P_{MAX} will be defined by the Manufacturer according to the parameters O_{AMAX} e O_{PMAX} and Ic defined in this paragraph, may be installed. The maximum speed and the period between the two subsequent maintenances are to be established by the Manufacturer and accepted by the Society.

For light and medium duty the parameters in addition to those in [1.6.1] are respectively:

- Light duty: I_C >= 0,4, $O_{A\,MIN}$ = 1000 hours
- Medium duty: I_C >=0,6 $O_{A\,MIN}$ = 3000 hours

Such engines are to be approved according to [6.12.1] and [6.12.2] and individually tested when required in Pt A Ch 2 App 3.

2 Type approval process

2.1

2.1.1

The type approval process consists of the steps in [2.2] to [2.5].

The documentation, as far as applicable to the type of engine, to be submitted by the engine design-er/licensor is listed in Tab 1 and Tab 2.

2.2 Documentation for information Table 1

2.2.1

Tab 1 lists basic descriptive information required to be submitted to provide an overview of the engine's design, engine characteristics and performance.

2.3 Documentation for approval or recalculation Table 2

2.3.1

Tab 2 lists the documents and drawings, which are to be submitted for approval.

Table 4 : Monitoring of main propulsion diesel engines *(1/1/2025)*

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				
			Main Engine			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
Fuel oil pressure after filter (engine inlet)		local					
~~Fuel oil viscosity before injection pumps or fuel oil temperature before injection pumps (For engine running on heavy fuel)~~		~~local~~					
Leakage from high pressure pipes where required	H						
Lubricating oil to main bearing and thrust bearing pressure **(5)**	L	local					
	LL			X			
Lubricating oil to cross-head bearing pressure when separate **(5)**	L	local					
	LL			X			
Lubricating oil to camshaft pressure when separate **(5)**	L	local					
	LL			X			
Turbocharger lubricating oil inlet pressure		local					
Lubricating oil inlet temperature		local					
Thrust bearing pads or bearing outlet temperature	H	local					
Cylinder fresh cooling water system inlet pressure	L	local **(3)**					
Cylinder fresh cooling water outlet temperature or, when common cooling space without individual stop valves, the common cylinder water outlet temperature		local					
Piston coolant inlet pressure on each cylinder **(1)**	L	local					
Piston coolant outlet temperature on each cylinder **(1)**		local					
Piston coolant outlet flow on each cylinder **(1) (2)**	L						
Scavenging air receiver pressure		local					
Scavenging air box temperature (Detection of fire in receiver)		local					
Exhaust gas temperature		local **(4)**					
Engine speed / direction of speed (when reversible) **(5)**		local					
	H			X			
Fault in the electronic governor system	X						

(1) Not required, if the coolant is oil taken from the main cooling system of the engine

(2) Where outlet flow cannot be monitored due to engine design, alternative arrangement may be accepted

(3) For engines of 220 kW and above

(4) Indication is required after each cylinder, for engines of 500 kW/cylinder and above

(5) To ensure independency of safety functions from control and monitoring functions, a separate sensor is to be installed for each row of the table.

Table 5 : Monitoring of diesel engines used for auxiliary services *(1/1/2025)*

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				
			Engine			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
Fuel oil viscosity or temperature before injection **(2)**		local					
~~Fuel oil pressure **(2)**~~		~~local~~					
Fuel oil leakage from pressure pipes	H						
Lubricating oil pressure	L	local		X **(1)**			
Pressure or flow of cooling water, if not connected to main system	L	local					
Temperature of cooling water or cooling air		local					
Engine speed **(4)**		local					
	H			X **(3)**			
Fault in the electronic governor system	X						

(1) Not acceptable to emergency generator set

(2) ~~Where heavy fuel is used~~

(3) Only requested for diesel engines having rating of 220 kW and above

(4) To ensure independency of safety functions from control and monitoring functions, a separate sensor is to be installed for each row of the table.

Table 6 : Monitoring of reciprocating I.C. engines required to be immediately available in an emergency and capable of being controlled remotely or automatically operated

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				
			Engine			Auxiliary	
Identification of system parameter	Alarm activation	Indication	Slow-down	Shut-down with alarm	Control	Stand by Start	Stop
Fuel oil leakage from high pressure pipes (fuel injection pipes and common rails)	X						
Lubricating oil pressure	L	local					
Lubricating oil temperature **(1)**	H	local					
Pressure or flow of cooling water **(1)**	L	local					
Activation of oil mist detection arrangements (or activation of the temperature monitoring systems or equivalent devices of: • the engine main and crank bearing oil outlet; or • the engine main and crank bearing) **(2)**	X	local					
Temperature of cooling water or cooling air	H	local					
Engine Overspeed activated **(1)**, **(3)**		local					
				X			

5.2 Turning gear

5.2.1

Each engine is to be provided with hand-operated turning gear; where deemed necessary, the turning gear is to be both hand and mechanically-operated.

The turning gear engagement is to inhibit starting operations.

5.3 Trays

5.3.1

Trays fitted with means of drainage are to be provided in way of the lower part of the crankcase and, in general, in way of the parts of the engine, where oil is likely to spill in order to collect the fuel oil or lubricating oil dripping from the engine.

5.4 Exhaust gas system

5.4.1

In addition to the requirements given in Sec 10, the exhaust system is to be efficiently cooled or insulated in such a way that the surface temperature does not exceed 220°C (see also Sec 1, [3.7]).

6 Type tests

6.1 Type tests - General

6.1.1 *(1/1/2025)*

Type testing is required for every new engine type intended for installation onboard yachts subject to classification in accordance with PT A Ch.2 App.3 .

6.1.2 *(1/1/2025)*

For light duty and medium duty engines [6.12] applies.

6.2 Objectives

6.2.1

The type testing, is to be arranged to represent typical foreseen service load profiles, as specified by the engine builder, as well as to cover for required margins due to fatigue scatter and reasonably foreseen in-service deterioration.

This applies to:

- Parts subjected to high cycle fatigue (HCF) such as connecting rods, cams, rollers and spring tuned dampers where higher stresses may be provided by means of elevated injection pressure, cylinder maximum pressure, etc.
- Parts subjected to low cycle fatigue (LCF) such as "hot" parts when load profiles such as idle-full load -idle (with steep ramps) are frequently used.
- Operation of the engine at limits as defined by its specified alarm system, such as running at maximum permissible power with the lowest permissible oil pressure and/or highest permissible oil inlet temperature.

6.3 Validity

6.3.1

A type test carried out for a particular type of engine at any place of manufacture will be accepted for all engines of the same type built by licensees or the licensor, subject to each place of manufacture being found to be acceptable to the Society.

6.3.2

One type test will be considered adequate to cover a range of different numbers of cylinders. However, a type test of an in-line engine may not always cover the V-version. Subject to the individual Societies' discretion, separate type tests

6.12 Validity

6.12.1 Type test light duty and medium duty engines *(1/1/2025)*

The Manufacturer demanding the approval of light duty or medium duty engines operating profile is requested to declare contextually with the demand the following parameters:

- P_{MAX} = Maximum pressure in kW
- n_{MAX} = round per minute at power P_{MAX}
- TBO = time between two main overhaul, in number of running hours
- $O_{A\,MAX}$ = Motion hours per year
- $O_{P\,MAX}$ = Motion hours per year at P_{MAX}
- Ic Loading index where = $(P_{MEDIA} \cdot O_{A\,MAX})/(P_{MAX} \cdot O_{A\,MIN})$

Where P_{MAX} average power deliverable from the engine in $O_{A\,MAX}$ running hours per year.

For proceeding in the type approval, the parameters above declared by the Manufacturer are not to be less than the minimum ones provided for the operating profile in [1.6.2].

Engines with Light duty and Medium duty operative profiles are to be type tested in accordance with [6.12.2]. In this respect, Manufacturer is to be admitted to testing and inspections according to an alternative inspection scheme..

6.12.2 Type test *(1/1/2025)*

The programme of the type test is to be in general as specified below, P_{MAX} being the maximum power and n_{MAX} the corresponding speed. The maximum power is that stated by the engine Manufacturer and accepted by the Society, as defined in [1.6.1]:

- 80 hours at P_{MAX} e n_{MAX}
- 10 hours at partial loads (25%, 50%, 75% and 90% of power P_{MAX})
- 2 hours at intermittent loads
- starting tests
- testing of speed governor, overspeed device and lubricating oil system failure alarm device;
- testing of the engine with one turbocharger out of action, when applicable
- testing of the minimum speed along the nominal (theoretical) propeller curve, for main propulsion engines driving fixed pitch propellers, and of the minimum speed with no brake load, for main propulsion engines driving controllable pitch propellers.

The tests at the above-mentioned outputs are to be combined together in working cycles which are to be repeated in succession for the entire duration within the limits indicated.

The partial load tests are to be carried out along the nominal (theoretical) propeller curve and at constant speed.

For all the engines presenting power not superior than 2000 kW for which the approval of light duty and medium duty operating profile is requested a running test of 100 hours in cycles purposed by:

a) 8 hours at P_{MAX} e n_{MAX}

b) 30 min at 90% of P_{MAX}

c) 30 min at 70% of P_{MAX}

d) 30 min at 50% of P_{MAX}

e) 30 min at 25% of P_{MAX}

is to be carried out.

Partial loads in items b), c), d) and e) are to be achieved along the nominal curve (theory) of the propeller considered in quadratic function of rounds engine.

During the running test the parameters listed in [6.8.2] are to be noticed and recorded; at the end of the running test the crankshaft is to be dismantled and submitted to visual survey and non-destructive controls by the Surveyor in charge.

The running test mentioned above will be valid for the type test for engines admitted to alternative test.

Light duty and medium duty operating profiles are to reported in the approval and testing certificates.

7 Certification of engine components, Workshop inspections and trials

7.1 General

7.1.1

The engine manufacturer is to have a quality control system that is suitable for the actual engine types to be certified by the Society. The quality control system is also to apply to any sub-suppliers. The Society re-serves the right to review the system or parts thereof. Materials and components are to be produced in compliance with all the applicable production and quality instructions specified by the engine manufacturer. The Society requires that certain parts are verified and documented by means of Society Certificate (SC), Work Certificate (W) or Test Report (TR).

a) The documents above are used for product documentation as well as for documentation of single inspections such as crack detection, dimensional check, etc. If agreed to by the Society, the documentation of single tests and inspections may also be arranged by filling in results on a control sheet following the component through the production.

b) The Surveyor is to review the TR and W for compliance with the agreed or approved specifications. SC means that the Surveyor also witnesses the testing, batch or individual, unless an ACS provides other arrangements.

c) The manufacturer is not exempted from responsibility for any relevant tests and inspections of those parts for which documentation is not explicitly requested by the Society. The manufacturing process and equipment is to be set up and maintained in such a way that all materials and components can be consistently produced to the required standard. This includes production and assembly lines, machining units, special tools and devices, assembly and testing rigs as well as all lifting and transportation devices.

7.2 Parts to be documented

7.2.1

The extent of parts to be documented depends on the type of engine, engine size and criticality of the part.

A summary of the required documentation for the engine components is listed in Tab 8.

Symbols used are listed in Tab 9.

Table 8 : Summary of required documentation for engine components *(1/1/2025)*

Item	Part **(6) (7) (8) (9)**	Material properties **(1)**	Non-destructive examination **(2)**	Hydrostatic test **(4)**	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
1	Welded bedplate	W(C+M)	W(UT+CD)			fit-up + post-welding	All	SC
2	Bearing transverse girders GS	W(C+M)	W(UT+CD)			X	All	SC
3	Welded frame box	W(C+M)	W(UT+CD)			fit-up + post-welding	All	SC
4	Cylinder block GJL			W **(11)**			400 kW/cyl	
5	Cylinder block GJS			W **(11)**			400 kW/cyl	
6	Welded cylinder frames	W(C+M)	W(UT+CD)				CH	SC
7	Engine block GJL			W **(11)**			>400 kW/cyl	
8	Engine block GJS	W(M)		W **(11)**			>400 kW/cyl	
9	Cylinder liner	W(C+M)		W **(11)**			D>300mm	
10	Cylinder head GJL			W			D>300mm	
11	Cylinder head GJS			W			D>300mm	
12	Cylinder head GS	W(C+M)	W(UT+CD)	W		X	D>300mm	SC
13	Forged cylinder head	W(C+M)	W(UT+CD)	W		X	D>300mm	SC
14	Piston crown GS	W(C+M)	W(UT+CD)			X	D>400mm	SC

(1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).

(2) Non-destructive examination means e.g. ultrasonic testing, crack detection by MPI or DP.When certain NDE method on the

(3) finished component is impractical (for example UT for items 12/13), the NDE method can be performed at earlier appropriate stages in the production of the component, see [1.5.4].

(4) Hydrostatic test is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.

(5) Material certification requirements for pumps and piping components are dependent on the operating pressure and temperature. Requirements given in this Table apply except where alternative requirements are explicitly given elsewhere in the Rule requirements.

(6) For turbochargers, see Sec 14.

(7) Crankcase explosion relief valves are to be type tested in accordance with App 5 of Tasneef Rules for The Classification of Ships and documented according to [4.3.4].

(8) Oil mist detection systems are to be type tested in accordance with App 6 of Tasneef Rules for The Classification of Ships and documented according to [4.3.5].

(9) For Speed governor and overspeed protective devices, see [4.7.3] to [4.7.6].

(10) Charge air coolers need only be tested on the water side.

(11) Hydrostatic test is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.

Item	Part **(6) (7) (8) (9)**	Material properties **(1)**	Non-destructive examination **(2)**	Hydrostatic test **(4)**	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
15	Forged piston crown	W(C+M)	W(UT+CD)			X	D>400mm	SC
16	Crankshaft: made in one piece	SC(C+M)	W(UT+CD)		W	Random, of fillets and oil bores	All	SC
17	Semi-built crankshaft (Crankthrow, forged main journal and journals with flange)	SC(C+M)	W(UT+CD)		W	Random, of fillets and shrink fittings	All	SC
18	Exhaust gas valve cage			W			CH	
19	Piston rod	SC(C+M)	W(UT+CD)			Random	D>400mm CH	SC
20	Cross head	SC(C+M)	W(UT+CD)			Random	CH	SC
21	Connecting rod with cap	SC(C+M)	W(UT+CD)		W	Random, of all surfaces, in particular those shot peened	All	SC
22	Coupling bolts for crankshaft	SC(C+M)	W(UT+CD)		W	Random, of interference fit	All	SC
23	Bolts and studs for main bearings	W(C+M)	W(UT+CD)				D>300mm	

(1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).

(2) Non-destructive examination means e.g. ultrasonic testing, crack detection by MPI or DP.When certain NDE method on the

(3) finished component is impractical (for example UT for items 12/13), the NDE method can be performed at earlier appropriate stages in the production of the component, see [1.5.4].

(4) Hydrostatic test is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.

(5) Material certification requirements for pumps and piping components are dependent on the operating pressure and temperature. Requirements given in this Table apply except where alternative requirements are explicitly given elsewhere in the Rule requirements.

(6) For turbochargers, see Sec 14.

(7) Crankcase explosion relief valves are to be type tested in accordance with App 5 of Tasneef Rules for The Classification of Ships and documented according to [4.3.4].

(8) Oil mist detection systems are to be type tested in accordance with App 6 of Tasneef Rules for The Classification of Ships and documented according to [4.3.5].

(9) For Speed governor and overspeed protective devices, see [4.7.3] to [4.7.6].

(10) Charge air coolers need only be tested on the water side.

(11) Hydrostatic test is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.

Item	Part **(6) (7) (8) (9)**	Material properties **(1)**	Non-destructive examination **(2)**	Hydrostatic test **(4)**	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
24	Bolts and studs for cylinder heads	W(C+M)	W(UT+CD)			TR of thread making	D>300mm	
25	Bolts and studs for connecting rods	W(C+M)	W(UT+CD)			TR of thread making	D>300mm	
26	Tie rod	W(C+M)	W(UT+CD)			Random	CH	SC
27	High pressure fuel injection pump body	W(C+M)		W			D>300mm	
		W(C+M)		TR			D<300mm	
28	High pressure fuel injection valves (only for those not autofretted)			W			D>300mm	
				TR			D<300mm	
29	High pressure fuel injection pipes including common fuel rail	W(C+M)		W for those that are not autofretted			D>300mm	
		W(C+M)		TR for those that are not autofretted			D<300mm	
30	High pressure common servo oil system	W(C+M)		W			D>300mm	
		W(C+M)		TR			D<300mm	

(1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).

(2) Non-destructive examination means e.g. ultrasonic testing, crack detection by MPI or DP.When certain NDE method on the

(3) finished component is impractical (for example UT for items 12/13), the NDE method can be performed at earlier appropriate stages in the production of the component, see [1.5.4].

(4) Hydrostatic test is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.

(5) Material certification requirements for pumps and piping components are dependent on the operating pressure and temperature. Requirements given in this Table apply except where alternative requirements are explicitly given elsewhere in the Rule requirements.

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(9) For Speed governor and overspeed protective devices, see [4.7.3] to [4.7.6].

(10) Charge air coolers need only be tested on the water side.

(11) Hydrostatic test is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.

Item	Part **(6) (7) (8) (9)**	Material properties **(1)**	Non-destructive examination **(2)**	Hydrostatic test **(4)**	Dimensional inspection, including surface condition	Visual inspection (surveyor)	Applicable to engines:	Component certificate
31	Cooler, both sides **(10)**	W(C+M)		W			D>300mm	
32	Accumulator	W(C+M)		W			All engines with accumulators with a capacity of > 0,5 l	
33	Piping, pumps, actuators, etc. for hydraulic drive of valves, if applicable	W(C+M)		W			>800 kW/cyl	
34	Engine driven pumps (oil, water, fuel, bilge) other than pumps referred to in item 27 and 33			W			>800 kW/cyl	
35	Bearings for main, crosshead, and crankpin	TR(C)	TR (UT for full contact between base material and bearing metal)		W		>800 kW/cyl	

(1) Material properties include chemical composition and mechanical properties, and also surface treatment such as surface hardening (hardness, depth and extent), peening and rolling (extent and applied force).

(2) Non-destructive examination means e.g. ultrasonic testing, crack detection by MPI or DP.When certain NDE method on the

(3) finished component is impractical (for example UT for items 12/13), the NDE method can be performed at earlier appropriate stages in the production of the component, see [1.5.4].

(4) Hydrostatic test is applied on the water/oil side of the component. Items are to be tested by hydraulic pressure at the pressure equal to 1.5 times the maximum working pressure. High pressure parts of the fuel injection system are to be tested by hydraulic pressure at the pressure equal to 1.5 maximum working pressure or maximum working pressure plus 300 bar, whichever is the less. Where design or testing features may require modification of these test requirements, special consideration may be given.

(5) Material certification requirements for pumps and piping components are dependent on the operating pressure and temperature. Requirements given in this Table apply except where alternative requirements are explicitly given elsewhere in the Rule requirements.

(6) For turbochargers, see Sec 14.

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(9) For Speed governor and overspeed protective devices, see [4.7.3] to [4.7.6].

(10) Charge air coolers need only be tested on the water side.

(11) Hydrostatic test is also required for those parts filled with cooling water and having the function of containing the water which is in contact with the cylinder or cylinder liner.

Table 9 : Symbols used in Table 8

Symbol	Description
C	chemical composition
CD	crack detection by MPI or DP
CH	crosshead engines
D	cylinder bre diameter (mm)
GJL	gray cast iron
GJS	spheroidal graphite cast iron
GS	cast steel
M	mechanical properties
SC	society certificate
TR	test report
UT	ultrasonic testing
W	work certificate
X	visual examination of accessible surfaces by the Surveyor

7.3 Hydrostatic tests

7.3.1

In addition to what indicated in Tab 8, pressure pipes, valves and other fittings (used for water, lubricating oil, fuel oil, compressed air and other fluid), are to be subjected to hydrostatic tests at 1,5 times the maximum working pressure, but not less than 0,4 MPa.

7.4 Workshop inspections and testing

7.4.1

In addition to the type test, diesel engines are to be subjected to works trials, which are to be witnessed by the Surveyor except where an Alternative Certification Scheme has been granted or where otherwise decided by the Society on a case by case basis.

Engines which are to be subjected to trials on the test bed at the Manufacturer's works and under the Society's supervision are to be tested in accordance with the scope as specified below.

Exceptions to this require the agreement of the Society.

Before any official testing, the engines shall be run-in as prescribed by the engine manufacturer.

Adequate test bed facilities for loads as required in [7.4.4] shall be provided. All fluids used for testing purposes such as fuel, lubrication oil and cooling water are to be suitable for the purpose intended, e.g. they are to be clean, preheated if necessary and cause no harm to engine parts. This applies to all fluids used temporarily or repeatedly for testing purposes only.

On occasion of the workshop testing, engines are to be inspected for:

- Jacketing of high-pressure fuel oil lines including the system used for the detection of leakage.
- Screening of pipe connections in piping containing flammable liquids.
- Insulation of hot surfaces by taking random temperature readings that are to be compared with corresponding readings obtained during the type test. This shall be done while running at the rated power of engine. Use of contact thermometers may be accepted at the discretion of the attending Surveyor. If the insulation is modified subsequently to the Type Approval Test, the Society may request temperature measurements as required in [6.10.9].
- Presence of sensors for the alarms and safeguards required in Tab 4, Tab 5 and Tab 6 as applicable; and relevant functionality as far as possible.

These inspections are normally to be made during the works trials by the manufacturer and the attending surveyor, but at the discretion of the Society parts of these inspections may be postponed to the board testing.

Engines for which an Alternative Certification Scheme has been agreed with the Manufacturer are to be subjected to trials at the Manufacturer's works in accordance with a procedure previously accepted on a case-by-case basis by the Society and recorded in the documentation relevant to the admission to the Alternative Certification Scheme.

7.4.2 Objectives

The purpose of the works trials is to verify design premises such as power, safety against fire, adherence to approved limits (e.g. maximum pressure), and functionality and to establish reference values or base lines for later reference in the operational phase.

7.4.3 Records

a) The following environmental test conditions are to be recorded:
   1) Ambient air temperature
   2) Ambient air pressure
   3) Atmospheric humidity

b) For each required load point, the following parameters are normally to be recorded:
   - Power and speed
   - Fuel index (or equivalent reading)
   - Maximum combustion pressures (only when the cylinder heads installed are designed for such measurement).
   - Exhaust gas temperature before turbine and from each cylinder (to the extent that monitoring is required in Sec 14 and [4.7.9].
   - Charge air temperature
   - Charge air pressure
   - Turbocharger speed (to the extent that monitoring is required in Sec 14.

c) Calibration records for the instrumentation are, upon request, to be presented to the attending Surveyor.

d) For all stages at which the engine is to be tested, the pertaining operational values are to be measured and recorded by the engine manufacturer. All results are to be compiled in an acceptance protocol to be issued by the engine manufacturer. This also includes crankshaft deflections if considered necessary by the engine designer.

e) In each case, all measurements conducted at the various load points are to be carried out at steady state operating conditions. However, for all load points provision should be made for time needed by the Surveyor to carry out visual inspections. The readings for MCR, i.e. 100% power (rated maximum continuous power at corresponding rpm) are to be taken at least twice at an interval of normally 30 minutes.

7.4.4 Test loads *(1/1/2025)*

Test loads for various engine applications are given below. In addition, the scope of the trials may be expanded depending on the engine application, service experience, or other relevant reasons.

Note 1: Alternatives to the detailed tests may be agred between the manufacturer and the Society when the overall scope of tests is found to be equivalent.

a) Propulsion engines driving propeller or impeller only
   1) 100% power (MCR) at corresponding speed n_0: at least 60 min.
   2) 110% power at engine speed $1.032n_0$: Records to be taken after 15 minutes or after steady conditions have been reached, whichever is shorter.

Note 2: Only required once for each different engine/turbocharger configuration and in general is not required for medium and light duty..

   3) Approved intermittent overload (if applicable): testing for duration as agreed with the manufacturer.
   4) 90% (or normal continuous cruise power), 75%, 50% and 25% power in accordance with the nominal propeller curve, the sequence to be selected by the engine manufacturer.
   5) Reversing manoeuvres (if applicable).

Note 3: After running on the test bed, the fuel delivery system is to be so adjusted that overload power cannot be given in service, unless intermittent overload power is approved by the Society. In that case, the fuel delivery system is to be blocked to that power.

SECTION 3 GAS TURBINES

1 General

1.1 Application

1.1.1 Propulsion turbines and turbines for essential services

The requirements of this Section apply to:

a) all propulsion turbines

b) turbines intended for auxiliary services essential for safety and navigation.

[4] and [5] are applicable when requested in accordance with the relevant Table of Pt A, Ch 2, App 3

1.1.2 Turbines for auxiliary generators

In addition to the requirements contained in this Section, auxiliary turbines driving electric generators are to comply with the applicable requirements of Chapter 2 of the Rules.

1.1.3 Type approval

Turbines intended for propulsion and essential services are to be type approved by the Society.

1.2 Definition of rated power

1.2.1 Rated power is the maximum constant power that the turbine can develop at constant speed in the range of air inlet temperature between 0°C and 35°C. This power is to be considered with 0 intake and exhaust losses and with an air relative humidity of 60%.

1.3 Documentation to be submitted

1.3.1 For propulsion turbines and turbines intended for driving machinery for essential services, the plans listed in Tab 1 are to be submitted.

The listed constructional plans are to be complete with all dimensions and are to contain full indication of the types of materials used.

2 Design and Construction

2.1 Materials

2.1.1 Approved materials

a) Gas turbine materials are to fulfil the requirements imposed by the operating conditions of the individual components. In the choice of materials, account is to be taken of effects such as creep, thermal fatigue, oxidation and corrosion to which individual components are subject when in service. Evidence of the suitability of the materials is to be supplied to the Society in the form of details of their chemical and mechanical properties and of the heat treatment applied. Where composite materials are used, their method of manufacture is to be described.

b) Turbine blades are to be built of corrosion and heat-resistant materials.

2.2 Stress analyses

2.2.1 Calculation

a) The manufacturer is to submit the results of calculation of the stresses on each rotor under the most severe service conditions.

b) Fatigue analysis on each rotor, taking into account the stress concentrations, is also to be submitted.

c) The results of previous in-service experience on similar applications may be considered by the Society as an alternative to items a) and b) above.

The calculations and analyses (see also [1.3.1]) are to be carried out in accordance with criteria agreed by the Society. Data on the design service life and test results used to substantiate calculation assumptions are also to be provided.

2.2.2 Vibrations

The range of service speeds is not to give rise to unacceptable bending vibrations or to vibrations affecting the entire installation. Calculations of the critical speeds including details of their basic assumptions are to be submitted.

2.3 Design and constructional details

2.3.1 Rotors and stators

a) All components of turbines and compressors are to be free from defects and are to be built and installed with tolerances and clearances in order to allow thermal expansion and to minimise the distortions of casings and rotors in all expected service conditions.

b) Adequate drain tubes and cocks are to be arranged in a suitable position, in the lower parts of the casings. Cocks are to be easily operated.

c) Suitable protective devices are to be provided in order to prevent heat, noise or possible failure of rotating parts from causing injury to personnel. If, to this end, the whole gas turbine is enclosed in a protective covering, the covering is to be adequately ventilated inside.

d) Particular attention is to be paid to the connection in the casings of pipes to the turbine stators in order to avoid abnormal loads in service.

e) Smooth fillets are to be provided at changes of sections of rotors, discs and blade roots. The holes in discs are to be well rounded and polished.

Table 1 : Documents to be submitted

No.	A/I **(1)**	ITEM
1	I	Sectional assembly
2	A	Detailed drawings of rotors, casings, blades, combustion chambers and heat exchangers **(2)**
3	A	Material specifications of the major parts, including their physical, chemical and mechanical properties, the data relevant to rupture and creep at elevated temperatures, the fatigue strength, the corrosion resistance and the heat treatments **(2)**
4	A	Where the rotors, stators or other components of turbines are of welded construction, all particulars on the design of welded joints, welding procedures and sequences, heat treatments and non-destructive examinations after welding **(2)**
5	I	General specification of the turbine, including instruction manual, description of structures and specification of the properties of fuel and lubricating oil to be used
6	I	Details of operating conditions, including the pressure and temperature curves in the turbine and compressor at the rated power and corresponding rotational speeds, and details of permissible temporary operation beyond the values for the rated power
7	A	Diagrammatic layout of the fuel system, including control and safety devices, and of the lubricating oil system

(1) A = to be submitted for approval in four copies
I = to be submitted for information in duplicate

(2) As an alternative, the Society may, on a case by case basis, consider reviewing a number of selected packages relative to important and critical parts of the turbine, where all the design, construction, inspection, testing and acceptance criteria used by the manufacturer are clearly described, provided the Quality Assurance system of the manufacturer is approved and certified by the Society.

2.3.7 Turbine exhaust arrangement

a) The gas exhaust arrangement is to be designed in such a way as to prevent the entrance of gases into the compressor.

b) Silencers or other equivalent arrangements are to be provided in the gas exhaust, to limit the airborne noise at one metre distance from the turbine to not more than 110 dB (A) in unmanned machinery spaces and not more than 90 dB (A) in manned spaces.

2.3.8 Multi-turbine installations

Multi-turbine installations are to have separate air inlets and exhaust systems to prevent recirculation through the idle turbine.

2.3.9 Fuel *(1/1/2025)*

a) Where the turbine is designed to burn non-distillate fuels, a fuel treatment system is to be provided to remove, as far as practicable, the corrosive constituents of the fuel or to inhibit their action in accordance with the manufacturer's specification.

b) Suitable means are to be provided to remove the deposits resulting from the burning of the fuel while avoiding abrasive or corrosive action, if applicable.

c) ~~Gas turbines burning boil-off gases of liquefied gas cargo tanks will be specially considered by the Society taking into account the requirements of Part E Chapter 9 Section 16.~~

2.3.10 Start-up equipment

a) Gas turbines are to be fitted with start-up equipment enabling them to be started up from the "shutdown" condition.

b) Provisions are to be made so that any dangerous accumulation of liquid or gaseous fuel inside the turbines is thoroughly removed before any attempt at starting or restarting.

c) Starting devices are to be so arranged that firing operation is discontinued and the main fuel valve is closed within a pre-determined time when ignition is failed.

d) The minimum number of starts is to be such as to satisfy the requirements of Sec 1, [1.4.4].

2.3.11 Astern power

For main propulsion machinery with reverse gearing, controllable pitch propellers or an electrical transmission system, astern running is not to cause any overloading of the propulsion machinery.

2.3.12 Emergency operation

a) In installations with more than one propeller and connected shafting and more than one turbine, the failure of any gas turbine unit connected to a shafting line is not to affect the continued, independent operation of the remaining units.

b) In installations with only one propeller and connected shafting, driven by two or more main turbines, care is to be taken to ensure that, in the event of one of the turbines failing, the others are able to continue operation independently.

c) Yachts classed for unrestricted service and fitted with only one propeller and connected shafting driven by a gas turbine are to be provided with means to ensure emergency propulsion in the event of failure of the main turbine.

2.4 Welded fabrication

2.4.1 The manufacturer's requirements relative to the welding of turbine rotors or major forged or cast pieces, where permitted, are to be readily identifiable by the Society in the plans submitted for approval.

In general, all weldings are to be carried out by qualified welders in accordance with qualified welding procedures using approved consumables.

2.5 Control and monitoring

2.5.1 General

In addition to those of this item [2.5], the general requirements given in Chapter 3 apply.

In the case of yachts with automation notations, the requirements in Part F, Chapter 2 also apply.

SECTION 5 PRESSURE VESSELS

1 General

1.1 Principles

1.1.1 Scope of the Rules

The pressure vessels, associated piping systems and fittings shall be of a design and construction adequate for the service for which they are intended and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design is to have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

1.1.2 Continuity of service

The Society shall give special consideration to the reliability of single essential propulsion components and may require a separate source of propulsion power sufficient to give the yacht a navigable speed, especially in the case of unconventional arrangements.

1.1.3 Tests

All pressure vessels including their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time (see also [7]).

1.1.4 Protection against overpressure

Where main or auxiliary boilers and other pressure vessels or any parts thereof may be subject to dangerous overpressure, means shall be provided where practicable to protect against such excessive pressure.

1.2 Application

1.2.1 Pressure vessels covered by the Rules

The requirements of this Section apply to pressure vessels of metallic construction and heat exchangers, including the associated fittings and mountings with the exception of those indicated in [1.2.2].

1.2.2 Boilers and pressure vessels not covered by the Rules

This Section is not applicable to pressure vessels of class 3, having design pressure p <= 1 MPa and product p V <= 150 (V being the internal volume, in dm3, calculated deducting the volume of tube bundles, if any).

However, Tasneef reserves the right to apply all or part of the requirements of this Section to class 3 heat exchangers and pressure-ves-sels, depending on the criticality of the equipment and/or of the system of which they are part.

The requirements of this Section are not applicable to pressure vessels that are part of non essential systems and whatever the work-ing pressure of the vessel if they are fitted in a protected location where a failure will not constitute danger to passengers or crew and will not produce failure to essential systems.

Small pressure vessels included in self-contained domestic equipment are not covered by the Rules and will be considered on a case by case basis.

1.2.3 Pressure vessels not requiring design approval

Plan approval is not required for pressure vessels of class 3 (as specified in [1.4]), having design pressure p < 1 MPa and product p V <= 150 (V being the internal volume, in dm^3, calculated deducting the volume of tube bundles, if any).

However, the Society reserves the right to apply all or part of the requirements of this Section to class 3 heat exchangers and pressure vessels, depending on the criticality of the equipment and/or of the system of which they are part.

1.3 Definitions

1.3.1 Pressure vessel

Pressure vessel is a welded or seamless container used for the containment of fluids at a pressure above or below the ambient pressure and at any temperature. Fluid power cylinders in hydraulic or pneumatic plants are also considered pressure vessels.

1.3.2 Heat exchanger

Heat exchanger is a pressure vessel used to heat or cool a fluid with another fluid. In general heat exchangers are composed of a number of adjacent chambers, the two fluids flowing separately in adjacent chambers. One or more chambers may consist of bundles of tubes.

1.3.3 Incinerator *(1/1/2025)*

Incinerator is a board facility for incinerating solid garbage approximating in composition to household garbage and liquid garbage deriving from the operation of the (e.g. domestic garbage, ~~cargo-associated garbage,~~ maintenance garbage, operational garbage, ~~cargo residue, and fishing gear~~), as well as for burning sludge with a flash point above 60°C.

These facilities may be designed to use the heat energy produced.

1.3.4 Design pressure

The design pressure is the pressure used by the manufacturer to determine the scantlings of the vessel. This pressure cannot be taken less than the maximum working pressure and is to be limited by the set pressure of the safety valve, as prescribed by the applicable Rules.

1.3.5 Design temperature

a) Design temperature is the actual metal temperature of the applicable part under the expected operating conditions. This temperature is to be stated by the manufacturer and is to take account of the effect of any temperature fluctuations which may occur during the service.

b) The design temperature is to be not less than the maximum temperature of the internal fluid unless specially agreed between the manufacturer and the Society on a case by case basis.

1.3.6 Ductile material

For the purpose of this Section, ductile material is a material having an elongation over 12%.

Table 1 : Pressure vessels classification

Equipment	class 1	class 2	class 3
Pressure vessels and heat exchangers	$p > 4$ MPa, or $t_A > 40$ mm, or $T > 350^oC$	$1,75 < p \leq 4$ MPa, or $15 < t_A \leq 40$ mm, or $150 < T \leq 350^oC$, or $p.t_A > 15$	All pressure vessels and heat exchangers which are not class 1 or 2
Note 1: Whenever the class is defined by more than one characteristic, the equipment is to be considered belonging to the highest class of its characteristics, independently of the values of the other characteristics.			

1.4 Classes

1.4.1 Pressure vessels are classed as indicated in Tab 1 in consideration of their service, characteristics and scantlings. The symbols used in the table have the following meanings:

p : Design pressure, in MPa

T : Design temperature, in °C

D : Inside diameter of the vessel, in mm

t_A : Actual thickness of the vessel, in mm

4.10 Specific requirements for class 2 vessels

4.10.1 General

For vessels whose scantlings have been determined using an efficiency of welded joint e greater than 0,90, see [4.9.1].

4.10.2 Non-destructive tests

All longitudinal and circumferential joints of class 2 vessels are to be subjected to 10% radiographic or equivalent examination. This extension may be extended at the Society's discretion based on the actual thickness of the welded plates.

As specified in Tab 5, where a joint efficiency of 0,75 is used in the formula for the calculation of the thickness of the vessel, the radiographic and the ultrasonic examinations may be omitted.

This assumes, however, that the Surveyor of the Society will adequately follow all the welding phases and that checks are completed by any non-destructive examinations deemed necessary.

4.10.3 Number of test samples

In general, the same requirements of [4.9.3] apply also to class 2 pressure vessels. However, test plates are required for each 50 m of longitudinal and circumferential weldings (or fraction).

4.11 Specific requirements for Class 3 vessels

4.11.1 For vessels whose scantlings have been determined using an efficiency of welded joint e greater than 0,90, see [4.9.1].

Heat treatment, mechanical tests and non-destructive tests are not required for welded joints of other Class 3 vessels.

5 Design and construction - Control and monitoring

5.1 Pressure vessel instrumentation

5.1.1

a) Pressure vessels are to be fitted with the necessary devices for checking pressure, temperature and level, where it is deemed necessary.

b) In particular, each air pressure vessel is to be fitted with a local manometer.

5.2 Control and monitoring

5.2.1

In addition to those of this item [5.4], the general requirements given in Chapter 3 apply.

In the case of s with automation notations, the requirements in Pt F, Ch 2 also apply.

5.2.2

Tab 10 summarise the control and monitoring requirements for incinerators.

Note 1: Some departures from Tab 10 may be accepted by the Society in the case of s with a restricted navigation notation.

Table 10 : Incinerators *(1/1/2025)*

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				
			Incinerator			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
Flame failure	X			X			
Furnace temperature	H			X			
Exhaust gas temperature	H						
(1) ~~Where heavy fuel is used~~							

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				
			Incinerator			Auxiliary	
Identification of system parameter	Alarm	Indication	Slow-down	Shut-down	Control	Stand by Start	Stop
Fuel oil pressure		local					
~~Fuel oil temperature or viscosity (1)~~	~~H+L~~	~~local~~					
(1) ~~Where heavy fuel is used~~							

6 Arrangement and installation

6.1 Foundations

6.1.1 For boilers and pressure vessels bolting down to their foundations, see Sec 1, [3.3.1]. Where necessary, they are also to be secured to the adjacent hull structures by suitable ties.

Where chocks are required to be fitted between the boilers and their foundations, they are to be of cast iron or steel.

7 Material test, workshop inspection and testing, certification

7.1 Material testing

7.1.1 General

Materials, including welding consumables, for the constructions of boilers and pressure vessels are to be certified by the material manufacturer in accordance with the appropriate material specification.

7.1.2 Class 1 pressure vessels and heat exchangers

In addition to the requirement in [7.1.1], testing of materials intended for the construction of pressure parts of class 1 pressure vessels and heat exchangers is to be witnessed by the Surveyor.

This requirement may be waived at the Society's discretion for mass produced small pressure vessels (such as accumulators for valve controls, gas bottles, etc.).

7.2 Workshop inspections

7.2.1 Individually produced class 1 and 2 pressure vessels

The construction, fitting and testing of boilers and individually produced class 1 and 2 pressure vessels are to be attended by the Surveyor, at the builder's facility.

7.2.2 Mass produced pressure vessels

Construction of mass produced pressure vessels which are type approved by the Society need not be attended by the Surveyor. Reference is to be made to Pt A, Ch 2, App.3.

7.3 Hydrostatic tests

7.3.1 General

Hydrostatic tests of all class 1, 2 and 3 pressure vessels are to be witnessed by the Surveyor with the exception of mass produced pressure vessels which are built under the conditions stated in [7.2.2].

SECTION 6 GEARING

1 General

1.1 Application

1.1.1

Unless otherwise specified, the requirements of this section apply to:

- reduction and/or reverse gears intended for propulsion plants with a transmitted power of 220 kW and above
- other reduction and step-up gears with a transmitted power of 110 kW and above, intended for essential service auxiliary machinery.

All other gears are to be designed and constructed according to sound marine practice and delivered with the relevant works' certificate (see Pt D, Ch 1, Sec 1, [4.2.3]).

Gearing approved prior to the application date and having a documented satisfactory service experience may be exempted from application of these Rules.

The provisions of Article [2] apply only to cylindrical involute spur or helical gears with external or internal teeth.

Additional requirements for gears fitted to s having an ice notation are given in Part F, Chapter 9.

Some departure from the requirements of this Section may be accepted by the Society in cases of gears fitted to s having short range navigation notation.

Alternative calculations based on a recognized standard may be submitted by the manufacturer of the gears and will be given special consideration by the Society.

[5] and [6] are applicable when requested in accordance with the relevant Table of Pt A, Ch 2, App 3.

1.2 Documentation to be submitted

1.2.1 Documents

Before starting construction, all plans, specifications and calculations listed in Tab 1 are to be submitted to the Society.

Table 1 : Documents to be submitted for gearing

No.	I/A **(1)**	Document **(2)**
1	A	Constructional drawings of shafts and flanges
2	A	Constructional drawings of pinions and wheels, including: a) specification and details of hardening procedure: • core and surface mechanical characteristics • diagram of the depth of the hardened layer as a function of hardness values b) specification and details of the finishing procedure: • finishing method of tooth flanks (hobbing, shaving, lapping, grinding, shot-peening) • surface roughness for tooth flank and root fillet • tooth flank corrections (helix modification, crowning, tip-relief, end-relief), if any • grade of accuracy according to ISO 1328-1:2013
3	A	Shrinkage calculation for shrunk-on pinions, wheels rims and/or hubs with indication of the minimum and maximum shrinkage allowances
4	A	Calculation of load capacity of the gears
5	A / I **(3)**	Constructional drawings of casings

No.	I/A (1)	Document (2)
6	A	Functional diagram of the lubricating system, with indication of: • specified grade of lubricating oil • expected oil temperature in service • kinematic viscosity of the oil
7	A	Functional diagram of control, monitoring and safety systems
8	I	Longitudinal and transverse cross-sectional assembly of the gearing, with indication of the type of clutch
9	I	Data form for calculation of gears

(1) A = to be submitted for approval, in four copies
I = to be submitted for information, in duplicate.

(2) Constructional drawings are to be accompanied by the specification of the materials employed including the chemical composition, heat treatment and mechanical properties and, where applicable, the welding details, welding procedure and stress relieving procedure.

(3) "A" for welded casing, "I" otherwise

1.2.2 Data

The data listed in Tab 2 are to be submitted with the documents required in [1.2.1].

Table 2 : Data to be submitted for gearing

No.	Description of the data
1	Type of driving and driven machines and, if provided, type of flexible coupling
2	Maximum power transmitted by each pinion in continuous running and corresponding rotational speed, for all operating conditions, including clutching-in
3	Modules of teeth for pinion and wheels
4	Pressure angle and helix angle
5	Tooth profiles of pinions and wheels together with tip diameters and fillet radii
6	Operating centre distance
7	Addendum of the cutting tool
8	Common face width, operating pitch diameter
9	Data related to the bearings: • type, characteristics and designed service life of roller bearings • materials and clearances of plain bearings • position of each gear in relation to its bearings
10	Torsional vibration data (inertia and stiffness)

1.3 Light duty e medium duty gears

1.3.1 General *(1/1/2025)*

Gears intended for light duty and medium duty operating profiles, as defined in Sec 2, [1.6.1],may be adopted. For such gears inferior coefficients than the ones provided in this section may be used. The Manufacturer demanding the approval of light duty or medium duty operating profile is requested to declare contextually with the demand the following parameters:

- P_{MAX} = Maximum pressure in kW
- n_{MAX} = round per minute at power P_{MAX}
- TBO = time between two main overhaul, in number of running hours
- $O_{A\,MAX}$ = Motion hours per year
- $O_{P\,MAX}$ = Motion hours per year at P_{MAX}
- Ic Loading index where = $(P_{MEDIA} \cdot O_{A\,MAX})/(P_{MAX} \cdot O_{A\,MIN})$

Where P_{MAX} average power deliverable from the engine in $O_{A\,MAX}$ running hours per year.

The parameters above declared by the Manufacturer are not to be less than the minimum ones provided for the operating profile in [1.6.1].

Engines with Light duty and Medium duty operative profiles are to be type tested in accordance with [1.6.4]. In this respect, Manufacturer is to be admitted to testing and inspections according to an alternative inspection scheme.

The length rolling bearings is to be calculate in accordance with ISO 281-1 referring all the material and lubricating features.

The calculation coefficient Lh10a23 is to refer to the distribution of loads in time provided by the reference operating profile.

The length rolling bearings expressed through the coefficient Lh10a23 is to be in accordance with values listed below:

Light duty:

K_A = 1.1

S_H = 1.0

S_F = 1.1

L_{h10a23} (following ISO 281-1): >= 5000 hours

Medium Duty:

K_A = 1.2

S_H = 1.0

S_F = 1.2

L_{h10a23} (following ISO 281-1): >= 5000 hours

1.3.2 Safety coefficient for light and medium duty gears *(1/1/2025)*

The shaft of pinions and wheels are to be measured in accordance with [3.4.2]; otherwise a direct calculation contemplating at the same time static and fatigue stresses and assuming the values of safety coefficients may be accepted by the Society:

- Safety coefficient as regards the yield limit = 2,0
- Safety coefficient as regards the alternate bending fatigue limit: = 1,1 (light duty) 1,2 (medium duty)

Gears approved for light duty and medium duty operating profile may reproduce this inscription in the approval documents.

2 Design of gears - Determination of the load capacity

2.1 Symbols, units, definitions

2.1.1 Symbols and units

The meaning of the main symbols used in this Section is specified below.

Other symbols introduced in connection with the definition of influence factors are defined in the appropriate articles.

a	:	Centre distance, in mm
b	:	Common face width (for double helix gear, width of one helix), in mm
$b_{1,2}$	:	Face width of pinion, wheel
d	:	Reference diameter, in mm
d_a	:	Tip diameter, in mm
d_b	:	Base diameter, in mm
d_f	:	Root diameter, in mm
$d_{w1,2}$	:	Working diameter of pinion, wheel, in mm
x	:	Addendum modification coefficient
z	:	Number of teeth
z_n	:	Virtual number of teeth
n	:	Rotational speed, in rpm

SECTION 10 PIPING SYSTEM

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
- [17] for their certification, inspection and testing.

b) Specific requirements for piping systems and machinery piping systems are given in Articles [6] to [16].

[17] is applicable when requested in accordance with the relevant Table of Pt A, Ch 2, App 3.

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.

Table 1 : Documents to be submitted

No.	I/A **(1)**	Document **(2)**
1	A	Drawing showing the arrangement of the sea chests and side valves
2	A	Diagram of the bilge and ballast systems (in and outside machinery spaces)
3	A	Specification of the central priming system intended for bilge pumps, when provided
4	A	Diagram of the scuppers and sanitary discharge systems
5	A	Diagram of the air, sounding and overflow systems
6	A	Diagram of cooling systems (sea water and fresh water)
7	A	Diagram of fuel oil system
8	A	Drawings of the fuel oil tanks not forming part of the yacht‘s structure
9	A	Diagram of the lubricating oil system
10	A	Diagram of the hydraulic systems intended for essential services or located in machinery spaces
11	A	Diagram of the compressed air system
12	A	Diagram of the hydraulic and pneumatic remote control systems
13	A	Diagram of the remote level gauging system
14	I	Diagram of the exhaust gas system

(1) A = to be submitted for approval;
I = to be submitted for information.

(2) Diagrams are also to include, where applicable, the (local and remote) control and monitoring systems and automation systems.

No.	I/A **(1)**	Document **(2)**
15	A	Diagram of drip trays and gutterway draining system
16	A	Drawings and specification of valves and accessories, where required in [2.6]

(1) A = to be submitted for approval;
I = to be submitted for information.

(2) Diagrams are also to include, where applicable, the (local and remote) control and monitoring systems and automation systems.

Table 2 : Information to be submitted

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 in function of temperature • the characteristics of inflammability and fire resistance • the resistance to the products intended to be conveyed
7	A	For fuel oil system : the diagram of the fuel oil system is to indicate the location of sampling points or a dedicated diagram of sampling points is to be presented together with the documentation relevant to the fuel system

(1) A = to be submitted for approval;
I = to be submitted for information.

1.3 Definitions

1.3.1 Piping and piping systems *(1/1/2025)*

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 ~~boilers,~~ turbines, internal combustion engines and reduction gears.

Note 1: The equipment other than piping is to be designed in accordance with the relevant Sections of Chapter 1.

1.3.2 Design pressure

a) The design pressure of a piping system is the pressure considered by the manufacturer to determine the scantling of the system components. It is not to be taken less than the maximum working pressure expected in this system or the highest setting pressure of any safety valve or relief device, whichever is the greater.

b) The design pressure of a piping system located on the low pressure side of a pressure reducing valve where no safety valve is provided is not to be less than the maximum pressure on the high pressure side of the pressure reducing valve.

c) The design pressure of a piping system located on the delivery side of a pump or a compressor is not to be less than the setting pressure of the safety valve for displacement pumps or the maximum pressure resulting from the operating (head-capacity) curve for centrifugal pumps, whichever is the greater.

1.3.3 Design temperature

The design temperature of a piping system is the maximum temperature of the medium inside the system.

1.3.4 Flammable oils

Flammable oils include fuel oils, lubricating oils, thermal oils and hydraulic oils (having flashpoint lower than 150°C).

K : Permissible stress defined in [2.2.2],

e : Weld efficiency factor to be:

- equal to 1 for seamless pipes and pipes fabricated according to a welding procedure approved by the Society,
- specially considered by the Society for other welded pipes, depending on the service and the manufacture procedure.

b : Thickness reduction due to bending defined in [2.2.3], in mm

c : Corrosion allowance defined in [2.2.4], in mm

a : Negative manufacturing tolerance percentage:

- equal to 10 for copper and copper alloy pipes, cold drawn seamless steel pipes and steel pipes fabricated according to a welding procedure approved by the Society,
- equal to 12,5 for hot laminated seamless steel pipes,
- subject to special consideration by the Society in other cases.

b) The thickness thus determined does not take into account the particular loads to which pipes may be subjected. Attention is to be drawn in particular to the case of high temperature and low temperature pipes.

Table 3 : Class of piping systems *(1/1/2025)*

Media conveyed by the piping system	CLASS I	CLASS II	CLASS III
Fuel oil **(1)**	p > 1,6 or T > 150	other **(2)**	p ≤ 0,7 and T ≤ 60
Flammable Hydraulic oil **(5)**	p>1,6 or T>150	other **(2)**	p ≤ 0,7 and T≤60
Lubricating oil	p> 1,6 or T > 150	other **(2)**	p ≤ 0,7 and T ≤ 60
Other flammable media: • heated above flashpoint, or • having flashpoint <60°C and liquefied gas	without special safeguards **(3)**	with special safeguards **(3)**	
Toxic media	irrespective of p, T		
Corrosive media	without special safeguards **(3)**	with special safeguards **(3)**	
Air, gases, water, non-flammable hydraulic oil **(4)**	p > 4 or T > 300	other **(2)**	p ≤ 1,6 and T ≤ 200
Open-ended pipes (drains, overflows, vents, exhaust gas lines~~, boiler escape pipes~~)			irrespective of T

(1) Valves under static pressure on fuel oil tanks belong to class II.

(2) Pressure and temperature conditions other than those required for class I and class III.

(3) Safeguards for reducing the possibility of leakage and limiting its consequences, e.g. pipes led in positions where leakage of internal fluids will not cause a potential hazard or damage to surrounding areas which may include the use of pipe ducts, shielding, screening, etc.

(4) Valves and fittings fitted on the side and collision bulkhead belong to class II.

(5) Steering gear piping belongs to class I irrespective of p and T

Note 1: p : Design pressure, as defined in [1.3.2], in MPa.

Note 2: T : Design temperature, as defined in [1.3.3], in °C.

Table 4 : Conditions of use of metallic materials in piping systems *(1/1/2025)*

Material	Allowable classes	Maximum design temperature (°C) **(1)**	Particular conditions of use
Carbon and carbon-manganese steels	III, II, I	400 **(2)**	Class I and II pipes are to be seamless drawn pipes **(3)**
Copper and aluminium brass	III, II, I	200	**(4)**
Copper-nickel	III, II, I	300	
Special high temperature resistant bronze	III, II, I	260	
Stainless steel	III, II, I	300	Austenitic stainless steel is not recommended for sea water systems
Spheroidal graphite cast iron	III, II	350	• Spheroidal cast iron of the ferritic type according to the material rules of the Society may be accepted for bilge, and ballast ~~and cargo oil~~ piping • The use of this material for pipes, valves and fittings for other services, in principle Classes II and III, will be subject to special consideration • Spheroidal cast iron pipes and valves fitted on yacht's side should have specified properties to the Society's satisfaction, • Minimum elongation is not to be less than 12% on a gauge length of $5,65.S^{0,5}$, where S is the actual cross-sectional area of the test piece
Grey cast iron	III II **(5)**	220	Grey cast iron is not to be used for the following systems: • ~~boiler blow-down systems and other~~ piping systems subject to shocks, high stresses and vibrations • bilge lines in tanks • parts of scuppers and sanitary discharge systems located next to the hull below the freeboard deck or for passengers s below the bulkhead deck • side valves and fittings • valves fitted on the collision bulkhead • valves fitted to fuel oil and lubricating oil tanks under static pressure head • class II fuel oil systems
Aluminium and aluminium alloys	III, II, I **(6)**	200	Aluminium and aluminium alloys are not to be used on the following systems: • flammable oil systems **(6)** • sounding and air pipes of fuel oil tanks • fire-extinguishing systems • scuppers and overboard discharges except for pipes led to the bottoms or to the shell above the freeboard deck or fitted at their upper end with closing means operated from a position above the freeboard deck

(1) Maximum design temperature is not to exceed that assigned to the class of piping.

(2) Higher temperatures may be accepted if metallurgical behaviour and time dependent strength (ultimate tensile strength after 100000 hours) are in accordance with national or international standards or specifications and if such values are guaranteed by the steel manufacturer.

(3) Pipes fabricated by a welding procedure approved by the Society may also be used.

(4) Pipes made of copper and copper alloys are to be seamless.

(5) Use of grey cast iron is not allowed when the design pressure exceeds 1,3 MPa.

(6) Accessories of aluminium or aluminium alloys intended for flammable oil systems may be accepted subject to the satisfactory result of an endurance flame test to be carried out according to the "Rules for the type approval of flexible hoses and expansion joints" issued by the Society.

Table 16 : Application of mechanical joints *(1/1/2025)*

Systems		Kind of connections				
		Pipe Unions	Compression Couplings	Slip-on Joints	Classification of pipe system	Fire endurance test condition7
Flammable fluids (Flash point <= 60°)						
1	All lines **(1)**	+	+	+	dry	30 min dry (*)
2	Vent lines **(3)**	+	+	+	dry	
Flammable fluids (Flash point > 60°)						
3	Fuel oil lines **(2) (3)**	+	+	+	wet	30 min wet (*)
4	Lubricating oil lines **(2) (3)**	+	+	+	wet	30 min wet (*)
5	Hydraulic oil **(2) (3)**	+	+	+	wet	30 min wet (*)
Sea Water						
6	Bilge lines **(4)**	+	+	+	dry/wet	8 min dry + 22 min wet (*)
7	Permanent Water filled fire extinguishing systems, e.g. fire main, sprinkler systems **(3)**	+	+	+	wet	30 min wet (*)
8	Non-permanent water filled fire extinguishing systems, e.g. foam, drencher systems and fire main **(3)**	+	+	+	dry/wet	8 min dry + 22 min wet (*) For foam systems FSS Code Chapter 6 to be observed
9	Ballast system **(4)**	+	+	+	wet	30 min wet (*)
10	Cooling water system **(4)**	+	+	+	wet	30 min wet (*)
11	Tank cleaning services	+	+	+	dry	Fire endurance test not required
12	Non-essential systems	+	+	+	dry dry/wet wet	Fire endurance test not required
Fresh water						
13	Cooling water system **(4)**	+	+	+	wet	30 min wet (*)
14	Condensate return **(4)**	+	+	+	wet	30 min wet (*)
15	Non-essential system	+	+	+	dry dry/wet wet	Fire endurance test not required
Sanitary/Drains/Scuppers						

Abbreviations:

+ Application is allowed

- Application is not allowed

* Fire endurance test as specified in [5.5.6] of the Rules for the Type Approval of Mechanical Joints for Pipes

Footnotes - Table 16 - Fire resistance capability

If mechanical joints include any components which readily deteriorate in case of fire the following footnotes are to be observed:

(1) Fire endurance test is to be applied when mechanical joints are installed in open decks.

(2) Slip on joints are not accepted inside machinery spaces of category A or accommodation spaces. May be accepted in other machinery spaces provided the joints are located in easily visible and accessible positions (refer to MSC/Circ.734).

(3) Approved fire-resistant types except in cases where such mechanical joints are installed on open decks, and not used for fuel oil lines.

(4) Fire endurance test is to be applied when mechanical joints are installed inside machinery spaces of category A.

Footnotes - Table 16 - General

(5) Only above ~~bulkhead deck of passenger s and~~ freeboard deck ~~of cargo s~~.

(6) Slip type slip-on joints as shown in Table 16. May be used for pipes on deck with a design pressure of 10 bar or less.

(7) If a connection has passed the "30 min dry" test, it is considered suitable also for applications for which the "8 min dry+22 min wet" and/or "30 min wet " tests are required. If a connection has passed the "8 min dry+22 min wet" test, it is considered suitable also for applications for which the "30 min wet" test is required.

Systems		Kind of connections				
		Pipe Unions	Compression Couplings	Slip-on Joints	Classification of pipe system	Fire endurance test condition7
16	Deck drains (internal) **(5)**	+	+	+	dry	Fire endurance test not required
17	Sanitary drains	+	+	+	dry	
18	Scuppers and discharge (overboard)	+	+	-	dry	
Sounding/Vent						
19	Water tanks/Dry spaces	+	+	+	dry, wet	Fire endurance test not required
20	Oil tanks (f.p.> 60°C) **(2) (3)**	+	+	+	dry	
Miscellaneous						
21	Starting/Control air **(4)**	+	+	-	dry	30 min dry (*)
22	Service air (non-essential)	+	+	+	dry	Fire endurance test not required
23	Brine	+	+	+	wet	
24	CO_2 system (outside protected space)	+	+	-	dry	30 min dry (*)
25	CO_2 system (inside protected space)	+	+	-	dry	Mechanical joints are to be constructed of materials with melting point above 925°C. Ref. to FSS Code Chapter 5.
	Urea	+	+	+	wet	30 min (*)

Abbreviations:

\+ Application is allowed

\- Application is not allowed

* Fire endurance test as specified in [5.5.6] of the Rules for the Type Approval of Mechanical Joints for Pipes

Footnotes - Table 16 - Fire resistance capability

If mechanical joints include any components which readily deteriorate in case of fire the following footnotes are to be observed:

(1) Fire endurance test is to be applied when mechanical joints are installed in open decks.

(2) Slip on joints are not accepted inside machinery spaces of category A or accommodation spaces. May be accepted in other machinery spaces provided the joints are located in easily visible and accessible positions (refer to MSC/Circ.734).

(3) Approved fire-resistant types except in cases where such mechanical joints are installed on open decks, and not used for fuel oil lines.

(4) Fire endurance test is to be applied when mechanical joints are installed inside machinery spaces of category A.

Footnotes - Table 16 - General

(5) Only above ~~bulkhead deck of passenger s and~~ freeboard deck ~~of cargo s~~.

(6) Slip type slip-on joints as shown in Table 16. May be used for pipes on deck with a design pressure of 10 bar or less.

(7) If a connection has passed the "30 min dry" test, it is considered suitable also for applications for which the "8 min dry+22 min wet" and/or "30 min wet " tests are required. If a connection has passed the "8 min dry+22 min wet" test, it is considered suitable also for applications for which the "30 min wet" test is required.

Table 17 : Application of mechanical joints depending upon the class of piping

Types of joints	Classes of piping systems		
	Class I	Class II	Class III
Pipe Unions			
Welded and brazed type	yes (outside diameter <= 60.3mm)	yes (outside diameter £ 60.3mm)	yes
Compression Couplings			
yes means application is allowed not means application is not allowed			

5 Arrangement and installation of piping systems

5.1 General

5.1.1 Unless otherwise specified, piping and pumping systems covered by the Rules are to be permanently fixed on board .

5.2 Location of tanks and piping system components

5.2.1 Flammable oil systems

Location of tanks and piping system components conveying flammable fluids under pressure is to comply with [5.10].

5.2.2 Piping systems with open ends

Attention is to be paid to the requirements for the location of open-ended pipes on board s having to comply with the provisions of [5.5].

5.2.3 Pipe lines located inside tanks

a) The passage of pipes through tanks, when permitted, requires special arrangements such as reinforced thickness as per Tab 5 for steel pipes or tunnels, in particular for:
   - bilge pipes
   - ballast pipes
   - scuppers and sanitary discharges
   - air, sounding and overflow pipes
   - fuel oil pipes.

b) Junctions of pipes inside tanks are to be made by welding or welded reinforced flange connections. See also [2.4.3].

5.2.4 Overboard discharges

Overboard discharges are to be so located as to prevent any discharge of water into the lifeboats while they are being lowered.

5.2.5 Piping and electrical apparatus

The installation of piping near switchboards and other electrical apparatus is to comply with Ch 2, Sec 12, [6.1.7].

5.3 Passage through watertight bulkheads or decks

5.3.1 Penetration of watertight bulkheads and decks

a) Where penetrations of watertight bulkheads and internal decks are necessary for piping and ventilation, arrangements are to be made to maintain the watertight integrity.

b) Lead or other heat sensitive materials are not to be used in piping systems which penetrate watertight subdivision bulkheads or decks, where deterioration of such systems in the event of fire would impair the watertight integrity of the bulkhead or decks.

   This applies in particular to the following systems:
   - bilge system
   - ballast system
   - scuppers and sanitary discharge systems.

c) Where bolted connections are used for piping passing through watertight bulkheads or decks, the bolts are to be screwed in heavy pads secured to the bulkhead or deck plating without penetration of the plating by the bolt holes. Where welded connections are used, they are to be welded on both sides of the bulkhead or deck plating.

d) Penetrations of watertight bulkheads or decks by plastic pipes are to comply with App 3, [3.6.2].

5.3.2 Passage through the collision bulkhead

See Pt B, Ch 1, Sec 1, [5.1.3].

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5.9.3 Flexible hoses and expansion joints

a) Flexible hoses are to be so arranged as to be clearly visible and readily accessible at all times.

b) In general, flexible hoses and expansion joints are to be limited to a length necessary to provide for relative movement between fixed and flexibly mounted items of machinery/equipment or systems.

c) Flexible hose assemblies and expansion joints are not to be installed where they may be subjected to torsion deformation (twisting) under normal operating conditions.

d) The adjoining pipes are to be suitably aligned, supported, guided and anchored.

e) The number of flexible hoses and expansion joints is to be kept to a minimum.

f) Where flexible hoses and expansion joints are intended to be used in piping systems conveying flammable fluids that are in close proximity to heated surfaces, the risk of ignition due to failure of the hose assembly and subsequent release of fluids is to be mitigated as far as practicable by the use of screens or other similar protection to the satisfaction of the Society.

g) Expansion joints are to be protected against over-extension and over-compression.

h) The installation of flexible hose assemblies and expansion joints is to be in accordance with the Manufacturer's instructions and use limitations with particular attention to the following, as applicable:

- orientation
- end connection support (where necessary)
- avoidance of hose contact that could cause rubbing and abrasion
- minimum bend radii.

5.9.4 Thermometers

Thermometers and other temperature-detecting elements in fluid systems under pressure are to be provided with pockets built and secured so that the thermometers and detecting elements can be removed while keeping the piping under pressure.

5.9.5 Pressure gauges

Pressure gauges and other similar instruments are to be fitted with an isolating valve or cock at the connection with the main pipe.

5.9.6 Nameplates

a) Accessories such as cocks and valves on the fluid lines referred to in this Section are to be provided with nameplates indicating the apparatus and lines they serve except where, due to their location on board, there is no doubt as to their purpose.

b) Nameplates are to be fitted at the upper part of air and sounding pipes.

5.10 Additional arrangements for flammable fluids

5.10.1 General

The requirements in [5.10.3] and [5.10.4] apply to:

- fuel oil systems, in all spaces
- lubricating oil systems, in machinery spaces
- other flammable oil systems, in locations where means of ignition are present.

5.10.2 Prohibition of carriage of flammable oils in forepeak tanks *(1/1/2025)*

~~In cargo s of more than 400 tons gross tonnage and in passenger s,~~ f~~F~~uel oil, lubricating oil and other flammable oils are not to be carried in forepeak tanks or tanks forward of the collision bulkhead.

5.10.3 Prevention of flammable oil leakage ignition *(1/1/2025)*

a) As far as practicable, parts of the fuel oil and lubricating oil systems containing heated oil under pressure exceeding 0,18 MPa are to be placed above the platform or in any other position where defects and leakage can readily be observed.

The machinery spaces in way of such parts are to be adequately illuminated.

b) No flammable oil tanks are to be situated where spillage or leakage therefrom can constitute a hazard by falling on:
   - hot surfaces, including those of ~~boilers,~~ heaters, ~~steam pipes,~~ exhaust manifolds and silencers
   - electrical equipment
   - air intakes
   - other sources of ignition.

c) Parts of flammable oil systems under pressure exceeding 0,18 MPa such as pumps, filters and heaters are to comply with the provisions of b) above.

d) Flammable oil lines are not to be located immediately above or near units of high temperature including ~~boilers, steam pipelines,~~ exhaust manifolds, silencers or other equipment required to be insulated in Sec 1, [3.7.1]. As far as practicable, flammable oil lines are to be arranged far from hot surfaces, electrical installations or other sources of ignition and to be screened or otherwise suitably protected to avoid oil spray or oil leakage onto the sources of ignition.

   Precautions are to be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.

e) Any relief valve of fuel oil and lubricating oil systems is to discharge to a safe position, such as an appropriate tank. See also item (a) of [9.1.7].

5.10.4 Provisions for flammable oil leakage containment

a) Tanks used for the storage of flammable oils together with their fittings are to be so arranged as to prevent spillages due to leakage or overfilling.

b) Drip trays with adequate drainage to contain possible leakage from flammable fluid systems are to be fitted:
   - under independent tanks (refer to Part B)
   - under burners
   - under purifiers and any other oil processing equipment
   - under pumps, heat exchangers and filters
   - under valves and all accessories subject to oil leakage
   - surrounding internal combustion engines.

c) The coaming height of drip trays is to suit the amount of potential oil spillage.

d) Where drain pipes are provided for collecting leakages, they are to be led to an appropriate drain tank.

5.10.5 Drain tank

a) The drain tank is not to form part of an overflow system and is to be fitted with an overflow alarm device.

b) In s required to be fitted with a double bottom, appropriate precautions are to be taken when the drain tank is constructed in the double bottom, in order to avoid flooding of the machinery space where drip trays are located, in the event of accidentally running aground.

5.10.6 Valves

All valves and cocks forming part of flammable oil systems are to be capable of being operated from readily accessible positions and, in machinery spaces, from above the working platform.

5.10.7 Level switches

Level switches fitted to flammable oil tanks are to be contained in a steel or other fire-resisting enclosure.

6 Bilge systems

6.1 Principle

6.1.1 General *(1/1/2025)*

An efficient bilge pumping system shall be provided, capable of pumping from and draining any watertight compartment other than a space permanently appropriated for the carriage of fresh water, water ballast, fuel oil ~~or liquid cargo~~ and for which other efficient means of pumping are to be provided, under all practical conditions. Efficient means shall be provided for draining water from insulated holds.

Bilge pumping system is not intended at coping with water ingress resulting from structural or main sea water piping damage.

6.1.2 Availability of the bilge system

The bilge system is to be able to work while the other essential installations of the yacht, especially the fire-fighting installations, are in service.

6.1.3 Bilge and ballast systems *(1/1/2025)*

The arrangement of the bilge and ballast pumping system shall be such as to prevent the possibility of water passing from the sea and from water ballast spaces into the machinery spaces, or from one compartment to another.

Provisions shall be made to prevent any deep tank having bilge and ballast connections being inadvertently flooded from the sea ~~when containing cargo~~, or being discharged through a bilge pump when containing water ballast.

6.2 Design of bilge systems

6.2.1 General

a) The bilge pumping system is to consist of pumps connected to a bilge main line so arranged as to allow the draining of all spaces mentioned in [6.1.1] through bilge branches, distribution boxes and bilge suctions, except for some small spaces where individual suctions by means of hand pumps may be accepted as stated in [6.5.3] and [6.5.4].

b) If deemed acceptable by the Society, bilge pumping arrangements may be dispensed with in specific compartments provided the safety of the yacht is not impaired.

6.2.2 Number and distribution of bilge suctions

a) Draining of watertight spaces is to be possible, when the is on an even keel and either is upright or has a list of up to 5°, by means of at least:

- two suctions in machinery spaces, including one branch bilge suction and one direct suction and, in addition, for spaces containing propulsion machinery, one emergency bilge suction
- one suction in other spaces.

See also [6.3.5].

b) Bilge suctions are to be arranged as follows:

- wing suctions are generally to be provided except in the case of short and narrow compartments when a single suction ensures effective draining in the above conditions
- in the case of compartments of unusual form, additional suctions may be required to ensure effective draining under the conditions mentioned in [6.2.2], item a).

c) In all cases, arrangements are to be made such as to allow a free and easy flow of water to bilge suctions.

6.2.3 Prevention of communication between spaces - Independence of the lines

a) Bilge lines are to be so arranged as to avoid inadvertent flooding of any dry compartment.

b) Bilge lines are to be entirely independent and distinct from other lines except where permitted in [5.4].

6.3 Draining of machinery spaces

6.3.1 General *(1/1/2025)*

Where all the propulsion machinery~~, boilers~~ and main auxiliaries are located in a single watertight space, the bilge suctions are to be distributed and arranged in accordance with the provisions of [6.3.5].

6.3.2 Branch bilge suction

The branch bilge suction is to be connected to the bilge main.

6.3.3 Direct suction

The use of ejectors for pumping through the direct suction will be given special consideration.

6.3.4 Emergency bilge suction

a) The emergency bilge suction is to be led directly from the drainage level of the machinery space to a main circulating (or cooling) pump and fitted with a non-return valve.

b) In s where, in the opinion of the Society, the main circulating (or cooling) pump is not suitable for this purpose, the emergency bilge suction is to be led from the largest available independent power driven pump to the drainage level

6.5.5 Choice of the pumps

a) Bilge pumps are to be of the self-priming type. Centrifugal pumps are to be fitted with efficient priming means, unless an approved priming system is provided to ensure the priming of pumps under normal operating conditions.

b) Circulating or cooling water pumps connected to an emergency bilge suction need not be of the self-priming type.

c) Sanitary, ballast and general service pumps may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system.

6.5.6 Connection of power pumps

a) Bilge pumps and other power pumps serving essential services which have common suction or discharge are to be connected to the pipes in such a way that:
   - compartments and piping lines remain segregated in order to prevent possible intercommunication
   - the operation of any pump is not affected by the simultaneous operation of other pumps.

b) The isolation of any bilge pump for examination, repair or maintenance is to be made possible without impeding the operation of the remaining bilge pumps.

6.5.7 Electrical supply of submersible pump motors

a) Where submersible bilge pumps are provided, arrangements are to be made to start their motors from a convenient position above the bulkhead deck.

b) Where an additional local-starting device is provided at the motor of a permanently installed submersible bilge pump, the circuit is to be arranged to provide for the disconnection of all control wires therefrom at a position adjacent to the starter installed on the deck.

6.6 Size of bilge pipes

6.6.1 Bilge main line

a) The diameter of the bilge main is to be calculated according to the following formula:

$$d = 25 + 1{,}68\sqrt{L(B + D)}$$

where:

d : The internal diameter of the bilge main, in mm

L : Length of the is the length measured between perpendiculars taken at the extremities of the deepest subdivision load line, in m.

B : Breadth of the yacht is the extreme width from outside of frame to outside of frame at or below the deepest subdivision load line, in m.

D : Moulded depth of the to the bulkhead deck, in m, .

b) Where the bilge pumps are designed to pump from the machinery space only, the internal diameter d, in mm, of the bilge main may be less than that required in (a) but not less than that calculated with the following formula:

$$d = 35 + 3\sqrt{L_0(B + D)}$$

where:

L_0 : Length of the engine room, in m

B : Breadth of the , in m, as defined in a)

D : Moulded depth of the to the bulkhead deck, in m, as defined in a)

In any case, the internal section of the bilge main is not to be less than twice that of the bilge suction pipes determined from [6.6.3].

c) When fixed pressure water-spraying systems are fitted in closed vehicle spaces and closed ro-ro spaces, the requirements contained in the guidelines developed by IMO (see Note 2) are to be duly considered (see Note 3).

Note 1: see resolution MSC.1/Circ. 1320 "Guidelines for the drainage of fire-fighting water from closed vehicle and ro-ro spaces and special category spaces of passenger and cargo ships"

d) In no case is the actual internal diameter to be:
   - more than 5 mm smaller than that obtained from the formula given in a) or b), or
   - less than 60 mm.

Relaxations may be considered for multihull.

6.6.2 Distribution box branch pipes

The cross-section of any branch pipe connecting the bilge main to a bilge distribution box is not to be less than the sum of the cross-sections required for the two largest branch suctions connected to this box. However, this cross-section need not exceed that of the bilge main.

6.6.3 Branch bilge suction pipes *(1/1/2025)*

a) The internal diameter, in mm, of pipes situated between distribution boxes and suctions in holds and machinery spaces is not to be less than the diameter given by the following formula ~~(a smaller actual diameter may be accepted, as specified in [6.6.1], b)~~:

$$d_1 = 25 + 2{,}16\sqrt{L_1(B + D)}$$

where:

B and D : as defined in [6.6.1]

L_1 : Length of the compartment, in m.

d_1 is not to be less than 50 mm and need not exceed 100 mm.

b) When fixed pressure water-spraying systems are fitted in closed vehicle spaces, the requirements contained in the guidelines developed by IMO (see Note 1) are to be duly consi~~u~~dered (see Note 2).

Note 1: see resolution MSC.1/Circ. 1320 "Guidelines for the drainage of fire-fighting water from closed vehicle and ro-ro spaces and special category spaces of passenger and cargo ships".

6.6.4 Direct suctions other than emergency suctions

a) Direct suctions are to be suitably arranged and those in a machinery space are to be of a diameter not less than that required for the bilge main.

b) In yachts having separate machinery spaces of small dimensions, the size of the direct suctions need not exceed that given in [6.6.3] for branch bilge suctions.

6.6.5 Emergency suctions in machinery spaces

a) The diameter of emergency bilge suction pipes is to be the same as the diameter of the pump inlet :

b) Where the emergency suction is connected to a pump other than a main circulating or cooling pump, the suction is to be the same diameter as the main inlet of the pump.

6.6.6 Bilge suctions from tunnels

Bilge suction pipes to tunnel wells are not to be less than 65 mm in diameter. In yachts up to 60 metres in length, this diameter may be reduced to 50 mm.

6.6.7 ~~Bilge main for tankers~~

~~In tankers and other s where the bilge pumps are designed to pump from the machinery space only, the internal diameter d, in mm, of the bilge main may be less than that required by the formula in [6.8.1] above, but it is to be not less than that obtained from the formula specified in Pt E, Ch 7, Sec 4.~~

6.7 Bilge accessories

6.7.1 Drain valves on watertight bulkheads

a) The fitting of drain valves or similar devices is not allowed on the collision bulkhead.

b) On other watertight bulkheads, the fitting of drain valves or similar devices is allowed unless practical alternative draining means exist. Such valves are to be easily accessible at all times and operable from above the freeboard deck. Means indicating whether the valves are open or closed are to be provided.

6.7.2 Screw-down non-return valves

a) Accessories are to be provided to prevent intercommunication of compartments or lines which are to remain segregated from one another. For this purpose, non-return devices are to be fitted:
   - on the pipe connections to bilge distribution boxes or to the alternative valves, if any
   - on direct and emergency suctions in machinery spaces
   - on the suctions of pumps which also have connections from the sea or from compartments normally intended to contain liquid
   - on flexible bilge hose connections
   - on the suctions of water bilge ejectors
   - at the open end of bilge pipes passing through deep tanks
   - in compliance with the provisions for the prevention of progressive flooding, if applicable.

b) Screw-down and other non-return valves are to be of a recognised type which does not offer undue obstruction to the flow of water.

6.7.3 Bilge Alarm

A bilge level alarm is to be fitted. Such an alarm is to provide an audible and visual warning in the Master's cabin and in the wheel-house. The audible and visual alarm may be accepted elsewhere if it is considered that such a location may by more appropriate

6.7.4 Strum boxes

a) In compartments other than machinery spaces and shaft tunnels, the open ends of bilge suction pipes are to be fitted with strum boxes or strainers having holes not more than 10 mm in diameter. The total area of such holes is to be not less than twice the required cross-sectional area of the suction pipe.

b) Strum boxes are to be so designed that they can be cleaned without having to remove any joint of the suction pipe.

6.7.5 Bilge wells

a) The wells provided for draining the various compartments are to be made of steel plate and their capacity is not to be less than 0,15 m^3. In small compartments, smaller cylindrical wells may be fitted.

b) Bilge wells are to comply with the relevant provisions of Part B.

6.7.6 Liquid sealed traps

a) The bilge line of refrigerated spaces is to be provided with liquid sealed traps of adequate size arranged for easy cleaning and refilling with brine. These traps are to be fitted with removable grids intended to hold back waste products when defrosting.

b) Where drain pipes from separate refrigerated rooms join a common main, each of these pipes is to be provided with a liquid sealed trap.

c) As a general rule, liquid sealed traps are to be fitted with non-return valves. However, for refrigerated spaces not situated in the bottom, non-return valves may be omitted, provided this arrangement does not impair the integrity of the watertight subdivision.

6.8 Bilge piping arrangement

6.8.1 Passage through double bottom compartments

Bilge pipes are not to pass through double bottom compartments. If such arrangement is unavoidable, the parts of bilge pipes passing through double bottom compartments are to comply with [5.2.3].

6.8.2 Passage through deep tanks *(1/1/2025)*

The parts of bilge pipes passing through deep tanks intended to contain water ballast, fresh water, ~~liquid cargo~~ or fuel oil are normally to be contained within pipe tunnels. Alternatively, such parts are to comply with [5.2.3]; the number of joints is to be as small as possible. These pipes are to be provided at their ends in the holds with non-return valves.

6.8.3 Provision for expansion

Where necessary, bilge pipes inside tanks are to be fitted with expansion bends. Sliding joints are not permitted for this purpose.

6.8.4 Connections

Connections used for bilge pipes passing through tanks are to be welded joints or reinforced welded flange connections.

6.8.5 Access to valves and distribution boxes

All distribution boxes and manually operated valves in connection with the bilge pumping arrangement shall be in positions which are accessible under ordinary circumstances

Hand-wheels of valves controlling emergency bilge suctions are to be readily accessible and preferably above the floor.

7 Ballast systems

7.1 Design of ballast systems

7.1.1 Independence of ballast lines

Ballast lines are to be entirely independent and distinct from other lines except where permitted in [5.4].

7.1.2 Prevention of undesirable communication between spaces or with the sea

Ballast systems in connection with bilge systems are to be so designed as to avoid any risk of undesirable communication between spaces or with the sea. See [6.1.3].

7.1.3 Alternative carriage of ballast water and fuel oil

a) Oily ballast systems serving tanks intended for alternative carriage of fuel oil and water ballast are to be independent of clean ballast systems:
   - serving the other ballast tanks, or
   - connected to tanks also intended to contain feed water.

b) Where tanks are intended to alternatively contain fuel oil and ballast water, the relevant piping systems are to be arranged in accordance with [11.4.4].

7.1.4 Alternative carriage of ballast water ~~or other liquids and dry cargo~~

Holds and deep tanks designed for the alternative carriage of water ballast or fuel oil are to have their filling and suction lines provided with blind flanges or appropriate change-over devices to prevent any mishandling.

7.1.5 Alternative carriage of ballast water and feed water

Where tanks are intended to alternatively contain ballast water and feed water, the suction line is to have removable elbows for connection to the ballast and feed water systems, so as to avoid any accidental interconnection between the two systems due to manoeuvring error.

7.2 Ballast pumping arrangement

7.2.1 Filling and suction pipes

a) All tanks including aft and fore peak and double bottom tanks intended for ballast water are to be provided with suitable filling and suction pipes connected to special power driven pumps of adequate capacity.

b) Small tanks used for the carriage of domestic fresh water may be served by hand pumps.

c) Suctions are to be so positioned that the transfer of sea water can be suitably carried out in the normal operating conditions of the yacht. In particular, two suctions may be required in long compartments.

7.2.2 Pumps

At least two power pumps connected to the ballast system are to be provided, one of which may be driven by the propulsion machinery.

Bilge pumps may be used for ballast water transfer provided the provisions of [6.5.3] are fulfilled.

7.2.3 Passage of ballast pipes through tanks

If not contained in pipe tunnels, the parts of ballast pipes passing through tanks intended to contain fresh water or fuel oil are to comply with [5.2.3].

7.3 Ballast Water Management Systems

7.3.1

When a Ballast water Management (treatment) system is installed on board, the requirements in App 4 are to be complied with.

8 Scuppers and sanitary discharges

8.1 Application

8.1.1

a) This Article applies to:
   - scuppers and sanitary discharge systems, and
   - discharges from sewage tanks.

b) Discharges in connection with machinery operation are dealt with in [2.7].

8.2 Principle

8.2.1

a) Scuppers, sufficient in number and suitable in size, are to be provided to permit the drainage of water likely to accumulate in the spaces which are not located in the 's bottom. The Society may permit the means of drainage to be dispensed with in any particular compartment if it is satisfied that, by reason of size or internal subdivision of such space, the safety of the is not impaired.

b) The number of scuppers and sanitary discharge openings in the shell plating is to be reduced to a minimum either by making each discharge serve as many as possible of the sanitary and other pipes, or in any other satisfactory manner.

8.3 Drainage from spaces below the freeboard deck or within enclosed superstructures and deckhouses on the freeboard deck

8.3.1 Normal arrangement *(1/1/2025)*

Scuppers and sanitary discharges from spaces below the freeboard deck or from within superstructures and deckhouses on the freeboard deck fitted with weathertight doors c~~omplying with the provisions of Pt B, Ch 9, Sec 6~~ are to be led to:

a) a suitable space, or spaces, of appropriate capacity, having a high water level alarm and provided with suitable pumping arrangements for discharge overboard. In addition, it is to be ensured that:
   1) the number, size and arrangement of the scuppers are such as to prevent unreasonable accumulation of free water,
   2) the pumping arrangements take account of the requirements for any fixed pressure water-spraying fire-extinguishing system
   3) water contaminated with petrol or other dangerous substances is not drained to machinery spaces or other spaces where sources of ignition may be present, and
   4) ~~where the enclosed cargo space is protected by a carbon dioxide fire-extinguishing system, the deck scuppers are fitted with means to prevent the escape of the smothering gas.~~

b) suitable sanitary tanks in the case of sanitary discharges.

8.3.2 Alternative arrangement

The scuppers and sanitary discharges may be led overboard provided that:

- the freeboard deck edge is not immersed when the heels 5°, and
- the inboard end of the discharge is located above the load waterline formed by a 5° heel, to port or starboard, at a draft corresponding to the assigned summer freeboard, and,
- the pipes are fitted with efficient means of preventing water from passing inboard in accordance with [8.6] and [8.7].

8.4 Drainage of superstructures or deckhouses not fitted with efficient weathertight doors

8.4.1

Scuppers leading from superstructures or deckhouses not fitted with doors are to be led overboard, and subject to [8.3.2].

8.5 Drainage of spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion

8.5.1 Prevention of build-up of free surfaces

In spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion and fitted with a fixed pressure water-spraying fire-extinguishing system, the drainage arrangement is to be in compliance with the requirements contained in the guidelines developed by IMO (see Note 1) such as to prevent the build-up of free surfaces.

Note 1: see resolution MSC.1/Circ. 1320 "Guidelines for the drainage of fire-fighting water from closed vehicle and ro-ro spaces and special category spaces of passenger and cargo ships".

8.5.2 Scupper draining

Scuppers from spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion are not to be led to machinery spaces or other places where sources of ignition may be present.

8.6 Arrangement of discharges - General

8.6.1 Arrangement of discharges through the shell more than 450 mm below the freeboard deck or less than 600 mm above the summer load waterline

Scupper and discharge pipes originating at any level and penetrating the shell either more than 450 millimetres below the freeboard deck or less than 600 millimetres above the summer load waterline are to be provided with a non-return valve at the shell. Unless required by [8.7], this valve may be omitted if the piping is of substantial thickness, as per Tab 2~~3~~2.

8.6.2 Arrangement of discharges through the shell less than 450 mm below the freeboard deck and more than 600 mm above the summer load waterline

Scupper and discharge pipes penetrating the shell less than 450 millimetres below the freeboard deck and more than 600 millimetres above the summer load waterline are not required to be provided with a non-return valve at the shell, except for the cases indicated in [8.7].

8.7 Arrangement of discharges from enclosed spaces below the freeboard deck or on the freeboard deck

8.7.1 Normal arrangement

Each separate discharge led though the shell plating from enclosed spaces below the freeboard deck is to be provided with one automatic non-return valve fitted with positive means of closing it from above the freeboard deck or one automatic non-return valve and one sluice valve controlled from above the freeboard deck.

The requirements for non-return valves are applicable only to those discharges which remain open during the normal operation of the yacht; For discharges which are to be kept closed at sea (such as gravity drain from topside ballast tanks), a single screw down valve operated from above the freeboard deck is acceptable.

Where a valve with positive means of closing is fitted, the operating position above the freeboard deck shall always be readily accessible and means shall be provided for indicating whether the valve is open or closed.

The position of the inboard end of discharges is related to the timber summer load waterline when a timber freeboard is assigned.

8.7.2 Alternative arrangement when the inboard end of the discharge pipe is above the summer waterline by more than 0,01 L

Where the vertical distance from the summer load waterline to the inboard end of the discharge pipe exceeds 0,01 L, the discharge may have two automatic non-return valves without positive means of closing, provided that the inboard valve:

- is above the deepest subdivision load line, and
- is always accessible for examination under service conditions.

If the inboard non-return valve is not according to the above, a valve with positive means of closing controlled locally is to be fitted in between the shell plating and the inboard valve.

8.7.3 Alternative arrangement when the inboard end of the discharge pipe is above the summer waterline by more than 0,02 L

Where the vertical distance from the summer load waterline to the inboard end of the discharge pipe exceeds 0,02 L, a single automatic non-return valve without positive means of closing may be accepted subject to the approval of the Society.

8.7.4 Arrangement of discharges through manned machinery spaces

Where sanitary discharges and scuppers are lead overboard through the shell in way of manned machinery spaces, the fitting at the shell of a locally operated positive closing valve together with a non-return valve inboard may be accepted. The operating position of the valve will be given special consideration by the Society.

8.8 Summary table of overboard discharge arrangements

8.8.1 *(1/1/2025)*

The various arrangements acceptable for scuppers and sanitary overboard discharges are summarised in Table 22.1 of Regulation 22 of the 1966 Convention on Load Line shown in Fig 3.

8.9 Valves and pipes

8.9.1 Materials

a) All shell fittings and valves are to be of steel, bronze or other ductile material. Valves of ordinary cast iron or similar material are not acceptable. All scupper and discharge pipes are to be of steel or other ductile material. Refer to [2.1].

b) Plastic is not to be used for the portion of discharge line from the shell to the first valve.

8.9.2 Thickness of pipes *(1/1/2025)*

a) The thickness of scupper and discharge pipes led to the bilge or to draining tanks is not to be less than that required in [2.2].

b) The thickness of scupper and discharge pipes led to the shell is not to be less than the minimum thickness given in Tab 22 ~~and Tab 23~~, for the part between the shell plating and the outermost valve.

8.9.3 Operation of the valves

a) Where valves are required to have positive means of closing, such means is to be readily accessible and provided with an indicator showing whether the valve is open or closed.

b) Where plastic pipes are used for sanitar discharges and scuppers, the valve at the shell is to be operated from outside the space in which the valve is located.

Where such plastic pipes are located below the summer waterline (timber summer load waterline), the valve is to be operated from a position above the freeboard deck.

Refer also to App 3.

8.10 Arrangement of scuppers and sanitary discharge piping

8.10.1 Overboard discharges and valve connections

a) Overboard discharges are to have pipe spigots extending through the shell plate and welded to it, and are to be provided at the internal end with a flange for connection to the valve or pipe flange.

b) Valves may also be connected to the hull plating in accordance with the provisions of [2.7.3], item c).

Figure 3 : Overboard discharge arrangement

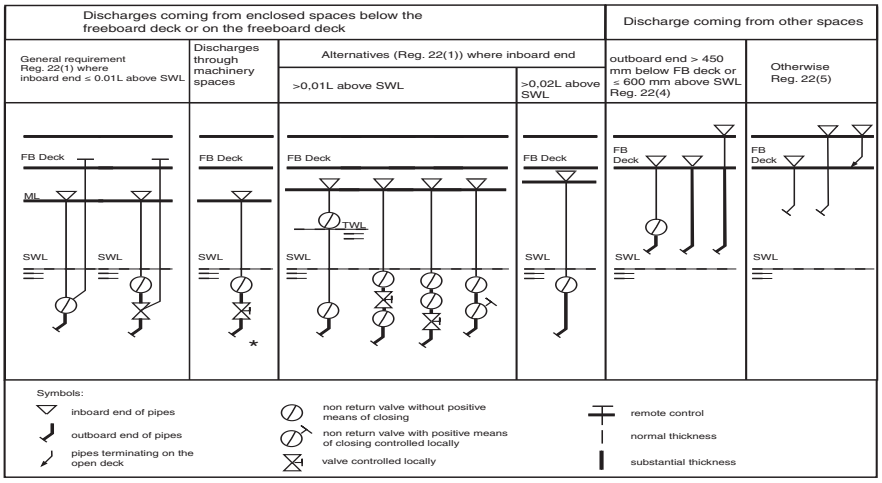


Table 22 : ~~Thickness of scupper and discharge pipes led to the shell, according to their location~~

~~Applicable requirement ®~~ / ~~Pipe location~~	~~[8.7.1]~~	~~[8.7.2]~~	~~[8.8.2]~~	~~[8.8.3]~~	~~[8.8.4]~~	~~[8.8.5]~~	~~[8.8.6] with valve~~	~~[8.8.6] without valve~~	~~[8.8.7]~~
~~Between the shell and the first valve~~	~~Thickness according to Tab 23, column 1, or 0,7 times that of the shell side plating, whichever is the greater (1)~~							~~NA~~	~~NA~~
~~Between the first valve and the inboard end~~	~~Thickness according to Tab 23, column 2~~							~~NA~~	~~NA~~
~~Below the freeboard deck~~	~~NA~~							~~Thickness according to Tab 23, column 1~~	~~Thickness according to Tab 23, column 2~~
~~Above the freeboard deck~~	~~NA~~							~~Thickness according to Tab 23, column 2~~	~~Thickness according to Tab 23, column 2~~

(1) ~~However, this thickness is not required to exceed that of the plating.~~

Note 1: ~~NA = not applicable~~

Table 23 : Minimum thickness of scupper and discharge pipes led to the shell

External diameter of the pipe d (mm)	Column 1 substantial thickness (mm)	Column 2 normal thickness (mm)
d ≤ 80,0	7,00	4,50
155	9,25	4,50
180	10,00	5,00
220	12,50	5,80
230 ≤ d	12,50	6,00
Note 1: Intermediate sizes may be determined by interpolation.		

8.10.2 Passage through tanks

a) As a rule, scupper and sanitary discharge pipes are not to pass through fuel oil tanks.

b) Where scupper and discharge pipes pass unavoidably through fuel oil tanks and are led through the shell within the tanks, the thickness of the piping is not to be less than that given in Tab 23, column 1 (substantial thickness). It need not, however, exceed the thickness of the adjacent Rule shell plating.

c) Scupper and sanitary discharge pipes are normally not to pass through fresh and drinking water tanks.

10.6.2 Coolers

a) Coolers are to be fitted with isolating valves at the inlets and outlets.

b) Coolers external to the hull (chest coolers and keel coolers) are to be fitted with isolating valves at the shell.

10.6.3 Filters

a) Where propulsion engines and auxiliary engines for essential services are directly cooled by sea water, both in normal service and in emergency operating conditions, filters are to be fitted on the suction of cooling pumps.

b) These filters are to be so arranged that they can be cleaned without interrupting the cooling water supply.

10.6.4 Pumps

a) Cooling pumps for which the discharge pressure may exceed the design pressure of the piping system are to be fitted with relief valves in accordance with [2.4].

b) Where general service pumps, ballast pumps or other pumps may be connected to a cooling system, arrangements are to be made, in accordance with [2.4], to avoid overpressure in any part of the cooling system.

10.6.5 Air venting

Cocks are to be installed at the highest points of the pipes conveying cooling water to the water jackets for venting air or gases likely to accumulate therein. In the case of closed fresh water cooling systems, the cock is to be connected to the expansion tank.

11 Fuel oil systems

11.1 Application

11.1.1 Scope

This Article applies to all fuel oil systems supplying any kind of installation.

11.1.2 Requirements applying to fuel oil systems and not contained in this Section (1/1/2007)

Additional requirements are given:

- for independent fuel oil tanks, in Pt B
- for fuel oil supply equipment forming part of engines, gas turbines, and incinerators, in the corresponding sections
- for the location and scantling of tanks forming part of the ’s structure, in Part B, Ch.1 Sec.1.

11.2 Principle

11.2.1 General *(1/1/2025)*

a) Fuel oil systems are to be so designed as to ensure the proper characteristics (purity, viscosity, pressure) of the fuel oil supply to engines.

b) Fuel oil systems are to be so designed as to prevent:
   - overflow or spillage of fuel oil from tanks, pipes, fittings, etc.
   - fuel oil from coming into contact with sources of ignition
   - overheating and seizure of fuel oil.

c) Fuel oils used for engines ~~and boilers~~ are to have a flashpoint complying with the provisions of Sec 1.

11.2.2 Availability of fuel systems *(1/1/2025)*

a) Fuel oil systems are to be so designed that, in the event that any one essential auxiliary of such systems becomes inoperative, the fuel oil supply to ~~boilers and~~ engines can be maintained (see also [11.2.1] a)). Partial reduction of the propulsion capability may be accepted, however, when it is demonstrated that the safe operation of the yacht is not impaired.

b) Fuel oil tanks are to be so arranged that, in the event of damage to any one tank, complete loss of the fuel supply to essential services does not occur.

11.3 General

11.3.1 Arrangement of fuel oil systems

a) In a in which fuel oil is used, the arrangements for the storage, distribution and utilisation of the fuel oil are to be such as to ensure the safety of the yacht and persons on board.

b) The provisions of [5.10] are to be complied with.

11.3.2 Provision to prevent overpressure

Provisions are to be made to prevent overpressure in any oil tank or in any part of the fuel oil system. Any relief valve is to discharge to a safe position.

11.3.3 Ventilation

The ventilation of machinery spaces is to be sufficient under all normal conditions to prevent accumulation of oil vapour.

11.3.4 Access

Spaces where fuel oil is stored or handled are to be readily accessible.

11.4 Design of fuel oil filling and transfer systems

11.4.1 General

a) A system of pumps and piping for filling and transferring fuel oil is to be provided.

b) Provisions are to be made to allow the transfer of fuel oil from any storage, settling or service tank to another tank.

11.4.2 Filling systems

a) Filling pipes of fuel oil tanks are to terminate on open deck or in filling stations isolated from other spaces and efficiently ventilated. Suitable coamings and drains are to be provided to collect any leakage resulting from filling operations.

b) Arrangements are to be made to avoid overpressure in the filling lines which are served by pumps on board. Where safety valves are provided for this purpose, they are to discharge to the overflow tank referred to in [9.3.3] or to other safe positions deemed satisfactory.

11.4.3 Independence of fuel oil transfer lines

Except where permitted in [11.4.5], the fuel oil transfer piping system is to be completely separate from the other piping systems of the yacht .

11.4.4 Simultaneous transfer of fuel oil and ballast water

Where, under the provisions of [7.1.3], tanks are intended to alternately contain fuel oil and ballast water, the piping arrangement is to be such that fuel may be transferred by means of fuel pumps to or from any tank while ballast pumps are simultaneously being used.

11.4.5 Alternative carriage of fuel oil, or ballast water ~~or other liquid and dry cargo~~ *(1/1/2025)*

Where certain compartments are likely to contain alternatively fuel oil or, ballast water ~~and other liquid or dry cargo~~, the transfer pipes supplying these compartments are to be fitted with blind flanges or other appropriate change-over devices.

11.4.6 Transfer pumps

a) At least two means of transfer are to be provided. One of these means is to be a power pump. The other may consist of:

- a standby pump,
- or, alternatively, an emergency connection to another suitable power pump.

Note 1: Where provided, purifiers may be accepted as means of transfer.

b) Where necessary, transfer pumps are to be fitted on their discharge side with a relief valve leading back to the suction of the pump or to any other place deemed satisfactory.

11.5 Arrangement of fuel oil tanks

11.5.1 Location of fuel oil tanks

a) No fuel oil tank is to be situated where spillage or leakage therefrom can constitute a hazard by falling on heated surfaces.

b) As far as practicable, fuel oil tanks are to be part of the yacht's structure and are to be located outside machinery spaces of category A. Where fuel oil tanks, other than double bottom tanks, are necessarily located adjacent to or within machinery spaces of category A, at least one of their vertical sides is to be contiguous to the machinery space boundaries, and is preferably to have a common boundary with the double bottom tanks, and the area of the tank boundary common with the machinery spaces is to be kept to a minimum. Where such tanks are situated within the boundaries of machinery spaces of category A, they are not to contain fuel oil having a flashpoint of less than 60 °C.

Note 1: Machinery spaces of category A are defined in Ch 4, Sec.1.

c) The location of fuel oil tanks is to be in compliance with the requirements of Part B, Chapter 2, particularly as regards the installation of cofferdams, the separation between fuel oil tanks or bunkers and the other spaces of the , and the protection of these tanks and bunkers against any abnormal rise in temperature.

11.5.2 Use of free-standing fuel oil tanks

a) In general the use of free-standing fuel oil tanks is permitted in category A machinery spaces.

b) For the design and the installation of independent tanks, refer to Pt B, Ch 1, Sec.4.

11.6 Design of fuel oil tanks and bunkers

11.6.1 General

Tanks such as collector tanks, de-aerator tanks etc. are to be considered as fuel oil tanks for the purpose of application of this sub-article, and in particular regarding the valve requirements.

Tanks with a volume lower than 500 l will be given special consideration by the Society.

11.6.2 Scantlings

a) The scantlings of fuel oil tanks forming part of the 's structure are to comply with the requirements stated in Part B.

b) Scantlings of fuel oil tanks and bunkers which are not part of the 's structure are to comply with Pt B, Ch 1, Sec 4.

11.6.3 Filling and suction pipes

a) All suction pipes from fuel oil tanks and bunkers, including those in the double bottom, are to be provided with valves.

b) For storage tanks, filling pipes may also be used for suction purposes.

c) Where the filling pipes to fuel oil tanks are not led to the upper part of the such bunkers and tanks, they are to be provided with non-return valves at their ends, unless they are fitted with valves arranged in accordance with the requirements stated in [11.6.4].

11.6.4 Remote control of valves

a) Every fuel oil pipe which, if damaged, would allow oil to escape from a storage, settling or daily service tank having a capacity of 500 l and above situated above the double bottom, is to be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space in which such tanks are situated in the event of a fire occurring in such space.

Note 1: For the location of the remote controls, refer to [11.10.4], item c).

b) Such valves and cocks are also to include local control and on the remote and local controls it is to be possible to verify whether they are open or shut. (See [2.6.3]).

11.6.5 Drain pipes

Where fitted, drain pipes are to be provided with self-closing valves or cocks.

A tank drain cock is not to be considered as a sampling point.

11.6.6 Air and overflow pipes

Air and overflow pipes are to comply with [9.1] and [9.3].

As far as practicable, the Service tank overflow return line to the settling tank is to be drawn from near the bottom of the service tank to the top of the settling tank to ensure any accumulating sediment in the service tank bottom is minimized.

11.6.7 Sounding pipes and level gauges

a) Safe and efficient means of ascertaining the amount of fuel oil contained in any fuel oil tank are to be provided.

b) Sounding pipes of fuel oil tanks are to comply with the provisions of [9.2].

c) Oil-level gauges complying with [2.8.2] may be used in place of sounding pipes.

d) Gauge cocks for ascertaining the level in the tanks are not to be used.

11.7 Design of fuel oil treatment systems

11.7.1 Drains

a) Settling tanks and daily service tanks, are to be provided with drains permitting the evacuation of water and impurities likely to accumulate in the lower part of such tanks.

If settling tanks are not provided, the fuel oil daily service tanks are to be designed and constructed in such a way as to direct water and sludge towards a drainage outlet.

b) Efficient means are to be provided for draining oily water escaping from the drains.

11.7.2 Purifiers *(1/1/2025)*

a) Where fuel oil needs to be purified, at least two purifiers are to be installed on board, each capable of efficiently purifying the amount of fuel oil necessary for the normal operation of the engines.

Note 1: On yachts with a restricted navigation notation where fuel oil needs to be purified, one purifier only may be accepted.

b) Subject to special consideration by the Society, the capacity of the standby purifier may be less than that required in a), depending on the arrangements made for the fuel oil service tanks to satisfy the requirement in [11.9.2].

c) The standby purifier may also be used for other services.

d) Each purifier is to be provided with an alarm in case of failures likely to affect the quality of the purified fuel oil.

e) The amount of water reaching the ~~engine~~ oil fuelled machineryis to be not more than 0.3 % v/v or according to engine maker's recommendations.

f) ~~Every attempt is to be made to reduce the amount of catalyst fines to the lowest possible levels. The amount of catalyst fines reaching the engine is normally not to exceed 10 ppm Al+Si. Exceptionally, this might rise to 15 ppm for short periods (i.e. few hours).~~

~~Note: Particle size has a significant influence on the capacity of the centrifugal separators to lower the level of catalyst fines in the fuel, with particles of 2 microns or less being particularly difficult to remove. The presence of particles of 2 microns size or lower may cause difficulties in achieving the 10 ppm limit. Engine manufacturer recommendations are also to be referred to for any further system specific recommendations.~~

Fuel treatment system performance in the removal of catfines andwater is recommended to be regularly assessed, bydrawing and analyzing samples from before and after the purifier plant and after the service tank to ensure that the catfines and water levels dot not exceedmaximum engine entry levels recommended by engine manufacturers.

g) Centrifugal separators are to be certified for a flow rating in accordance with a recognised standard, e.g. EN 17763:2022, Centrifuges - Marine fuel centrifuges - Determination of particle separation performance and certified flow rate (CFR) under defined test conditions CEN Workshop Agreement (CWA) 15375 (latest revision).

h) Centrifugal separators are to meet the safety requirements of a recognized standard, e.g. EN 12547, Centrifuges - Common safety requirements.

11.8 Fuel oil pumps

11.8.1 General

Fuel pump capacity is to ensure that fuel flow rate through the fuel system is sufficient to maintain the installed oil fuelled machinery's fuel consumption during normal operation at maximum continuous rating of the propulsion plant and normal operating load at sea of the generator plant.

Satisfactory fuel pump operation is to be verified according to the Society requirements after installation on board.

11.9 Design of fuel supply systems

11.9.1 General

a) When necessary, arrangements are to be made for cooling the marine diesel oil from engine return lines.

b) The fuel oil treatment system is to be provided with redundancy so that failure of one system will not render the other system(s) inoperative. Arrangements are to ensure that any single failure in the system will not interrupt the supply of clean fuel to machinery used for propulsion and electrical generating purposes where the fuel conditioning system is installed between fuel oil service tanks and the inlet to the combustion system.

11.9.2 Fuel oil service tanks

a) Two fuel oil service tanks for each type of fuel used on board necessary for propulsion and vital systems, or equivalent arrangements, are to be provided on each new , with a capacity of at least 8 h at maximum continuous rating of the propulsion plant and normal operating load at sea of the generator plant.

11.9.3 Fuel oil supply to internal combustion engines *(1/1/2025)*

a) The suctions of engine fuel pumps are to be arranged at an appropriate distance above the fuel-oil treatment tank drain point in order to prevent accumulated water and sludge being drawn into the fuel oil treatment system (e.g. 5% of the tank volume is below the suction pipe).

b) Suitable filters are to be provided on the fuel oil line to the injection pumps.

Fuel filters are to reduce the level of contaminants(i.e.metallic particles / sediments etc.) in the fuel to a level commensurate with the downstream equipment manufacturers' requirements.

Internal combustion engines intended for main propulsion are to be fitted with at least two filters, or similar devices, so arranged that one of the filters can be overhauled while the other is in use.

Note 1: Where the propulsion plant consists of:

- two or more engines, each one with its own filter, or
- one engine with an output not exceeding 375 kW,

the second filter may be replaced by a readily accessible and easily replaceable spare filter.

c) Oil filters fitted in parallel are to be so arranged as to minimise the possibility of a filter under pressure being opened by mistake.

Filter chambers are to be provided with suitable means for:

- ventilating when put into operation
- de-pressurising before being opened.

Valves or cocks used for this purpose are to be fitted with drain pipes led to a safe location.

d) Oil filters are to be so located that in the event of a leakage the fuel oil cannot be pulverised onto the exhaust manifold.

e) When a fuel oil booster pump is fitted which is essential to the operation of the main engine, a standby pump, connected ready for immediate use, is to be provided.

The standby pump may be replaced by a complete spare pump of appropriate capacity ready to be connected, in the following cases:

- where two or more main engines are fitted, each with its own booster pump
- in yachts having main engines each with an output not exceeding 375 kW.

f) Excess fuel oil from pumps or injectors is to be led back to the service or settling tanks, or to other tanks intended for this purpose.

15 Exhaust gas systems

15.1 General

15.1.1 Application *(1/1/2025)*

This Article applies to:

- exhaust gas pipes from engines and gas turbines
- smoke ducts from ~~boilers and~~ incinerators.

15.1.2 Principle

Exhaust gas systems are to be so designed as to:

- limit the risk of fire
- prevent gases from entering manned spaces
- prevent water from entering engines.

15.2 Design of exhaust systems

15.2.1 General

Exhaust systems are to be so arranged as to minimise the intake of exhaust gases into manned spaces, air conditioning systems and engine intakes. The exhaust piping is to be fitted in a manner such as to ensure an adequate air gap from the adjacent hull structure and other fittings; such air gap is to be, in general, not less than 200 mm.

iSee also Part B Ch.1 Sec.1 [5.3.3]

15.2.2 Limitation of exhaust line surface temperature

a) Exhaust gas pipes and silencers are to be either water cooled or efficiently insulated where:
   - their surface temperature may exceed 220°C, or
   - they pass through spaces of the where a temperature rise may be dangerous.

b) The insulation of exhaust systems is to comply with the provisions of Sec 1, [3.7.1].

15.2.3 Limitation of pressure losses *(1/1/2025)*

Exhaust gas systems are to be so designed that pressure losses in the exhaust lines do not exceed the maximum values permitted by the engine ~~or boiler~~ manufacturers.

Table 31 : Compressed air systems

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							

15.2.4 Intercommunication of engine exhaust gas lines ~~or boiler smoke ducts~~ *(1/1/2025)*

a) Exhaust gas from different engines is not to be led to a common exhaust main, exhaust gas ~~boiler or~~ economiser, unless each exhaust pipe is provided with a suitable isolating device.

15.2.5 Exhaust gas pipe terminations

a) Where exhaust pipes are led overboard close to the load waterline, means are to be provided to prevent water from entering the engine or the .

b) Where exhaust pipes are water cooled, they are to be so arranged as to be self-draining overboard.

15.2.6 Control and monitoring

A high temperature alarm is to be provided in the exhaust gas manifolds of thermal oil heaters to detect any outbreak of fire.

15.3 Materials

15.3.1 General

Materials of exhaust gas pipes and fittings are to be resistant to exhaust gases and suitable for the maximum temperature expected.

15.3.2 Use of plastics

The use of non-metallic materials may be accepted in water cooled systems in accordance with the provisions of App 3.

15.4 Arrangement of exhaust piping systems

15.4.1 Provision for thermal expansion

a) Exhaust pipes and smoke ducts are to be so designed that any expansion or contraction does not cause abnormal stresses in the piping system, and in particular in the connection with engine turboblowers.

b) The devices used for supporting the pipes are to allow their expansion or contraction.

15.4.2 Provision for draining *(1/1/2025)*

a) Drains are to be provided where necessary in exhaust systems~~, and in particular in exhaust ducting below exhaust gas boilers,~~ in order to prevent water flowing into the engine.

b) Where exhaust pipes are water cooled, they are to be so arranged as to be self-draining overboard.

15.4.3 Flexible hoses

The use of flexible hoses in water cooled exhaust systems will be given special consideration by the Society.

15.4.4 Silencers

Engine silencers are to be so arranged as to provide easy access for cleaning and overhaul.

15.5 Exhaust gas treatment systems

15.5.1

When exhaust gas treatment systems are installed, they are to be in compliance with the requirements in [16].

16 Exhaust gas treatment systems

16.1 Application

16.1.1

This Article applies to selective catalytic reduction (SCR) systems.

16.2 Exhaust ducting

16.2.1

The parts of the Exhaust gas treatment systems containing exhaust gas are to be in compliance with [15].

When the exhaust gas treatment system may influence the operation of essential machinery, arrangements are to be made to ensure the continuity of the service concerned also in case of possible failures of the exhaust gas treatment system (e.g. exhaust gas bypasses are to be arranged, to enable continued operation of engine intended to drive single essential users in case of filters clogging by particulate matter).

Table 34 : Inspection and testing at works for piping systems and their components *(1/1/2025)*

No.	Item	Tests for materials **(1)**		Inspections and tests for the product **(1)**			Reference to the Rules
		Tests required	Type of material certificate **(2)**	During manufacturing (NDT)	After completion **(3)**	Type of product certificate **(2)**	
1	Valves, pipes and fittings						
	a) class I, d ≥ 50 mm or class II, d ≥ 100 mm	X	C	X **(4)**	X	C	[17.3.2] [3.6.2] [3.6.3] [17.4.3]; Pt D, Ch 2, Sec 2, [1.8]
	b) class I, d < 50 mm or class II, d < 100 mm	X	W	X **(4)**	X	C	[17.3.2] [3.6.2] [3.6.3] [17.4.3]; Pt D, Ch 2, Sec 2, [1.8]
	c) class III where "d" is the nominal diameter	X	W		X	W	[17.3.2]
2	Flexible hoses and expansion joints	X **(5)**	W		X	C	[17.3.2] [17.4.6]
3	Pumps and compressors						
	a) all	X	W		X	C	[17.4.5]
	b) bilge and fire pumps	X	W		X	C	[17.5.1]
	~~c) feed pumps for main boilers:~~						
	~~• casing and bolts~~	~~X~~	~~C~~				~~Part D~~
	~~• main parts~~			~~X~~		~~C~~	~~Part D~~
	~~• rotor~~				~~X~~		~~[17.5.1]~~
	~~d) forced circulation pumps for main boiler:~~						
	~~• casing and bolts~~	~~X~~	~~C~~			~~C~~	~~Part D~~

(1) X = test is required
(2) C = class certificate
W = works' certificate
(3) Visual examination and hydrostatic pressure test as required.
(4) NDT on welding in case of welded construction.
(5) If metallic.
(6) 100% radiographic examination or equivalent on butt-welded joints of pipes with an external diameter exceeding 75 mm. Magnetic particle or liquid penetrant tests on other types of welded joints.
(7) 10% radiographic examination or equivalent on butt-welded joints of pipes with an external diameter exceeding 100 mm. Magnetic particle or liquid penetrant tests on other types of welded joints.
(8) C certificate for the piping systems mentioned in [17.4.2] a).

SECTION 14 TURBOCHARGERS

1 General

1.1 Application

1.1.1

These Rules apply to turbochargers with regard to design approval, type testing and certification and their matching on engines.

1.1.2

Turbochargers are to be type approved, either separately or as a part of an engine. The requirements are written for exhaust gas driven turbochargers, but apply in principle also for engine driven chargers.

The requirements escalate with the size of the turbochargers. The parameter for size is the engine power (at MCR) supplied by a group of cylinders served by the actual turbocharger, (e.g. for a V-engine with one turbocharger for each bank the size is half of the total engine power).

1.1.3

Turbochargers are categorized in three groups depending on served power by cylinder groups with:

- Category A: < 1000 kW
- Category B: > 1000 kW and < 2500 kW
- Category C: > 2500 kW

1.1.4 In the case of special types of turbochargers, the Society reserves the right to modify the requirements of this Section, demand additional requirements in individual cases and require that additional plans and data be submitted.

1.1.5

Turbochargers with an existing type approval on 1 January 2023 are not required to be re-type approved in accordance with this Section until the current Type Approval reaches its expiry date.

[3] is applicable when requested in accordance with the relevant Table of Pt A, Ch 2, App 3

1.2 Documentation to be submitted

1.2.1

The Manufacturer is to submit to the Society the following documents.

1.2.2

For Category A turbochargers:

On request:

- containment test report;
- cross sectional drawing with principal dimensions and names of components;
- test program.

1.2.3

For Category B and C turbochargers:

- cross sectional drawing with principal dimensions and materials of housing components for containment evaluation;
- documentation of containment in the event of disc fracture;
- operational data and limitations as;
- maximum permissible operating speed (rpm);
- alarm level for over-speed;
- maximum permissible exhaust gas temperature before turbine;
- alarm level for exhaust gas temperature before turbine;
- minimum lubrication oil inlet pressure;
- lubrication oil inlet pressure low alarm set point;
- maximum lubrication oil outlet temperature;
- lubrication oil outlet temperature high alarm set point;
- maximum permissible vibration levels, i.e. self- and externally generated vibration.
  (Alarm levels may be equal to permissible limits but shall not be reached when operating the engine at 110% power or at any approved intermittent overload be-yond the 110%);
- arrangement of lubrication system, all variants within a range;
- type test reports;
- test program.

1.2.4

For Category C turbochargers:

- drawings of the housing and rotating parts including details of blade fixing;
- material specifications (chemical composition and mechanical properties) of all parts mentioned above;
- welding details and welding procedure of above mentioned parts, if applicable;
- documentation of safe torque transmission when the disc is connected to the shaft by an interference fit, see [2.2.4];
- information on expected lifespan, considering creep, low cycle fatigue and high cycle fatigue;
- operation and maintenance manuals (see Note 1).

Note 1: Applicable to two sizes in a generic range of turbochargers.

1.2.5

When the turbochargers are manufactured by a licensee on the basis of a previously type approved licensor design, but using parts manufactured outside of the licensor premises and making use of other than the original licensor drawings and specifications, the licensee is to submit, for each turbocharger type, a list of all the drawings specified above, indicating for each drawing the relevant number and revision status from both licensor and licensee.

Where the licensee proposes design modifications to components, the associated documents are to be submitted by the licensee to the Society for approval, with a Licensor statement confirming acceptance of the changes.

In all cases, the licensee is to provide the Surveyor entrusted to carry out the testing, with a complete set of the documents specified above.

2 Design and construction

2.1 Application

2.1.1

The turbochargers shall be designed to operate under conditions given in Sec 1, [2.4] and Sec 1, [2.5].

The component lifetime and the alarm level for speed shall be based on 45°C air inlet temperature.

2.2 Materials

2.2.1

The requirements of Sec 5, [2.1.1] are to be complied with, as far as applicable, at the Society’s discretion.

2.3 Design

2.3.1 Stress analyses

a) For Category B and C turbochargers, the manufacturer is to submit a calculation report concerning the stresses on each rotor under the most severe service conditions.

b) The results of previous in-service experience on similar applications may be considered by the Society as an alternative to item a) above.

Data on the design service life and test results used to substantiate calculation assumptions are also to be provided.

2.3.2 Vibrations

The range of service speeds is not to give rise to unacceptable vibrations affecting the rotor and blades.

Calculations of the critical speeds including details of their basic assumptions are to be submitted for Category B and C turbochargers.

2.3.3 Containment *(1/1/2025)*

a) Turbochargers shall fulfil containment in the event of a rotor burst. This means that at a rotor burst no part may penetrate the casing of the turbocharger or escape through the air intake. For documentation purposes (test/calculation), it shall be assumed that the discs disintegrate in the worst possible way.

b) For category B and C, containment shall be documented by testing. Fulfilment of this requirement can be awarded to a generic range of turbochargers based on testing of one specific unit. Testing of a large unit is preferred as this is considered conservative for all smaller units in the generic range. In any case, it must be documented (e.g. by calculation) that the selected test unit really is representative for the whole generic range.

Note 1: A generic range means a series of turbocharger which are of the same design, but scaled to each other.

c) The minimum test speeds, relative to the maximum permissible operating speed, are:

- for the compressor:120%
- for the turbine: 140% or the natural burst speed, whichever is lower.

d) Containment tests shall be performed at ~~working~~ temperature a temperature which is not lower than the maximum allowable temperature of the turbocharger to be specified by the manufacturer .

e) Manufacturers are to determine whether cases more critical than those defined in [2.3.3], c) and [2.3.3], d) exist with respect to containment safety. Where such a case is identified, evidence of containment safety is also to be provided for that case

f) A numerical analysis ~~(~~simulation~~)~~ such as Finite Element Method (FEM)of sufficient containment integrity of the casing based on calculations by means of a simulation model may be accepted in lieu of the practical containment test, provided that:

- the numerical simulation model has been tested and its suitability/accuracy has been proven by direct comparison between calculation results and the practical containment test for a reference application (reference containment test). This test shall be performed at least once by the manufacturer for acceptance of the numerical simulation method in lieu of tests;
- the corresponding numerical simulation for the containment is performed for the same speeds as specified for the containment test;
- material properties for high-speed deformations are to be applied in the numeric simulation. The correlation between normal properties and the properties at the pertinent deformation speed are to be substantiated;
- the design of the turbocharger regarding geometry and kinematics is to be similar to the turbocharger that was used for the reference containment test. ~~In general, totally new designs will call for a new reference containment test.~~

  g) In cases where a totally new design is adopted for a turbocharger for which an application for type approval certification has been requested, new reference containment tests are to be performed.

  Note 2: Totally new design means the principal differences between a new turbocharger and previous ones are related to geometry and kinematics. The turbochargers are to be regarded as having a totally new design if the structure and/or material of the turbocharger casings are changed, or any of, but not limited to, the following items is changed from the previous design.

  • Maximum permissible exhaust gas temperature

  • Number of bearings

  • Number of turbine blades

• Number of turbine wheels and/or compressor wheels
• Direction of inlet air and/or exhaust gas (e.g., axial flow orientation, radial flow orientation)
• Type of the turbocharger drive (e.g., axial turbine type, radial turbine type, mixed flow turbine type)

2.3.4 Disc-shaft shrinkage fit

For Category C turbochargers, in cases where the disc is connected to the shaft with interference fit, calculations shall substantiate safe torque transmission during all relevant operating conditions such as maximum speed, maximum torque and maximum temperature gradient combined with minimum shrinkage amount.

2.3.5 Bearings

a) Turbine bearings are to be so located that their lubrication is not impaired by overheating from hot gases or adjacent hot parts.

b) Lubricating oil is to be prevented from dripping on high temperature parts.

c) Roller bearings are to be identifiable and are to have a life adequate for their intended purpose.

2.3.6 Welded fabrication *p*

The manufacturer's requirements relative to the welding of turbine rotors or major forged or cast pieces, where permitted, are to be readily identifiable by the Society in the plans submitted for approval.

Requirements relative to fabrication, welding, heat treatments, examinations, testing and acceptance will be stipulated on a case by case basis.

In general, all welding is to be carried out by qualified welders in accordance with qualified welding procedures using approved consumables.

2.4 Alarms and Monitoring

2.4.1

For all turbochargers of Categories B and C, indications and alarms as listed in Tab 1 are required.

2.4.2

Indications may be provided at either local or remote locations.

Table 1

Pos.	Monitored Parameters	Category of Turbochargers				Notes
		B		C		
		Alarm	Indication	Alarm	Indication	
1	Speed	High **(4)**	X **(4)**	High **(4)**	X **(4)**	
2	Exhaust gas at each turbocharger inlet, temperature	High **(1)**	X **(1)**	High	X	High temp. alarms for each cylinder at engine is acceptable **(2)**

(1) For Category B turbochargers, the exhaust gas temperature may be alternatively monitored at the turbocharger outlet, provided that the alarm level is set to a safe level for the turbine and that correlation between inlet and outlet temperatures is substantiated.

(2) Alarm and indication of the exhaust gas temperature at turbocharger inlet may be waived if alarm and indication for individual exhaust gas temperature is provided for each cylinder and the alarm level is set to a value safe for the turbocharger.

(3) Separate sensors are to be provided if the lubrication oil system of the turbocharger is not integrated with the lubrication oil system of the diesel engine or if it is separated by a throttle or pressure reduction valve from the diesel engine lubrication oil system.

(4) On turbocharging systems where turbochargers are activated sequentially, speed monitoring is not required for the turbocharger(s) being activated last in the sequence, provided all turbo-chargers share the same intake air filter and they are not fitted with waste gates.

Pos.	Monitored Parameters	Category of Turbochargers				Notes
		B		C		
		Alarm	Indication	Alarm	Indication	
3	Lub. oil at turbocharger outlet, temperature			High	X	If not forced system, oil temperature near bearings
4	Lub. oil at turbocharger outlet, temperature	Low	X	Low	X	Only for forced lubrication systems **(3)**

(1) For Category B turbochargers, the exhaust gas temperature may be alternatively monitored at the turbocharger outlet, provided that the alarm level is set to a safe level for the turbine and that correlation between inlet and outlet temperatures is substantiated.

(2) Alarm and indication of the exhaust gas temperature at turbocharger inlet may be waived if alarm and indication for individual exhaust gas temperature is provided for each cylinder and the alarm level is set to a value safe for the turbocharger.

(3) Separate sensors are to be provided if the lubrication oil system of the turbocharger is not integrated with the lubrication oil system of the diesel engine or if it is separated by a throttle or pressure reduction valve from the diesel engine lubrication oil system.

(4) On turbocharging systems where turbochargers are activated sequentially, speed monitoring is not required for the turbocharger(s) being activated last in the sequence, provided all turbo-chargers share the same intake air filter and they are not fitted with waste gates.

3 Type tests, material tests, workshop inspection and testing, certification

3.1 Type testing

3.1.1
Applicable to Categories B and C.

3.1.2
The type test for a generic range of turbochargers may be carried out either on an engine (for which the turbocharger is foreseen) or in a test rig.

3.1.3 *(1/1/2025)*
Turbochargers for the low, medium, and high-speed engines are to be subjected to at least 500 load cycles at the limits of operation. This test may be waived if the turbocharger together with the engine is subjected to this kind of low cycle testing, according to Sec 2 The suitability of the turbocharger for such kind of operation is to be preliminarily stated by the manufacture.

3.1.4
The rotor vibration characteristics shall be measured and recorded in order to identify possible sub-synchronous vibrations and resonances.

3.1.5
The type test shall be completed by a hot running test at maximum permissible speed combined with maximum permissible temperature for at least one hour. After this test, the turbo-charger shall be opened for examination, with focus on possible rubbing and the bearing conditions.

3.1.6
Normally the surveyor's presence during the various parts of the type tests is required.

3.2 Workshop inspections and testing

3.2.1
The manufacturer shall adhere to a quality system designed to ensure that the designer's specifications are met, and that manufacturing is in accordance with the approved drawings; the verification of compliance with this requirement is within the scope of a Type approval.

3.2.2

For category C, this shall be verified by means of periodic product audits of an Alternative Certification Scheme (ACS) (Pt A Ch 2 App.3) by the Society.

These audits shall focus on:

- chemical composition of material for the rotating parts;
- mechanical properties of the material of a representative specimen for the rotating parts and the casing;
- UT and crack detection of rotating parts;
- dimensional inspection of rotating parts;
- rotor balancing;
- hydraulic testing of cooling spaces to 4 bars or 1.5 times maximum working pressure, whichever is higher;
- overspeed test of all compressor wheels for a duration of 3 minutes at either 20% above alarm level speed at room temperature or 10% above alarm level speed at 45°C inlet temperature when tested in the actual housing with the corresponding pressure ratio. The over-speed test may be waived for forged wheels that are individually controlled by an approved non-destructive method.

3.3 Type approval certificate and its validity

3.3.1 Issue of Type approval

When foreseen in Pt A Ch 2 App.3 the turbocharger defined in [1.1.1] may be type approved by The Society.

For a particular type of turbocharger, a Tasneef Type Approval Certificate valid for 3 years can be obtained by the maker by testing a prototype according to the requirements contained in [2] and subject to the satisfactory outcome of the type tests specified in [3.1] and a factory audit specified in [3.2.1], the Society will issue to the turbocharger Manufacturer a Type Approval Certificate valid for all turbochargers of the same type.

Where changes are made to a turbocharger and upon satisfactory review of documents as per [1.2.2], the extension to the modified turbocharger of the validity of the type tests and containment test previously carried out will be evaluated on a case by case basis.

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 engines of the same type, the tests required by the Rules can be carried out by the Manufacturer, who will issue a Certificate of conformity to the prototype

3.3.2 Renewal of type Approval

For the renewal of the Tasneef Type Approval Certificate, thep tests to be carried out will be specified in a scheme to be agreed with The Society.

3.4 Testing certification

3.4.1 *(1/1/2025)*

Turbochargers shall be delivered with:

- For category C, a society certificate, which a~~t~~s a minimum cites the applicable type approval and the Alternative Certification Scheme (ACS), when ACS ~~applicable~~ applies.
- For category B, a work's certificate, which at a minimum cites the applicable type approval, which includes production assessment according to [3.2.1].

3.4.2

The same applies to replacement of rotating parts and casing.

3.4.3

Rotating parts of category C turbochargers are to be marked for easy identification with the appropriate certificate.

3.4.4

Alternatively to the Alternative Certification Scheme and periodic product audits according to [3.2.2] individual certification of a turbocharger and its parts may be made at the discretion of the Society. However, such individual certification of category C turbocharger and its parts shall also be based on test requirements specified in [3.2.2].

APPENDIX 1 ALTERNATIVES, RELAXATIONS AND ADDITIONAL CONSIDERATIONS FOR YACHTS OF LESS THAN 500 GT

1 General Requirements (Sec 1)

1.1 Fuels

1.1.1 With reference to Sec 1, [2.9] with reference to the use of fuel oil having flash points of less than 43°C the arrangement is considered by the Society on a case by case basis.

1.2 Communications

1.2.1 With reference to Sec 1, [3.8.1] these requirements may be relaxed at the Society's discretion, in any case at least one fixed means of voice communication is to be provided for communicating orders from the wheelhouse to the position in the machinery space or in the control room from which the speed and the direction of the thrust of the propellers are controlled.

2 Shafting arrangement (Sec 7)

2.1 Propeller shaft

2.1.1 *(1/1/2025)* With reference to Sec 7, [2.2.3] as an alternative kp may be taken as 1,04.

2.2 Intermediate and propeller Shafts made of Corrosion resisting material

2.2.1 With reference to Sec 7, [2.2.3] for yachts of less than 300GT as an alternative [2.1.2] may be applied.
Proposal to use the formula in [2.1.2] for yachts between 300GT and 500GT will be evaluated on a case by case base by the Society.

2.2.2 Corrosion-resistant shaft materials *(1/1/2025)*
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 13);

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 strength in torsional shear (N/mm^2) (see Tab 13).

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 by Tasneef ~~for approval,~~ axial ~~and torsional~~ shaft vibration analysis is also to be submitted for approval;

b) the span between two consecutive supports of the shaft is to be not more than the value given by the formula as indicated in [2.1.3];

c) the ratio between shaft diameter and propeller diameter is to be, in general, not more than 14:1;

d) the length of the cone shaft is to be verified in order to check that the sectional area of the key is not less than the value in mm^2 given by the formula given in [2.1.5];

e) a visual inspection of the entire shaft is required at every intermediate survey, and an inspection with a non-destructive system may be requested by the Tasneef Surveyor. **Table 1 :**

Values of factor K_m and R_t

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

2.2.3 Shaft bearing spacing

The maximum shaft bearing space is to be not more than the value given by the following formula:

$l = (0,7439 \times D)/N)^{1/2} \cdot (E/W_1)^{1/4}$

where:

l : maximum unsupported length (m);

D : shaft diameter (mm);

N : shaft speed (RPM);

E : modulus of elasticity of shaft material, in tension (MPa);

W_1 : shaft material specific weight (kg/dm^3).

The minimum required spacing for rigid bearings is to exceed 20 shaft diameters when possible, to facilitate the alignment.

2.2.4 Shaft bearing spacing

With reference to Sec 7, [2.5.5] b) as an alternative [2.1.5] may be applied.

2.2.5 Propeller shaft keys and keyways

The sectional area of the key subject to shear stress is to be not less than the value A, in mm^2, given by the following formula:

$$A = 155 \cdot \frac{d^3}{\sigma_t \cdot d_{PM}}$$

where:

d : is the Rule diameter calculated according to the formula in Sec 7, [2.2.2].

In any case R_m is to be assumed equal to 400 N/mm^2.

d_{pm} : is the diameter, in mm, of the cone at the middle length of the key

σ_t : is the specified minimum tensile strength (UTS) of the key material, in N/mm^2.

The effective area in crushing of key, shaft or boss is to be not less than:

$$A = 24 \cdot \frac{d^3}{\sigma_y \cdot d_{PM}}$$

where:

d : is the Rule diameter calculated according to the formula in Sec 7, [2.2.2].
In any case R_m is to be assumed equal to 400 N/mm^2.

d_{pm} : is the diameter, in mm, of the cone at the middle length of the key

σ_y : is the yield strength of the key, shaft boss material as appropriate, in N/mm^2.

3 Propellers

3.1 Propeller blade thickness

3.1.1 With reference to Sec 8 the value of propeller thicknesses in Sec 8, [2.2], [2.3] and [2.4] may be multiplied by 0.88.

4 Shaft vibrations

4.1 General

4.1.1 With reference to Sec 9, shaft vibrations are required only when the formula in [2.1.2] is applied to shafts made of corrosion resisting material.

5 Piping

5.1 Conditions of use of metallic materials

5.1.1 With reference to Sec 10, Tab 4: Conditions of use of metallic materials in piping systems.

Aluminium and aluminium alloys may be accepted in the engine spaces provided that they are suitably protected against the effect of heat for the following services:

- flammable oil systems
- sounding and air pipes of fuel oil tanks
- fire-extinguishing systems
- bilge system
- scuppers and overboard discharges.

Outside the engine spaces, proposals for the use of aluminium and aluminium alloy pipes may be accepted considering the fire risk of the compartment where such pipes are fitted.

In addition, for the above services in engine spaces the minimum thickness of such pipes is to be not less than 4 mm.

For scuppers and overboard discharges the above insulation and the above required thickness may be omitted provided that they are fitted at their ends with closing means operated from a position above the main deck.

5.2 Use of welded and threaded metallic joints

5.2.1 With reference to Sec 10, Tab 15: Use of welded and threaded metallic joints in piping systems

a) Sleeve tapered threaded joint are acceptable on pipes of class II and III with outside diameter of not more than 80mm.

b) Sleeve parallel threaded joint are acceptable on pipes of class III with outside diameter of not more than 80mm.

5.3 Mechanical Joints

5.3.1 With reference to Sec 10, Tab 16: Application of mechanical joints.

For scuppers, slip-on joints may be accepted if they are located in an easily accessible position provided that the scuppers are fitted at their ends with closing means operated from a position above the main deck; the relevant fire resistance will be considered on the basis of the fire risk of the compartment where they are fitted. As an alternative, closing means operated from a position above the main deck are not required if the slip-on joints are fitted above the water level of maximum immersion and additional supporting devices for the scupper pipe are fitted near the ends of the slip-on joint.

5.4 Flexible hoses

5.4.1 With reference to Sec 10, [2.51]: Flexible hoses.

Only for yachts on composite material of less than 300 GT in short range navigation hydraulic oil for not essential systems in machinery space and outside of machinery spaces and also for essential systems only outside the machinery spaces of category A the Society may evaluate on a case by case basis, taking into account the probability and consequences of failure due to the position and the arrangement, the use of flexible hoses for long lengths or even the entire length of the system.

5.4.2 For yachts of less than 100GT in short range navigation in some systems flexible hoses may be used for the entire length in accordance with Tab 2~~1~~. Fire endurance of such flexible pipe is to be determined according to Tab 1.

Table 2 : For the fire endurance test of non metallic flexible hoses for yachts having GT<100, in short range navigation *(1/1/2025)*

Piping system	Location		
	Machinery spaces **(3) (4)**	Accommodation, service and control spaces **(5)**	Open decks
FLAMMABLE LIQUIDS (FLASHPOINT > 60°C)			
Fuel Oil	FTML	FTML	FTML
Lubricating Oil	FTML	FTML	FTML
FLAMMABLE LIQUIDS (FLASHPOINT > 150°C)			
Hydraulic Oil	FT	0	0
Hydraulic Steering Gear Oil	FTML	0	0 **(2)**
SEA WATER **(10)**			
Cooling Water, Essential Services	FT	FT	FT
Ballast	FT	FT	FT
FIRE SYSTEM **(10)**			
Fire Main And Water Spray	M	M	M

(1) Pipes fitted below the heaviest water level, and connected to sea inlet and overboard discharge are to be metallic structural pipes.

(2) Flexible hoses for hydraulic steering gear can be accepted on open deck if protected against mechanical damage by casing or equivalent means.

(3) Machinery spaces of category A are defined in Ch 4, Sec 1, [1.15].

(4) Spaces, other than category A machinery spaces, 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.

(5) Accommodation spaces, service spaces and control stations are defined in Ch 4, Sec 1, [1.1.1], [1.23], [1.9].

(6) Non-metallic flexible hoses are allowed only for the marine-engine wet-exhaust system.

(7) Exhaust gas pipes fitted below 1000 mm height from the water level, if no valve or overboard discharge is provided, are to be metallic structural pipes.

(8) For scuppers and draining coming from the open deck, M 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.

SYMBOLS:

FT: the fire endurance test is to be carried out according to ISO 15540 and ISO 15541

FTML: in addition to the fire endurance test carried out according to ISO 15540 and ISO 15541, the flexible hose shall be used for short length, normally not more than 800 mm, a different length may be accepted if indicated in the relevant Certificates, and shall be placed in sight in well-lighted spaces.

M: for the services, the space and position indicated, only metallic non-flexible pipes can be fitted: the use of flexible hoses is not allowed

EG: tests on non-metallic flexible hoses for engine exhaust gas are to be carried out according to ISO 13363

0: fire endurance tests not required

NA: flexible hoses are not allowed for the services and the space indicated.

Piping system	Location		
	Machinery spaces **(3) (4)**	Accommodation, service and control spaces **(5)**	Open decks
Foam System	FTML	FTML	FTML
Sprinkler System	M	M	M
Bilge Main And Branches	FTML	FTML	0
FRESH WATER			
Cooling Water, Essential Services	FT	FT	FT
Non-Essential Systems	0	0	0
SANITARY, DRAINS, SCUPPERS			
Deck Drains (Internal)	FT	0	0
Sanitary Drains (Internal)	0	0	0
Scuppers And Discharges (Overboard): Fitted below heaviest water level	M	M	M
Scuppers And Discharges (Overboard): Fitted above heaviest water level	M **(8)**	M **(8)**	M **(8)**
SOUNDING, AIR			
Sounding pipes	NA	NA	NA
Water Tanks, Dry Spaces - air pipes	NA	NA	NA
Oil Tanks (FlashPoint > 60°C) - air pipes	M	M	M
Control Air	FT	FT	FT
Service Air	0	0	0
(Non-Essential)	0	0	0

(1) Pipes fitted below the heaviest water level, and connected to sea inlet and overboard discharge are to be metallic structural pipes.

(2) Flexible hoses for hydraulic steering gear can be accepted on open deck if protected against mechanical damage by casing or equivalent means.

(3) Machinery spaces of category A are defined in Ch 4, Sec 1, [1.15].

(4) Spaces, other than category A machinery spaces, 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.

(5) Accommodation spaces, service spaces and control stations are defined in Ch 4, Sec 1, [1.1.1], [1.23], [1.9].

(6) Non-metallic flexible hoses are allowed only for the marine-engine wet-exhaust system.

(7) Exhaust gas pipes fitted below 1000 mm height from the water level, if no valve or overboard discharge is provided, are to be metallic structural pipes.

(8) For scuppers and draining coming from the open deck, M 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.

SYMBOLS:

FT: the fire endurance test is to be carried out according to ISO 15540 and ISO 15541

FTML: in addition to the fire endurance test carried out according to ISO 15540 and ISO 15541, the flexible hose shall be used for short length, normally not more than 800 mm, a different length may be accepted if indicated in the relevant Certificates, and shall be placed in sight in well-lighted spaces.

M: for the services, the space and position indicated, only metallic non-flexible pipes can be fitted: the use of flexible hoses is not allowed

EG: tests on non-metallic flexible hoses for engine exhaust gas are to be carried out according to ISO 13363

0: fire endurance tests not required

NA: flexible hoses are not allowed for the services and the space indicated.

Piping system	Location		
	Machinery spaces **(3) (4)**	Accommodation, service and control spaces **(5)**	Open decks
Brine	0	0	0
ENGINE EXHAUST GAS			
Exhaust piping provided with valve on overboard discharge	EG **(6)**	NA	NA
Exhaust piping with no valve on overboard discharge: FITTED BELOW 1000 mm height from heaviest water level	M **(7)**	M **(7)**	NA
Exhaust piping with no valve on overboard discharge: FITTED AT OR ABOVE 1000 mm height from heaviest water level	EG **(6)**	EG **(6)**	NA

(1) Pipes fitted below the heaviest water level, and connected to sea inlet and overboard discharge are to be metallic structural pipes.

(2) Flexible hoses for hydraulic steering gear can be accepted on open deck if protected against mechanical damage by casing or equivalent means.

(3) Machinery spaces of category A are defined in Ch 4, Sec 1, [1.15].

(4) Spaces, other than category A machinery spaces, 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.

(5) Accommodation spaces, service spaces and control stations are defined in Ch 4, Sec 1, [1.1.1], [1.23], [1.9].

(6) Non-metallic flexible hoses are allowed only for the marine-engine wet-exhaust system.

(7) Exhaust gas pipes fitted below 1000 mm height from the water level, if no valve or overboard discharge is provided, are to be metallic structural pipes.

(8) For scuppers and draining coming from the open deck, M 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.

SYMBOLS:

FT: the fire endurance test is to be carried out according to ISO 15540 and ISO 15541

FTML: in addition to the fire endurance test carried out according to ISO 15540 and ISO 15541, the flexible hose shall be used for short length, normally not more than 800 mm, a different length may be accepted if indicated in the relevant Certificates, and shall be placed in sight in well-lighted spaces.

M: for the services, the space and position indicated, only metallic non-flexible pipes can be fitted: the use of flexible hoses is not allowed

EG: tests on non-metallic flexible hoses for engine exhaust gas are to be carried out according to ISO 13363

0: fire endurance tests not required

NA: flexible hoses are not allowed for the services and the space indicated.

5.5 Through hull fitting

5.5.1 When on composite vessels the passage through the hull of sea inlets and overboard discharges is designed with a metallic cylindrical system, provided with flanges fixed or screwed, or a short pipe is fitted between the side valve and the hull, and directly welded to the plating, the minimum wall thickness of the stem/pipe is indicated in Tab 3~~2~~.

A different wall thickness may be considered by the Society on a case-by-case basis, provided that it complies with recognised standards.

Where the through hull fittings are built in metals resistant to corrosion, or are protected against corrosion by means of coating, etc., thickness may be reduced at the discretion of the Society (as reference see Tab 4~~3~~, Tab 5~~4~~ and Tab 6~~5~~.

The through hull fitting is to be type approved based on strength test agreed with the Society.

Chapter 2
ELECTRICAL INSTALLATIONS

SECTION 1 GENERAL

1 Application

1.1 General

1.1.1 The requirements of this Chapter apply to electrical installations on yachts. In particular, they apply to the components of electrical installations for:

- primary essential services
- secondary essential services
- services for habitability and air conditioning.

The other parts of the installation are to be so designed as not to introduce any risks or malfunctions to the above services.

1.2 References to other regulations and standards

1.2.1 The Society may refer to other regulations and standards when deemed necessary. These include the IEC publications, notably the IEC 60092 series and ISO standards.

1.2.2 When referred to by the Society, publications by the International Electrotechnical Commission (IEC) or other internationally recognised standards, are those currently in force at the date of agreement for classification.

2 Documentation to be submitted

2.1

2.1.1 The documents listed in Tab 1 are to be submitted.

The list of documents requested is to be intended as guidance for the complete set of information to be submitted, rather than an actual list of titles.

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the system, equipment or components.

Unless otherwise agreed with the Society, documents for approval are to be sent in triplicate if submitted by the yard and in four copies if submitted by the equipment supplier.

Documents requested for information are to be sent in duplicate.

In any case, the Society reserves the right to require additional copies when deemed necessary.

2.1.2

In addition to the documentation listed in Tab 1, a FMEA, carried out according to the Tasneef "Guide for Failure mode and Effect Analysis" or other equivalent methods, and a Test Program, identifying the tests to be carried out in order to verify the assumptions and conclusions of the FMEA, may be requested for approval for the following systems where applicable (see Note 1):

- steering gear control system;
- electric propulsion control system;
- remote emergency stop/shutdown arrangements for systems which may support the propagation of fire and/or explosion;

The FMEA may be requested by the Society for other systems on a case by case basis, depending on their influence on the overall safety.

Note 1: where the modes of failure and their consequences are clearly identifiable from the relevant drawings the Society may waive this request.

2.1.3

When an alteration or addition to an existing installation is proposed, updated plans are to be submitted for approval. As a minimum a technical specification, schematic diagrams and a proposed list of tests to be carried out onboard at the presence of the Tasneef Surveyor are to be included.

2.1.4

Where computer based systems are implemented and used to control the electrical installation, or to provide safety functions in accordance with the requirements of this Chapter (e.g. electric propulsion, steering gear, emergency safety systems etc.), the arrangements are to satisfy the applicable requirements of Chapter 3.

3 Definitions

3.1 General

3.1.1 Unless otherwise stated, the terms used in this Chapter have the definitions laid down by the IEC standards.

The definitions given in the following requirements also apply.

3.2 Essential services

3.2.1 Essential services are those services essential for propulsion and steering, and the safety of the , and services to ensure minimum comfortable conditions of habitability.

Table 1 : Documents to be submitted

No.	I/A **(1)**	Documents to be submitted	Notes
GENERAL			
1	A	Single line diagram of main and emergency electric distribution systems.	The drawing is to include the single line diagram of: • the main switchboard and all the feeders connected to the main switchboard • the emergency switchboard and all feeders connected to the emergency switchboard • interconnector feeder between main switchboard and emergency switchboard • the main and emergency source of electrical power (i.e. generators and/or batteries and any additional source of power) • any distribution boards and motor control centers (MCC) • the main and emergency lighting distribution • transformers, converters and similar appliance which constitute an essential part of the electrical supply system • uninterruptible power system units (UPS) when providing an alternative power supply to essential services and/or when providing an alternative power supply or transitional power supply, if any, to the emergency services.
2	A	Electrical power balance (main and emergency supply including transitional source of emergency power, when required)..	The load balance of the main supply is to include the operating modes in which the yacht is intended to operate.
(1) A: to be submitted for approval I: to be submitted for information			

No.	I/A **(1)**	Documents to be submitted	Notes
3	I	Calculation of short-circuit currents for installation in which the sum of rated power of the energy sources which may be connected contemporaneously to the network is greater than 500 kVA.	The calculation is to include the short circuit currents at: • the main switchboard(s) • the emergency switchboard • all the distribution boards and MCC including those fed from transformers. Document is to include details of circuit breaker and fuse operating times and discrimination curves.
4	A	List of circuits including, for each supply and distribution circuit, data concerning the nominal current, the cable type, length and cross-section, nominal and setting values of the protective and control devices.	Main switchboard, emergency switchboards, each distribution board, motor control centers (MCC) and UPS and/or battery distribution.
5	A	Single line diagram and detailed wiring diagram of the main switchboard	
6	A	Single line diagram and detailed wiring diagram of the emergency switchboard.	
7	A	Single line diagram and detailed wiring diagram of the main distribution boards, and motor control centers.	Main distribution boards and motor control centers are intended as boards which are supplied directly or through transformer by main or emergency switchboard
8	A	Diagram and arrangement of the general emergency alarm system, the public address system and other intercommunication systems.	
9	A	A functional diagram of the distribution board specially reserved for the navigation lights.	
10	I	Schedule for recording of the type, location and maintenance cycle of batteries used for essential and emergency services.	Reference is to be made to the requirements of Sec 3, [11.1.1].
11	A	For electrical propulsion installations: -single line diagram of power distribution -single line diagram of control system and its power supply diagram, -wiring diagrams of power and control switchboards, -alarm and monitoring system technical specification, including list of alarms and monitoring points and its power supply diagram, -safety system including the list of monitored parameters and its power supply diagram.	For control alarm and safety system see Chapter 3.
12	A/I	For BATTERY POWERED yachts documents required by App 2, Tab 1 and for FUEL CELL POWERED yaht, documents required by App 3, Tab 1.	
13	A	A Single line diagram and a wiring diagram of the electric power circuits for steering gear	Reference is to be made to the requirements of Ch 1, Sec 11, [2.3], [2.4], [3] & [4]. For control alarm and safety system see Chapter 3
14	A	Electrical diagram of local application fixed gas fire-extinguishing systems.	Reference is to be made to the requirements of Ch 4, Sec 1, [7.1.2]
15	A	Electrical diagrams of power control and position indication circuits of watertight doors	

(1) A: to be submitted for approval
I: to be submitted for information

No.	I/A **(1)**	Documents to be submitted	Notes
16	I	General arrangement plan of the yacht showing location of main items of the electrical system	The plan is to include: • main switchboard(s) and emergency switchboard • main source of power including battery rooms, if any • emergency source of power and transitional source of power (where required by the applicable rules) • distribution boards supplying primary and secondary essential services • UPS or batteries serving primary and secondary essential services and emergency services • major equipment serving propulsion (e.g. motors, transformers, converter, etc.)
17	A	A functional diagram of uninterruptible power supply (UPS) for essential services, emergency services.	Reference is to be made to Sec 7, [3].
18	A	Plan of hazardous areas, where applicable	
19	A	Electrical diagram of the automatic fire detection and alarm systems and manually operated call points.	
20	A	Electrical diagram of the fixed gas fire-extinguishing systems.	
21	A	Electrical diagram of the sprinkler systems.	
22	A	Electrical diagram of power control and position indication circuits for fire doors.	
23	A	Diagram of the remote stop system (ventilation, fuel pumps, etc.).	

(1) A: to be submitted for approval
I: to be submitted for information

3.3 Primary essential services

3.3.1 *(1/1/2025)* Primary essential services are those which need to be in continuous operation to maintain propulsion and steering.

Examples of equipment for primary essential services are the following:

- Steering gear
- Pumps for controllable pitch propellers
- Scavenging air blowers, fuel oil supply pumps, fuel valve cooling pumps, lubricating oil pumps and cooling water pumps for main and auxiliary engines and turbines necessary for the propulsion
- Azimuth thrusters which are the sole means for propulsion/steering with lubricating oil pumps, cooling water pumps
- Electrical equipment for electric propulsion plant with lubricating oil pumps and cooling water pumps
- Electric generators and associated power sources supplying the above equipment
- Hydraulic pumps supplying the above equipment
- ~~Viscosity control equipment for heavy fuel oil~~
- Control, monitoring and safety devices/systems for equipment for primary essential services
- Speed regulators dependent on electrical energy for main or auxiliary engines necessary for propulsion.

The main lighting system for those parts of the yacht normally accessible to and used by personnel and passengers is also considered (included as) a primary essential service.

3.4 Secondary essential services

3.4.1 *(1/1/2025)* Secondary essential services are those services which need not necessarily be in continuous operation to maintain propulsion and steering but which are necessary for maintaining the vessel's safety.

Examples of equipment for secondary essential services are the following:

- Windlasses
- Fuel oil transfer pumps and fuel oil treatment equipment
- Lubrication oil transfer pumps and lubrication oil treatment equipment
- ~~Preheaters for heavy fuel oil~~
- Sea water pumps
- Starting air and control air compressors
- Bilge, ballast and heeling pumps
- Fire pumps and other fire-extinguishing medium pumps
- Ventilation fans for engine ~~and boiler~~ rooms
- ~~Services considered necessary to maintain dangerous cargo in a safe condition~~
- Navigation lights, aids and signals
- Internal safety communication equipment
- Fire detection and alarm systems
- Electrical equipment for watertight closing appliances
- Electric generators and associated power supplying the above equipment
- Hydraulic pumps supplying the above equipment
- ~~Control, monitoring and safety for cargo containment systems~~
- Control, monitoring and safety devices/systems for equipment for secondary essential services.

3.4.2 Services for habitability are those which need to be in operation to maintain the vessel's minimum comfort conditions for people on board.

Examples of equipment for maintaining conditions of habitability:

- Cooking
- Heating
- Domestic refrigeration
- Mechanical ventilation
- Sanitary and fresh water
- Electric generators and associated power sources supplying the above equipment.

3.5 Safety voltage

3.5.1 A voltage which does not exceed 50 V a.c. r.m.s. between conductors, or between any conductor and earth, in a circuit isolated from the supply by means such as a safety isolating transformer.

3.5.2 A voltage which does not exceed 50 V d.c. between conductors or between any conductor and earth in a circuit isolated from higher voltage circuits.

3.6 Low-voltage systems

3.6.1 Alternating current systems with rated voltages greater than 50 V r.m.s. up to 1000 V r.m.s. inclusive and direct current systems with a maximum instantaneous value of the voltage under rated operating conditions greater than 50 V up to 1500 V inclusive.

3.7 High-voltage systems

3.7.1 Alternating current systems with rated voltages greater than 1000 V r.m.s. and direct current systems with a maximum instantaneous value of the voltage under rated operating conditions greater than 1500 V.

3.8 Basic insulation

3.8.1 Insulation applied to live parts to provide basic protection against electric shock.

Note 1: Basic insulation does not necessarily include insulation used exclusively for functional purposes.

The first characteristic numeral indicates the temperature range in which the electrical equipment operates satisfactorily, as specified in Tab 4

The second characteristic numeral indicates the vibration level in which the electrical equipment operates satisfactorily, as specified in Tab 5.

3.27.2 The tests for verifying the additional and supplementary letters and the characteristic numeral of the environmental categories are defined in Ch 3, Sec 6.

3.28 Navigation Light (NL)

3.28.1

Navigation Light (NL) means the following lights:

- masthead light, sidelights, sternlight, towing light, all-round light, flashing light as defined in Rule 21 of COLREGs (see Note 1),
- all-round flashing yellow light required for air-cushion vessels by Rule 23 of COLREGs,
- manoeuvring light required by Rule 34(b) of COLREGs.

Note 1:

COLREGs means Convention on the International Regulations for Preventing Collisions at Sea, 1972, including their annexes.

Table 2 : EC Code

Code letter	First characteristic numeral	Second characteristic numeral	Additional letter	Supplementary letter
EC	(numerals 1 to 4)	(numerals 1 to 3)	(letter S) **(1)**	(letter C) **(2)**
(1) The additional letter S indicates the resistance to salt mist (exposed decks, masts) of the electrical equipment. **(2)** The supplementary letter C indicates the relative humidity up to 80% (air conditioned areas) in which the electrical equipment operates satisfactorily.				

Table 3 : First characteristic numeral *(1/1/2025)*

First characteristic numeral	Brief description of location	Temperature range °C	
1	Air conditioned areas	+ 5	+ 40
2	Enclosed spaces	+ 5	+ 45
3a	Electronic equipment inside consoles, housing, etc..	+ 5	+ 55
3b	Close to combustion engines~~, boilers~~ and similar	+ 5	+ 70
4	Exposed decks, masts	- 25	+ 45

Table 4 : Second characteristic numeral *(1/1/2025)*

Second characteristic numeral	Brief description of location	Frequency range Hz	Displacement amplitude mm	Acceleration amplitude g
1	Machinery spaces, command and control stations, accommodation spaces, exposed decks~~, cargo spaces~~	from 2,0 to 13,2 from 13,2 to 100	1,0 -	- 0,7
2	Masts	from 2,0 to 13,2 from 13,2 to 50	3,0 -	- 2,1
3	On air compressors, on diesel engines and similar	from 2,0 to 25,0 from 25,0 to 100	1,6 -	- 4,0

SECTION 2 GENERAL DESIGN REQUIREMENTS

1 Environmental conditions

1.1 General

1.1.1 The electrical components of installations are to be designed and constructed to operate satisfactorily under the environmental conditions on board.

In particular, the conditions shown in the tables in this Article are to be taken into account.

Note 1: The environmental conditions are characterised by:

- one set of variables including climatic conditions (e.g. ambient air temperature and humidity), biological conditions, conditions dependent upon chemically active substances (e.g. salt mist) or mechanically active substances (e.g. dust or oil), mechanical conditions (e.g. vibrations or inclinations) and conditions dependent upon electromagnetic noise and interference, and
- another set of variables dependent mainly upon location on vessels, operational patterns and transient conditions.

1.2 Ambient air temperatures

1.2.1

For yachts classed for unrestricted navigation, the reference ambient air temperature ranges are shown in Tab 1 in relation to the various locations of installation.

1.2.2

Where electrical equipment is installed within environmentally controlled spaces, the ambient temperature for which the equipment is to be suitable may be reduced from 45° and maintained at a value not less than 35° provided:

- the equipment is not for use for emergency services.
- temperature control is achieved by at least two cooling units so arranged that in the event of loss of one cooling unit, for any reason, the remaining unit(s) is (are) capable of satisfactorily maintaining the design temperature.
- the equipment is able to be initially set to work safely up to a 45° ambient temperature until such time as the lower ambient temperature is achieved; the cooling equipment is to be rated for a 45 ° ambient temperature.
- audible and visual alarms are fitted, at a continually manned control station, to indicate any malfunction of the cooling units.

1.2.3

In accepting an ambient temperature less than 45° it is to be ensured that electrical cables are adequately rated throughout their length for the maximum ambient temperature to which they are exposed.

1.2.4

The equipment used for cooling and maintaining the lower ambient temperature is to be classified for a secondary essential service.

1.2.5 For yachts classed to operate in specific zones, the Society may accept different ambient air temperature (e.g. for s operating outside the tropical belt, the maximum ambient air temperature may be assumed as equal to + 40 °C instead of + 45 °C).

Table 1 : Ambient air temperature *(1/1/2025)*

Location	Temperature range, in °C	
Enclosed spaces	+ 5	+ 45
Electronic equipment inside console, housing, etc.	+ 5	+ 55
Fitted on combustion engine~~s, boilers~~ and similar	+ 5	+ 70
Exposed decks	- 25	+ 45

2.1.2
Unless otherwise stated in national or international standards, all equipment is to operate satisfactorily with the variations from its rated value shown in Tab 6 to Tab 8 subject to the following conditions.

a) For alternating current components, the voltage and frequency variations shown in Tab 6 are to be assumed.

b) For direct current components supplied by d.c. generators or converted by rectifiers, the voltage variations shown in Tab 7 are to be assumed.

c) For direct current components supplied by electrical batteries, the voltage variations shown in Tab 8 are to be assumed.

2.1.3
Any special system, e.g. electronic circuits, whose function cannot operate satisfactorily within the limits shown in Tab 6, Tab 7 and Tab 8 is not to be supplied directly from the system but by alternative means, e.g. through stabilised supply.

2.2 Harmonic distortions

2.2.1 For components intended for systems without substantially static converter loads and supplied by synchronous generators, it is assumed that the total voltage harmonic distortion does not exceed 5%, and the single harmonic does not exceed 3% of the nominal voltage.

2.2.2 For components intended for systems fed by static converters, and/or systems in which the static converter load predominates, it is assumed that:

- the single harmonics do not exceed 5% of the nominal voltage up to the 15th harmonic of the nominal frequency, decreasing to 1% at the 100th harmonic (see Fig 1), and that
- the total harmonic distortion does not exceed 10%.

Table 4 : Inclination

Type of machinery, equipment or component	Angles of inclination, in degrees **(1)**			
	Athwart		Fore-and-aft	
	static	dynamic(3)	static	dynamic(4)
Machinery and equipment relative to main electrical power installation	15	22,5	5	7,5
Machinery and equipment relative to the emergency power installation and crew and passenger safety systems of the yacht (e.g. emergency source of power, emergency fire pumps, etc.)	22,5	22,5	10	10
Switchgear and associated electrical and electronic components and remote control systems (2)	22,5	22,5	10	10

(1) Athwart and fore-and-aft angles may occur simultaneously in their most unfavourable combination.
(2) No undesired switching operations or functional changes are to occur.
(3) The period of dynamic inclination may be assumed equal to 10 s.
(4) The period of dynamic inclination may be assumed equal to 5 s.

Table 5 : Vibration levels *(1/1/2025)*

Location	Frequency range Hz	Displacement amplitude mm	Acceleration amplitude g
Machinery spaces, command and control stations, accommodation spaces, exposed decks~~, cargo spaces~~	from 2,0 to 13,2 from 13,2 to 100	1,0 -	- 0,7
On air compressors, on diesel engines and similar	from 2,0 to 25,0 from 25,0 to 100	1,6 -	- 4,0
Masts	from 2,0 to 13,2 from 13,2 to 50	3,0 -	- 2,1

SECTION 3 SYSTEM DESIGN

1 Supply systems and characteristics of the supply

1.1 Supply systems

1.1.1 The following distribution systems may be used:

a) on d.c. installations:
- two-wire insulated
- two-wire with one pole earthed

b) on a.c. installations:
- three-phase three-wire with neutral insulated
- three-phase three-wire with neutral directly earthed or earthed through an impedance
- three-phase four-wire with neutral directly earthed or earthed through an impedance
- single-phase two-wire insulated
- single-phase two-wire with one phase earthed.

1.1.2 Distribution systems other than those listed in [1.1.1] (e.g. with hull return, three-phase four-wire insulated) will be considered by the Society on a case by case basis.

1.1.3 The hull return system of distribution is not to be used for power, heating or lighting.

1.1.4 The requirement of [1.1.3] does not preclude under conditions approved by the Society the use of:

a) impressed current cathodic protective systems,

b) limited and locally earthed systems, or

c) insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavourable conditions.

Note 1: Limited and locally earthed systems such as starting and ignition systems of internal combustion engines are accepted provided that any possible resulting current does not flow directly through any dangerous spaces.

1.1.5 For the supply systems in HV Installations, see Sec 13.

1.2 Maximum voltages

1.2.1 The maximum voltages for both alternating current and direct current low-voltage systems of supply for the yacht's services are given in Tab 1.

Note 2: A 'blackout situation' means that the main and auxiliary machinery installations, including the main power supply, are out of operation but the services for bringing them into operation (e.g. compressed air, starting current from batteries etc.) are available.

2.2.11

Where transformers, converters or similar appliances constitute an essential part of the electrical supply system, the system is to be so arranged as to ensure the same continuity of supply as stated in this sub-article [2.2].

This may be achieved by arranging at least two three-phase or three single-phase transformers supplied, protected and installed as indicated in Fig 1, so that with any one transformer not in operation, the remaining transformer(s) is (are) sufficient to ensure the supply to the services stated in [2.2.3].

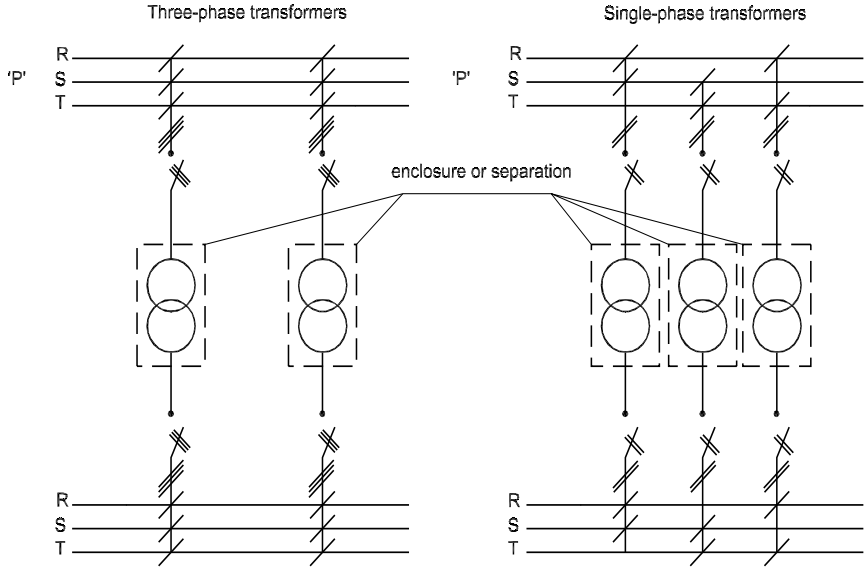
Each transformer required is to be located as a separate unit with separate enclosure or equivalent, and is to be served by separate circuits on the primary and secondary sides. Each of the primary circuits is to be provided with switchgears and protection devices in each phase. Each of the secondary circuits is to be provided with a multiple isolating switch.

Suitable interlocks or a warning label are to be provided in order to prevent maintenance or repair of one single-phase transformer unless both switchgears are opened on their primary and secondary sides.

2.2.12 For yachts intended for operation with periodically unattended machinery spaces, see Part F, Chapter 2.

2.2.13 For starting arrangements for main generating sets, see Ch 1, Sec 2, [5.1].

Figure 1



2.3 Emergency source of electrical power

2.3.1 A self-contained emergency source of electrical power shall be provided.

2.3.2 Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator may be used, exceptionally, and for short periods, to supply non-emergency circuits.

Exceptionally is understood to mean conditions, while the vessel is at sea, such as:

a) blackout situation

b) dead ship situation (when applicable)

c) routine use for testing

d) short-term parallel operation with the main source of electrical power for the purpose of load transfer.

Unless otherwise instructed by the Society, the emergency generator may be used during lay time in port for the supply of the yacht mains, provided the requirements of [2.4] are complied with.

2.3.3 The electrical power available shall be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously.

2.3.4 The emergency source of electrical power shall be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the services stated in [3.7.3] for the period specified, if they depend upon an electrical source for their operation.

2.3.5 The transitional source of emergency electrical power, where required, is to be of sufficient capacity to supply at least the services stated in [3.7.7] for half an hour, if they depend upon an electrical source for their operation.

2.3.6 An indicator shall be mounted in a suitable place on the main switchboard or in the machinery control room and at the navigating bridge to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of emergency electrical power referred to in [2.3.13] and [2.3.14] are being discharged.

2.3.7 If the services which are to be supplied by the transitional source receive power from an accumulator battery by means of semiconductor convertors, means are to be provided for supplying such services also in the event of failure of the convertor (e.g. providing a bypass feeder or a duplication of convertor).

2.3.8 *(1/1/2025)*
Where electrical power is necessary to restore propulsion, the capacity of the emergency source shall be sufficient to restore propulsion to the yacht in conjunction to other machinery as appropriate, from a dead ship condition.

For the purpose of this requirement only, the dead condition and blackout are both understood to mean a condition under which the main propulsion plant~~, boilers~~ and auxiliaries are not in operation and in restoring the propulsion, no stored energy for starting the propulsion plant, the main source of electrical power and other essential auxiliaries is to be assumed available. It is assumed that means are available to start the emergency generator at all times.

Emergency generator stored starting energy is not to be directly used for starting the propulsion plant, the main source of electrical power and/or other essential auxiliaries (emergency generator excluded).

2.3.9 Provision shall be made for the periodic testing of the complete emergency system and shall include the testing of automatic starting arrangements, where provided.

2.3.10 For starting arrangements for emergency generating sets, see Ch 1, Sec 2, [5.1].

2.3.11 The emergency source of electrical power may be either a generator or an accumulator battery which shall comply with the requirements of [2.3.12] or [2.3.13], respectively.

2.3.12 Where the emergency source of electrical power is a generator, it shall be:

a) driven by a suitable prime mover with an independent supply of fuel, having a flashpoint (closed cup test) of not less than 43°C;

b) started automatically upon failure of the main source of electrical power supply to the emergency switchboard unless a transitional source of emergency electrical power in accordance with (c) below is provided; where the emergency generator is automatically started, it shall be automatically connected to the emergency switchboard; those services referred to in [3.7.7] shall then be connected automatically to the emergency generator; and

c) provided with a transitional source of emergency electrical power as specified in [2.3.14] unless an emergency generator is provided capable both of supplying the services mentioned in that paragraph and of being automatically started and supplying the required load as quickly as is safe and practicable subject to a maximum of 45 s.

2.3.13 Where the emergency source of electrical power is an accumulator battery it shall be capable of:

a) carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage;

b) automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and

c) immediately supplying at least those services specified in [3.7.7].

2.3.14 The transitional source of emergency electrical power where required by [2.3.12] (item c) shall consist of an accumulator battery which shall operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be so arranged as to supply automatically in the event of failure of either the main or the emergency source of electrical power for half an hour at least the services in [3.7.7] if they depend upon an electrical source for their operation.

Figure 3

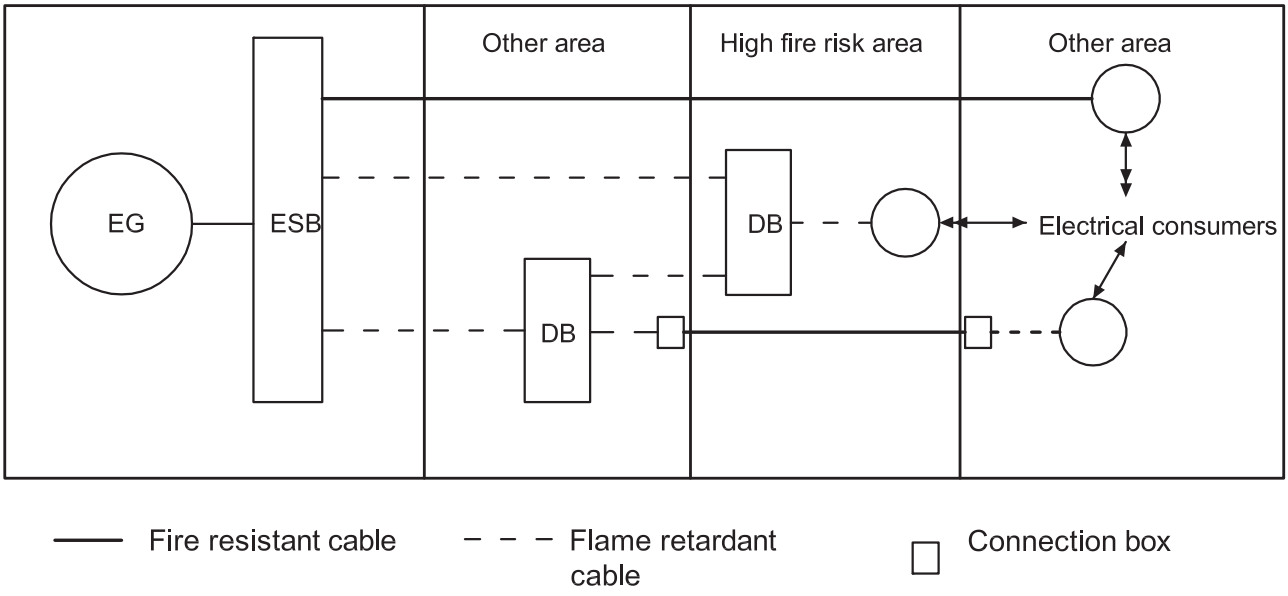


Table 3 : Maximum rated conductor temperature *(1/1/2025)*

Type of insulating compound	Abbreviated designation	Maximum rated conductor temperature, in °C	
		Normal operation	Short-circuit
a) Thermoplastic: - based upon polyvinyl chloride or copolymer of vinyl chloride and vinyl acetate	PVC~~/A~~	~~6~~70	150
b) Elastomeric or thermosetting: - based upon ethylene-propylene rubber or similar (EPM or EPDM) - based upon high modulus or hardgrade ethylene propylene rubber - based upon cross-linked polyethylene - based upon rubber silicon - based upon ethylene-propylene rubber or similar (EPM or EPDM) halogen free - based upon high modulus or hardgrade halogen free ethylene propylene rubber - based upon cross-linked polyethylene halogen free - based upon rubber silicon halogen free - based upon cross-linked polyolefin material for halogen free cable **(1)**	 EPR HEPR XLPE S 95 HF EPR HF HEPR HF XLPE HF S 95 HF ~~8~~905	 ~~85~~90 ~~85~~90 ~~85~~90 95 ~~85~~90 ~~85~~90 ~~85~~90 95 ~~85~~90	 250 250 250 350(2) 250 (2) 250 250 350 250

(1) Used on sheathed cable only

(2) This temperature is applicable only to power cables and not appropriate for tinned copper conductors

Table 4 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 60°C (ambient temperature 45°C) *(1/1/2025)*

Nominal section mm²	Number of conductors		
	1	2	3 or 4
~~1~~	~~8~~	~~7~~	~~6~~
1,5	~~12~~10	~~10~~9	~~8~~7
2,5	17	14	12
4	~~2~~232	~~19~~20	~~15~~16
6	29	25	20
10	40	34	28
16	54	46	38
25	71	60	50
35	~~87~~88	~~74~~75	~~61~~62

Nominal section mm²	Number of conductors		
	1	2	3 or 4
50	~~105~~110	~~89~~94	~~74~~77
70	135	115	95
95	~~165~~164	~~140~~139	~~116~~115
120	~~190~~189	~~162~~161	~~133~~132
150	~~220~~218	~~187~~185	~~154~~153
185	~~250~~248	~~213~~211	~~175~~174
240	~~290~~292	~~247~~248	~~203~~204
300	~~335~~336	~~285~~286	235
~~300~~400	~~335~~ d.c.:390 a.c.:380	~~285~~d.c.:332 a.c.:323	~~235~~d.c.:273 a.c.:266
~~300~~500	~~335~~ d.c.:450 a.c.:430	~~285~~d.c.:383 a.c.:366	~~235~~d.c.:315 a.c.:301
~~300~~600	~~335~~ d.c.:520 a.c.:470	~~285~~d.c.:442 a.c.:400	~~235~~d.c.:364 a.c.:329

Table 5 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 7~~5~~0°C (ambient temperature 45°C) *(1/1/2025)*

Nominal section mm²	Number of conductors		
	1	2	3 or 4
~~1~~	~~13~~	~~11~~	~~9~~
1,5	~~17~~15	~~14~~13	~~12~~11
2,5	~~24~~21	~~20~~18	~~17~~15
4	~~32~~29	~~27~~25	~~22~~20
6	~~41~~37	~~35~~31	~~29~~26
10	~~57~~51	~~48~~43	~~40~~36
16	~~76~~68	~~65~~58	~~53~~ 48
25	~~100~~90	~~85~~77	~~70~~ 63
35	~~125~~111	~~106~~ 94	~~88~~ 78
50	~~150~~138	~~128~~ 117	~~105~~97
70	~~190~~171	~~162~~145	~~133~~ 120
95	~~230~~207	~~196~~176	~~161~~145
120	~~270~~239	~~230~~203	~~189~~ 167
150	~~310~~275	~~264~~234	~~217~~193
185	~~350~~313	~~298~~266	~~245~~219
240	~~415~~369	~~353~~314	~~291~~258
300	~~475~~424	~~404~~360	~~333~~297
~~300~~400	~~475~~ d.c.:500 a.c.:490	~~404~~d.c.:425 a.c.:417	~~333~~d.c.:350 a.c.:343

Nominal section mm²	Number of conductors		
	1	2	3 or 4
3500	475d.c.:580 a.c.:550	404d.c.:493 a.c.:468	333d.c.:406 a.c.:385
3600	475d.c.:670 a.c.:610	404d.c.:570 a.c.:519	333d.c.:467 a.c.:427

Table 6 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 805°C (ambient temperature 45°C) *(1/1/2025)*

Nominal section mm²	Number of conductors		
	1	2	3 or 4
1	15	13	11
1,5	1921	168	13 5
2,5	2628	2224	1820
4	3538	3032	2527
6	4549	3842	32 34
10	6367	5457	4447
16	8491	7177	5964
25	110120	94102	7784
35	140148	119126	98104
50	165184	140156	116129
70	215228	183194	151160
95	260276	221235	182193
120	300319	255271	210223
150	340367	289312	238257
185	390418	332355	273293
240	460492	391418	322344
300	530565	450408	371396
4300	530d.c.:650 a.c.:630	450d.c.:553 a.c.:536	371d.c.:455 a.c.:441
5300	530d.c.:740 a.c.:680	450d.c.:629 a.c.:578	371d.c.:518 a.c.:476
6300	530 d.c.:840 a.c.:740	450d.c.:714 a.c.:629	371d.c.:588 a.c.:518

Table 7 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 8590°C (ambient temperature 45°C) *(1/1/2025)*

Nominal section mm²	Number of conductors		
	1	2	3 or 4
1	16	14	11
1,5	2023	1720	1416
2,5	2840	2426	2021
4	3851	3234	2728
6	4852	4144	3436

Nominal section mm²	Number of conductors		
	1	2	3 or 4
10	~~67~~72	~~57~~16	~~47~~50
16	~~90~~96	~~77~~82	~~63~~67
25	~~120~~127	~~102~~108	~~84~~89
35	~~145~~157	~~123~~133	~~102~~ 110
50	1~~80~~96	~~153~~167	~~126~~137
70	~~225~~242	~~191~~206	~~158~~169
95	~~275~~293	~~234~~249	~~193~~205
120	~~320~~339	~~272~~288	~~224~~237
150	3~~65~~89	3~~10~~31	~~256~~272
185	4~~15~~44	3~~53~~77	~~291~~311
240	~~490~~ 522	~~417~~444	~~343~~365
300	~~560~~601	~~476~~511	~~392~~421
4300	~~560~~ d.c.:690 a.c.:670	~~476~~d.c.:587 a.c.:570	~~392~~d.c.:483 a.c.:469
5300	~~560~~ d.c.:780 a.c.:720	~~476~~d.c.:663 a.c.:612	~~392~~d.c.:546 a.c.:504
6300	~~560~~ d.c.:890 a.c.:780	~~476~~d.c.:757 a.c.:663	~~392~~d.c.:623 a.c.:546

Table 8 : Current carrying capacity, in A in continuous service for cables based on maximum conductor operating temperature of 95°C (ambient temperature 45°C) *(1/1/2025)*

Nominal section mm²	Number of conductors		
	1	2	3 or 4
~~1~~	~~20~~	~~17~~	~~14~~
1,5	2~~4~~6	2~~0~~2	1~~7~~8
2,5	32	27	22
4	4~~2~~3	3~~6~~7	~~29~~30
6	55	47	39
10	7~~5~~6	6~~4~~5	53
16	10~~0~~2	8~~5~~7	7~~0~~1
25	135	115	95
35	16~~5~~6	14~~0~~1	116
50	20~~0~~8	17~~0~~7	140
70	25~~5~~6	21~~7~~8	179
95	310	264	217
120	3~~60~~59	30~~6~~5	25~~2~~1
150	41~~0~~2	3~~49~~50	28~~7~~8
185	470	400	329
240	5~~70~~35	4~~85~~70	3~~99~~87
300	6~~60~~36	5~~60~~41	4~~62~~45

Nominal section mm²	Number of conductors		
	1	2	3 or 4
4300	~~660~~ d.c.:760 a.c.:725	~~560~~d.c.:646 a.c.:616	~~462~~d.c.:532 a.c.:508
5300	~~660~~d.c.:875 a.c.:810	~~560~~d.c.:744 a.c.:689	~~462~~d.c.:612 a.c.:567
6300	~~660~~d.c.:1010 a.c.:900	~~560~~d.c.:859 a.c.:765	~~462~~d.c.:707 a.c.:630

8.9.6 Where a cable is intended to supply a short-time load for 1/2-hour or 1-hour service (e.g. mooring winches or bow thruster propellers), the current carrying capacity obtained from Tab 4 to Tab 8 may be increased by applying the corresponding correction factors given in Tab 10.

In no case is a period shorter than 1/2-hour to be used, whatever the effective period of operation.

8.9.7 For supply cables to single services for intermittent loads, the current carrying capacity obtained from Tab 4 to Tab 8 may be increased by applying the correction factors given in Tab 11.

The correction factors are calculated with rough approximation for periods of 10 minutes, of which 4 minutes with a constant load and 6 minutes without load.

8.10 Minimum nominal cross-sectional area of conductors

8.10.1 In general the minimum allowable conductor cross-sectional areas are those given in Tab 12.

8.10.2 The nominal cross-sectional area of the neutral conductor in three-phase distribution systems is to be equal to at least 50% of the cross-sectional area of the phases, unless the latter is less than or equal to 16 mm². In such case the cross-sectional area of the neutral conductor is to be equal to that of the phase.

8.10.3 For the nominal cross-sectional area of:

- earthing conductors, see Sec 12, [2.3]
- earthing connections for distribution systems, see Sec 12, [2.5].

8.11 Choice of cables

8.11.1 The rated voltage of any cable is to be not lower than the nominal voltage of the circuit for which it is used.

8.11.2 The nominal cross-sectional area of each cable is to be sufficient to satisfy the following conditions with reference to the maximum anticipated ambient temperature:

- the current carrying capacity is to be not less than the highest continuous load carried by the cable
- the voltage drop in the circuit, by full load on this circuit, is not to exceed the specified limits
- the cross-sectional area calculated on the basis of the above is to be such that the temperature increases which may be caused by overcurrents or starting transients do not damage the insulation.

8.11.3 The highest continuous load carried by a cable is to be calculated on the basis of the power requirements and of the diversity factor of the loads and machines supplied through that cable.

8.11.4 When the conductors are carrying the maximum nominal service current, the voltage drop from the main or emergency switchboard busbars to any point in the installation is not to exceed 6% of the nominal voltage.

For battery circuits with supply voltage less than 55 V, this value may be increased to 10%.

For the circuits of navigation lights, the voltage drop is not to exceed 5% of the rated voltage under normal conditions.

Table 9 : Correction factors for various ambient air temperatures (Reference ambient temperature of 45°C)
(1/1/2025)

Maximum conductor temperature, in °C	Correction factors for ambient air temperature of :										
	35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C	75°C	80°C	85°C
60	1,29	1,15	1,00	0,82	-	-	-	-	-	-	-
65	1.22	1.12	1.00	0.87	0.71	-	-	-	-	-	-
70	1.18	1.10	1.00	0.89	0.77	0.63	-	-	-	-	-
75	1,15	1,08	1,00	0,91	0,82	0,71	0,58	-	-	-	-
80	1,13	1,07	1,00	0,93	0,85	0,76	0,65	0,53	-	-	-
85	1,12	1,06	1,00	0,94	0,87	0,79	0,71	0,61	0,50	-	-
90	1.10	1.05	1.00	0.94	0.88	0.82	0.74	0.67	0.58	0.47	-
95	1,10	1,05	1,00	0,95	0,89	0,84	0,77	0,71	0,63	0,55	0,45

Table 10 : Correction factors for short-time loads

½ -hour service		1-hour service		
Sum of nominal cross-sectional areas of all conductors in the cable, in mm²		Sum of nominal cross-sectional areas of all conductors in the cable, in mm²		Correlation factor
Cables with metallic sheath and armoured cables	Cables with non-metallic sheath and non-armoured cables	Cables with metallic sheath and armoured cables	Cables with non-metallic sheath and non-armoured cables	
up to 20	up to 75	up to 80	up to 230	1,06
21-41	76-125	81-170	231-400	1,10
41-65	126-180	171-250	401-600	1,15
66-95	181-250	251-430	601-800	1,20
96-135	251-320	431-600	-	1,25
136-180	321-400	601-800	-	1,30
181-235	401-500	-	-	1,35
236-285	501-600	-	-	1,40
286-350	-	-	-	1,45

Table 11 : Correction factors for intermittent service

Sun of nominal cross selectionel areas of all conductors in the cable, in mm²		Correction factor
Cables with metallic sheath and armoured cables	Cables without metallic sheath and non-amoured cables	
	$S \leq 5$	1,10
	$5 < S \leq 8$	1,15
	$8 < S \leq 16$	1,20
$S \leq 4$	$16 < S \leq 825$	1,25
$4 < S \leq 7$	$25 < S \leq 42$	1,30
$7 < S \leq 17$	$42 < S \leq 72$	1,35
$17 < S \leq 42$	$72 < S \leq 140$	1,40
$42 < S \leq 110$	$140 < S$	1,45
$110 < S$	-	1,50

8.11.5 T9.11.4 Cables with conductors of cross-section less than 10 mm^2 are not to be connected in parallel.

9 Electrical installations in hazardous areas

9.1 Electrical equipment

9.1.1 No electrical equipment is to be installed in hazardous areas unless the Society is satisfied that such equipment is:

- essential for operational purposes,
- of a type which will not ignite the mixture concerned,
- appropriate to the space concerned, and
- appropriately certified for safe usage in the dusts, vapours or gases likely to be encountered.

9.1.2 Where electrical equipment of a safe type is permitted in hazardous areas it is to be selected with due consideration to the following:

a) risk of explosive dust concentration; see Sec 2, [6.2]:
   - degree of protection of the enclosure
   - maximum surface temperature

b) risk of explosive gas atmosphere; see Sec 2, [6.1]:
   - explosion group
   - temperature class.

9.1.3 Where electrical equipment is permitted in hazardous areas, all switches and protective devices are to interrupt all poles or phases and, where practicable, to be located in a non-hazardous area unless specifically permitted otherwise.

Such switches and equipment located in hazardous areas are to be suitably labelled for identification purposes.

9.1.4 For electrical equipment installed in Zone 0 hazardous areas, only the following types are permitted:

- certified intrinsically-safe apparatus Ex(ia)
- simple electrical apparatus and components (e.g. thermocouples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically-safe circuits of category “ia” not capable of storing or generating electrical power or energy in excess of limits stated in the relevant rules, and accepted by the appropriate authority
- equipment specifically designed and certified by the appropriate authority for use in Zone 0.

Table 12 : Minimum nominal cross-sectional areas

Service	Nominal cross-sectional area	
	external wiring mm^2	internal wiring mm^2
Power, heating and lighting systems	1,0	1,0
Control circuits for power plant	1,0	1,0
Control circuits other than those for power plant	0,75	0,5
Control circuits for telecommunications, measurement, alarms	0,5	0,2
Telephone and bell equipment, not required for the safety of the or crew calls	0,2	0,1
Bus and data cables	0,2	0,1

9.1.5 For electrical equipment installed in Zone 1 hazardous areas, only the following types are permitted:

- any type that may be considered for Zone 0
- certified intrinsically-safe apparatus Ex(ib)
- simple electrical apparatus and components (e.g. thermocouples, photocells, strain gauges, junction boxes, switching devices), included in intrinsically-safe circuits of category “ib” not capable of storing or generating electrical power or energy in excess of limits stated in the relevant rules, and accepted by the appropriate authority
- certified flameproof Ex(d)
- certified pressurised Ex(p)
- certified increased safety Ex(e)
- certified encapsulated Ex(m)
- certified sand filled Ex(q)
- certified specially Ex(s)
- through runs of cable.

9.1.6

For electrical equipment installed in Zone 2 hazardous areas, only the following types are permitted:

- any type that may be considered for Zone 1
- tested specially for Zone 2 (e.g. type “n” protection)
- pressurised, and accepted by the appropriate authority
- encapsulated, and accepted by the appropriate authority
- the type which ensures the absence of sparks and arcs and of “hot spots” during its normal operation (electrical equipment having an enclosure of at least IP55).

9.1.7 When apparatus incorporates a number of types of protection, it is to be ensured that all are suitable for use in the zone in which it is located.

9.1.8 Electrical equipment which is intended for use in explosive gas atmospheres or which is installed where flammable gases, va-pours or explosive dusts are liable to accumulate, such as in spaces containing petrol-powered machinery, petrol fuel tank(s), or joint fitting(s) or other connections between components of a petrol system, and in compartments or lockers containing LPG cylinders and or pressure regulators, is to conform to IEC 60079 series or equivalent standard

9.2 Electrical cables

9.2.1 Electrical cables are not to be installed in hazardous areas except as specifically permitted or when associated with intrinsically safe circuits.

9.2.2

All cables installed in Zone 0, Zone 1 and weather exposed areas classified Zone 2 are to be sheathed with at least one of the following:

a) a non-metallic impervious sheath in combination with braiding or other metallic covering

b) a copper or stainless steel sheath (for mineral insulated cables only).

9.2.3 All cables installed in non-weather exposed Zone 2 areas are to be provided with at least a non-metallic external impervious sheath.

9.2.4 Cables of intrinsically safe circuits are to have a metallic shielding with at least a non-metallic external impervious sheath.

9.2.5 The circuits of a category “ib” intrinsically safe system are not to be contained in a cable associated with a category “ia” intrinsically safe system required for a hazardous area in which only category “ia” systems are permitted.

9.3 Electrical installations in battery rooms

9.3.1

Only intrinsically safe apparatus and certified safe type lighting fittings may be installed in compartments assigned solely to large vented storage batteries; see Sec 11, [6.2.1].

The associated switches are to be installed outside such spaces.

Electric ventilator motors are to be outside ventilation ducts and, if within 3 m of the exhaust end of the duct, they are to be of an explosion-proof safe type. The impeller of the fan is to be of the non-sparking type.

Overcurrent protective devices are to be installed as close as possible to, but outside of, battery rooms.

Electrical cables other than those pertaining to the equipment arranged in battery rooms are not permitted.

Electrical equipment for use in battery rooms is to have minimum explosion group IIC and temperature class T1.

9.3.2 Standard marine electrical equipment may be installed in compartments assigned solely to valve-regulated sealed storage batteries.

9.3.3

Where vented (see Note 1) type batteries replace valve-regulated sealed (see Note 2) types, the requirements of Sec 11 are to be complied with.

Note 1: A vented battery is one in which the cells have a cover provided with an opening through which products of electrolysis and evaporation are allowed to escape freely from the cells to atmosphere.

Note 2: A valve-regulated battery is one in which cells are closed but have an arrangement (valve) which allows the escape of gas if the internal pressure exceeds a predetermined value.

9.4 Electrical installation in enclosed spaces and lockers containing fuel or flammable liquids having a flash point not exceeding 60°C or vehicle with fuel in their tanks

9.4.1 ~~10.4~~ In enclosed spaces, garages and larger lockers in which vehicles or craft with fuel~~-~~ in their tanks having a flash point not ex~~-~~ceeding 60°C are carried and on lockers storing such fuel in which explosive vapours might be expected to accumulate, electrical equipment and cables are to be installed at least 450 mm above the deck (to be regarded as hazardous area ZONE 2). Electrical equip~~-~~ment is to be as stated in [9.1.6] and electrical cables as stated in [9.2.3]~~.~~.

9.4.2

~~10.4~~ Where the installation of electrical equipment and cables at less than 450 mm above the deck (to be regarded as hazardous area ZONE 1) is deemed necessary for the safe operation of the yacht, the electrical equipment is to be of a certified safe type as stated in [9.1.5] and the electrical cables are to be as stated in [9.2.2].

9.4.3 Electrical equipment and cables in exhaust ventilation ducts are to be as stated in [9.4.2].

9.4.4 For alternative fuelled vehicles, including those battery powered, the adoption of additional measures maybe necessary upon the results of a dedicated risk assessment.~~-~~

9.5 Underwater lights and similar items (i.e. echo-sound, speed-log ....) *(1/1/2025)*

9.5.1 The lights or similar items to be installed through the outer hull~~-~~ of yachts, placed in a position such that the lower margin of the light is lower than 500 mm above the lower summer load line, are to have the following minimum degree of protection in accordance with IEC Publication 60529 or another equivalent standard:

- IP68 for the external part
- IP67 for the internal part.

The lights or similar items to be installed through the outer hull of yachts, placed in a position such that the lower margin of the light is higher than 500 mm above the lower summer load line, but below the freeboard deck, are to have a minimum degree of protection IP56 in accordance with IEC Publication 60529

9.5.2 Where lights or similar items are installed in spaces where flammable gas or vapours are liable to accumulate (i.e. gasoline engine compartments, etc), the lights are to be certified "safe type electrical equipment" suitable for Zone 1 according to 60079 series.

9.5.3 Constructional drawings of the lights or the items, including materials and characteristics of all components are to be submitted for exami~~-~~nation..

9.5.4 The underwater lights or similar items have to be tested at a pressure of at least 4 times the pressure corresponding to the intended location.

9.5.5 Underwater lights and similar items are to be type approved. Tests are to be carried out to verify the degree of protection; pressure test and duration of the test to verify degree of protection IP68 are to be agreed with the Maker taking into account the working condition of the lights (i.e. the depth and the position on the submerged part of the hull). The type approval certificate, having a validity of 5 years, will be issued by Tasneef after examination of the relevant test reports.

10 Recording of the Type, Location and Maintenance Cycle of Batteries

10.1 Battery schedule

10.1.1
Where batteries are fitted for use for essential and emergency services, a schedule of such batteries is to be compiled and maintained. The schedule, required in Sec 1, Tab 1, is to include at least the following information regarding the battery(ies):

- type and Manufacturer's type designation
- voltage and ampere-hour rating
- location
- equipment and/or system(s) served
- maintenance/replacement cycle dates
- date(s) of last maintenance and/or replacement
- for replacement batteries in storage, the date of manufacture and shelf life.

Note 1: Shelf life is the duration of storage under specified conditions at the end of which a battery retains the ability to give a specified performance.

SECTION 8 SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

1 Constructional requirements for main and emergency switchboards

1.1 Construction

1.1.1
Construction is to be in accordance with IEC Publication 60092-302-2.

1.1.2
Switchboard manufactured and tested to standards other than those specified in [1.1.1] will be accepted provided they are in accordance with an acceptable international or national standard of an equivalent or higher safety level.

1.1.3 Where the framework, panels and doors of the enclosure are of steel, suitable measures are to be taken to prevent overheating due to the possible circulation of eddy currents.

1.1.4 Insulating material for panels and other elements of the switchboard is at least to be moisture-resistant and flame-retardant.

1.1.5 Switchboards are to be of dead front type, with enclosure protection according to Sec 3, Tab 2.

1.1.6 Switchboards are to be provided with insulated handrails or handles fitted in an appropriate position at the front of the switchboard. Where access to the rear is necessary for operational or maintenance purposes, an insulated handrail or insulated handles are to be fitted.

1.1.7 Where the aggregate capacity of generators connected to the main busbars exceeds 100 kVA, a separate cubicle for each generator is to be arranged with flame-retardant partitions between the different cubicles. Similar partitions are to be provided between the generator cubicles and outgoing circuits.

1.1.8 Instruments, handles or push-buttons for switchgear operation are to be placed on the front of the switchboard. All other parts which require operation are to be accessible and so placed that the risk of accidental touching of live parts, or accidental making of short-circuits and earthings, is reduced as far as practicable.

1.1.9 Where it is necessary to make provision for the opening of the doors of the switchboard, this is to be in accordance with one of the following requirements:

a) opening is to necessitate the use of a key or tool (e.g. when it is necessary to replace a lamp or a fuse-link)
b) all live parts which can be accidentally touched after the door has been opened are to be disconnected before the door can be opened
c) the switchboard is to include an internal barrier or shutter with a degree of protection not less than IP2X shielding all live parts such that they cannot accidentally be touched when the door is open. It is not to be possible to remove this barrier or shutter except by the use of a key or tool.

1.1.10 All parts of the switchboard are to be readily accessible for maintenance, repair or replacement. In particular, fuses are to be able to be safely inserted and withdrawn from their fuse-bases.

1.1.11 Hinged doors which are to be opened for operation of equipment on the door or inside are to be provided with fixing devices for keeping them in open position.

1.1.12 Means of isolation of the circuit-breakers of generators and other important parts of the installation are to be provided so as to permit safe maintenance while the main busbars are alive.

1.1.13 Where components with voltage exceeding the safety voltage are mounted on hinged doors, the latter are to be electrically connected to the switchboard by means of a separate, flexible protective conductor.

1.1.14 All measuring instruments and all monitoring and control devices are to be clearly identified with indelible labels of durable, flame-retardant material.

3 Testing

3.1 General

3.1.1
The following switchgear and control gear assemblies are to be subjected to the tests specified from [3.2] to [3.4] and surveyed by the society during testing:

a) main switchboard ~~main switchboard~~;

b) emergency switchboard ~~emergency switchboard~~;

c) low voltage distribution boards, starters and motor control centers having busbars rated current of 100A and above;

d) h~~e~~igh voltage assemblies;

3.1.2 The manufacturer is to issue the relative test reports providing information concerning the construction, serial number and technical data relevant to the switchboard, as well as the results of the tests required.

3.1.3 The tests are to be carried out prior to installation on board.

3.1.4
The test procedures are as specified in IEC Publication 60092-302-2.

3.2 Inspection of equipment, check of wiring and electrical operation test

3.2.1 It is to be verified that the switchboard:

- complies with the approved drawings
- maintains the prescribed degree of protection
- is constructed in accordance with the relevant constructional requirements, in particular as regards creepage and clearance distances.

3.2.2 The connections, especially screwed or bolted connections, are to be checked for adequate contact, possibly by random tests.

3.2.3 Depending on the complexity of the switchboard it may be necessary to carry out an electrical functioning test. The test procedure and the number of tests depend on whether or not the switchboard includes complicated interlocks, sequence control facilities, etc. In some cases it may be necessary to conduct or repeat this test following installation on board.

3.3 High voltage test

3.3.1 The test is to be performed with alternating voltage at a frequency between 45 and 65 Hz of approximately sinusoidal form.

3.3.2 The test voltage is to be applied:

- between all live parts connected together and earth
- between each polarity and all the other polarities connected to earth for the test.

During the high voltage test, measuring instruments, ancillary apparatus and electronic devices may be disconnected and tested separately in accordance with the appropriate requirements.

3.3.3 The test voltage at the moment of application is not to exceed half of the prescribed value. It is then to be increased steadily within a few seconds to its full value. The prescribed test voltage is to be maintained for 5 seconds (1 minute for high voltage assemblies) 1 minute. The overcurrent relay shall not trip when the output current is less than 100mA. The high-voltage transformer used for the test shall be so designed that, when the output terminals are short-circuited after the output voltage has been adjusted to the appropriate test voltage, the output current shall be at least 200 mA.

3.3.4 The value of the test voltage for main and auxiliary circuits is given in Tab 2 and Tab 3.

SECTION 15 TESTING

1 General

1.1 Rule application *(1/1/2025)*

1.1.1 Before a new installation, or any alteration or addition to an existing installation, is put into service, the electrical equipment is to be tested in accordance with [3], [4] and [5] to be read together with Pt A, Ch 2, App.3 equipment testing tables E and N to the satisfaction of the Surveyor in charge.

1.2 Insulation-testing instruments

1.2.1 Insulation resistance may be measured with an instrument applying a voltage of at least 500 V. The measurement will be taken when the deviation of the measuring device is stabilised.

Note 1: Any electronic devices present in the installation are to be disconnected prior to the test in order to prevent damage.

2 Type approved components

2.1

2.1.1

The following components are to be type tested or type approved according to the requirements in the present Chapter 2 and, excluding cables, transformers, rotating machines and converters (but not the relevant electronic control equipment), according to the tests listed in Ch 3, Sec 6, Tab 1, as far as applicable, or in accordance with [2.1.2]:

- electrical cables (internal wiring of equipment excluded)
- transformers
- rotating machines
- electrical convertors
- circuit-breakers, contactors, fuses and fuse-combination units used in power and lighting distribution systems, motor and transformer circuits, overcurrent protective devices
- sensors, alarm panels, electronic protective devices, automatic and remote control equipment, actuators, safety devices for installations intended for essential services (steering, controllable pitch propellers, propulsion machinery, etc.), electronic speed regulators for main or auxiliary engines, electronic devices for alarm, safety and control of electrical convertors for primary essential services and emergency services as defined in Sec 3, [3.7.3]
- programmable electronic systems intended for functions which are subject to classification requirements
- cable trays/protective casings made of plastic materials.

2.1.2 Case by case approval based on submission of adequate documentation and execution of tests may also be granted at the discretion of the Society.

3 Insulation resistance

3.1 Lighting and power circuits

3.1.1 The insulation resistance between all insulated poles (or phases) and earth and, where practicable, between poles (or phases), is to be at least 1 MΩ in ordinary conditions.

The installation may be subdivided to any desired extent and appliances may be disconnected if initial tests give results less than that indicated above.

Chapter 3
AUTOMATION

SECTION 3 COMPUTER BASED SYSTEMS

1 Scope

1.1 General

1.1.1

These Requirements apply to design, construction, commissioning and maintenance of computer based systems where they depend on software for the proper achievement of their functions and focus on the functionality of the software and on the hardware supporting the software.

1.1.2

These Requirements apply to the use of computer based systems which provide control, alarm, monitoring, safety or internal communication functions which are subject to classification requirements.

1.1.3

Computer-based systems that are covered by statutory regulations are excluded from the requirements of this Section.

Guidance:

Examples of such systems are navigation systems and radio communication system required by SOLAS chapter V and IV, and vessel loading instrument/stability computer.

For loading instrument/stability computer, IACS recommendation no. 48 may be considered

1.2 Reference to other regulations and standards

1.2.1

For the purposes of this Section, the applicable requirements in Sec 6 are to be complied with.

1.2.2

For the purposes of this Section,the following standards are listed for information and may be used for the development of hardware/software of computer based systems:

- IEC 61508 "Functional safety of electrical/electronic/programmable electronic safety related Systems"
- ISO/IEC 12207 "Systems and software engineering - Software life cycle processes"
- ISO 9001"Quality Management Systems - Requirements"
- ISO/IEC 90003 "Software engineering - Guidelines for the application of ISO 9001 to computer software"
- IEC 60092-504 "Electrical installations in s - Part 504: Special features - Control and instrumentation"
- ISO/IEC 25000 "Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - Guide to SQuaRE"
- ISO/IEC 25041 "Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - Evaluation guide for developers, acquirers and independent evaluators"
- IEC 61511 "Functional safety - Safety instrumented systems for the process industry sector"
- ISO/IEC 15288 "Systems and software engineering - system life cycle process".
- ISO 90007 Quality management - Guidelines for configuration management
- ISO 24060 Ships and marine technology - Ship software logging system for operational technology.

Other industry standards may be considered.

3.3 System category examples

3.3.1 *(1/1/2025)*

The category of a system is always to be evaluated in the context of the specific vessel in question; thus, the categorization of a system may vary from one vessel to the next. This means that the examples of categories below are given as guidance only. For determining the categorization of systems for a specific vessel, see [4.3.3].

Examples of category I systems:

Fuel monitoring system, maintenance support system, diagnostics and troubleshooting system, closed circuit television, cabin security, entertainment system, fish detection system.

Examples of category II systems:

Fuel oil treatment system, alarm monitoring and safety systems for propulsion and auxiliary machinery, ~~Inert gas system, control, monitoring and safety system for cargo containment system~~.

Examples of category III systems:

Propulsion control system, steering gear control system, electric power system (including power management system), dynamic positioning system (IMO classes 2 and 3).

Note 1: The list of example systems in [3.3.1] is not exhaustive.

4 Requirements on development and certification of computer-based system

4.1 General requirements

4.1.1 Life cycle approach with appropriate standards

Requirement:

A global top-down approach is to be undertaken in the design and development of both hardware and software and the integration in sub-systems, systems, and system of systems, spanning the complete system lifecycle. This approach is to be based on the standards as listed herein or other standards recognized by the Society.

Society's verification:

This is verified by the Society as a part of the quality management system verification described in [4.1.2].

4.1.2 Quality management system

Systems integrators and system suppliers are, in the development of computer-based systems for category II and category III, to comply to a recognised quality standard such as ISO 9001; also incorporating principles of IEC/ISO 90003.

The quality management system is as a minimum to include the topics in Tab 3, applicable for both category II and category III systems.

Table 3 : Quality management system

Area		Role	
N	Topic	System supplier	Systems integrator
1	Responsibilities and competency of the staff	x	x
2	The complete lifecycle of delivered software and of associated hardware	x	x
3	Specific procedure for unique identification of a computer-based system, it's components and versions	x	
4	Creation and update of the vessel's system architecture		x
5	Organization set in place for acquisition of software and related hardware from suppliers	x	x
6	Organization set in place for software code writing and verification	x	
7	Organization set in place for system validation before integration in the vessel	x	

APPENDIX 1 ALTERNATIVES, RELAXATIONS AND ADDITIONAL CONSIDERATIONS FOR YACHTS ~~YCH BELOW~~ OF LESS THAN 500GT

1 General Requirement (Section 1)

1.1 General

1.1.1 With reference to Pt. C Ch.3 Section 1, when allowed in pt A Ch.2 App.3, par. [1.4.1] is not mandatory.

1.1.2 With reference to Pt. C Ch.3 Section 1, [2], following drawings listed in Table 1 need not to be sent: Instruction manuals and Diagram of the engineers' alarm system.

1.1.3 With reference to Pt. C Ch.3 Section 1, par. [2.3.1] to [2.4] and Table 2, when allowed in pt A Ch.2 App.3, as an alternative what at [1.1.4] may be applied.

1.1.4 ISO 9001 or ISO 90003 certification, or equivalent, stating that the system integrator and the software developer quality software development is in compliance with an international or national standard. If the above certification is not available, then the following documentation is to be sent:

- procedures regarding responsibilities, system documentation, configuration management and staff competency;
- procedures regarding software and associated hardware lifecycle:
  - organization set in place for acquisition of related hardware and software from suppliers (if mandatory);
  - organization set in place for software code writing and verification
  - organization set in place for system validation before integration in the vessel

In addition, the following documentation is to be submitted:

- General functional description of software and associated hardware;
- System block diagram, showing the arrangement of individual parts, input and output devices and interconnections.
- Test programs and procedures for functional on board test,
- List and versions of software(s) installed in system,
- User manual including instructions during software maintenance.

1.1.5 With reference to Pt C, Ch 3, Sec 1, when allowed in Pt A, Ch 2, App 3, [4.2] is not mandatory.

2 Design Requirement (Section 2)

2.1 General

2.1.1 With reference to Pt C, Ch 3, Sec 2, when allowed in Pt A, Ch 2, App 3, [2], as an alternative what at [2.1.2] may be applied.

2.1.2 The automation system is to be continuously powered. Failure of the power supply is to generate an alarm. Each automation system is to have separate power supplies with short circuit and overload protection. Safety systems are to have power supplies as far as possible separate from control and alarm system, or an equivalent safety level is to be ensured.

2.2 Control of propulsion machinery

2.2.1 With reference to Pt C, Ch 3, Sec 2, when allowed in Pt A, Ch 2, App 3, [4.1.4], is not mandatory.

3 Computer Based Systems (Section 3)

3.1 General

3.1.1 ~~Pt C, Ch 3, Sec 3 is applicable as far as it is practicable.~~With reference to Pt C, Ch 3, App 3 "Guidance for the application of Section 3 on Computer Based Systems", as an alternative to [2.1.1 a)] for category II and III services only, the software version (or release) is to be communicated.

4 Constructional Requirements (Section 4)

4.1 General

4.1.1 With reference to Pt C, Ch 3, Sec 4, when allowed in Pt A, Ch 2, App 3, [2.2.6] is not mandatory.

5 Testing (Section 6)

5.1 General

5.1.1 With reference to Pt C, Ch 3, Sec 6, [1.1], when allowed in Pt A, Ch 2, App 3, as an alternative what at [5.1.2] maybe applied

5.1.2 Automation systems are to be commissioned when installed on board and prior to sea trials, to verify their performance and adaptation on site. Commissioning tests are to be carried out on automation systems associated with essential services to verify their compliance with the Rules, by means of visual inspection, functional tests according to Sec.6 Tab 3 2Commisioning Tests". When completed, automation systems are to be such that a single failure, for example loss of power supply, will not result in a major degradation of the propulsion or steering of the craft. Adequate spare parts are to be provided. A blackout test is to be carried out to show that automation systems are continuously supplied. Upon completion of the commissioning tests, test re-ports are to be made available to the Surveyor.

5.1.3 With reference to Pt C, Ch 3, Sec 6, when allowed in Pt A, Ch 2, App 3, [2] is not mandatory.

5.1.4 With reference to Pt C, Ch 3, Sec 6, when allowed in Pt A, Ch 2, App 3, [3] is not mandatory.

APPENDIX 3 GUIDANCE FOR THE APPLICATION OF SECTION 3 ON COMPUTER BASED SYSTEMS

1 Application

1.1 Introduction

1.1.1 Since the categorization of a system is strictly function of the design of the yacht and software applications can be originated from a wide range of solutions, the correct and final approval path for a computer-based system software is to be defined in the first stages of the yacht design.

1.1.2 It is to be noted that the main aim of Section 3 is to give the detailed description of a complete software approval process which it is to be applied only to some computer-based systems installed on board of a yacht defined at the beginning of the project. For other Computer based system a case-by-case procedure may be applied.

1.1.3 The standard minimum information or documents that are to be anyway sent to the Society concerning computer-based systems are reported in [2].

2 Design Requirements

2.1 Software version (or release)

2.1.1 Software version (or release) of each programmable device (computer) which manages the following services or systems is to be communicated after onboard functioning tests performed with surveyor attendance, but before the date of the yacht Certificate of Classification issue:

a) Single essential or safety service (e.g. steering automation system, main propulsion engine control system, navigation lights automation system, bilges alarms system)

b) Vessel automation/monitoring system (even if its correct functioning is not necessary for the vessel proper operation and safety)

c) Integrated automation system which correct functioning is necessary for the vessel proper operation and safety (e.g. power management system, energy management system, AUT-UMS system)

2.2 Integrated Automation System

2.2.1 With reference to those systems as described at [2.1.1] point c), the following documents are to be submitted:

a) Hardware FMEA and Risk Assessment,

b) Software FMEA or internal software tests report,

c) System acceptance test (SAT) to be performed on board,

d) Software change management and backup restoring procedures,

e) Software supplier quality plan, choosing one of the following:

- ISO (or other national or international recognized standard) certificate(s) concerning quality software development;
- Set of documents which describes supplier organization, roles, internal checks set in place for software development and commissioning (see Appendix 1, [1.1.4]).

Chapter 4
FIRE PROTECTION, DETECTION AND EXTINCTION

SECTION 1 GENERAL REQUIREMENTS

1 Definitions

1.1 Application

1.1.1 This Chapter is applicable, in general, in case the Society does not carry out the compliance activity to an Administration Safety Code deemed considered as an equivalent standard.

1.1.2 In case of matters not delegated to class by the Administration (i.e. means of escape) the approval of the Flag Administration may be accepted on a case by case base.

1.1.3 The Rules of an Administration recognized acceptable by Tasneef may be considered alternative to this chapter with the exception of the following paragraph that have to applied in any case:

- Pt C, Ch 4, Sec 6, [2.1.1] for newbuilding yachts

1.2 Definitions

1.2.1 The definition used in this chapter are those contained in SOLAS and other IMO publications. In addition some other definitions are reported here below.

1.2.2 Not readily ignitable

When the surface thus described will not continue to burn for more than 20 seconds after removal of a suitable impinging test flame.

1.2.3 Standard fire test

A test in which the representative specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding to the standard time-temperature curve in accordance with the Fire Test Procedures Code. The dimensions of the specimens may be agreed with Tasneef.

For composite structures, considering that:

a) the absolute temperature is not to reach the Heat Deflection Temperature during the fire test;

b) the increase of temperature above the ambient temperature is to measured according to the IMO FTP Code; and

c) the ambient temperature may influence the test results since the increase of the sample temperature during a fire resistance test is normally independent from the ambient temperature

the fire resistance tests to evaluate the acceptance of the proposed insulation are to be carried out measuring the temperature increase above a standard ambient temperature normally set at 30°C.

1.2.4 Public spaces

Portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

1.2.5 Battery charging station

A permanently (fixed) integrated element of the vessel electrical plant for the recharging of plug-in equipment. A fixed charging station provides electrical conversion, monitoring, or safety functionality. Standard electrical sockets or outlets are not to be considered fixed charging stations.

2 Documentation to be submitted

2.1

2.1.1 The Interested Party is to submit to Tasneef the documents listed in Tab 1.

3 Type Approved Products

3.1

3.1.1 In general the following materials, equipment or products to be used for fire protection are to be type approved by Tasneef. In special cases Tasneef may accept a Type Approval Certificate issued by another recognised organisation, or, for individual yachts, Tasneef may consider acceptance on the basis of ad hoc tests.

a) Fire-resisting and fire-retarding divisions (bulkheads or decks) and associated doors

b) Materials with low flame spread characteristic when they are required to have such characteristic

c) Fixed foam fire-extinguishing systems and associated foam-forming liquids

d) Fixed powder fire-extinguishing systems, including the powder

e) Non-combustible materials

f) Sprinkler heads for automatic sprinkler systems

g) Nozzles for fixed pressure water-spraying fire-extinguishing systems for machinery spaces~~, boiler rooms~~ and vehicle spaces

h) Sensing heads for automatic fire alarm and fire detection systems

i) Fixed fire detection and fire alarm systems

j) Fire dampers

k) Equivalent water-based fire-extinguishing systems for machinery spaces of category A

l) Equivalent fixed gas fire-extinguishing system components for machinery spaces of category A

m) Other fixed fire-extinguishing systems different from those listed above

n) portable fire extinguishers.

Tasneef may request type approval for other materials, equipment, systems or products for installations of special types.

4 Fire control plan

4.1 General

4.1.1 The fire control plan is to be provided and displayed on board, show and describe the principal fire prevention and protection equipment and material.

On this basis such plans are to be developed as general arrangement plans containing the following details:

- class divisions relevant to the bulkhead and decks of the various spaces. Such spaces are to be identified with the same numeration as defined in Sec 3
- control stations
- schematic scheme showing the fire detection and fire alarm systems
- schematic scheme showing the installed fire-fighting systems
- means of escape from the various compartments
- ventilating system
- location and means of control of systems and openings which are to be closed in the case of a fire event
- location and characteristics of the fire appliances.

The above plans are to be exhibited in a dedicated position on the yacht for guidance of the personnel on board.

Plans are to be kept up to date.

SECTION 2 FIRE PREVENTION

1 Engine space arrangement

1.1

1.1.1 The boundary of the engine space is to be arranged in order to contain the fire-extinguishing medium so that it cannot escape.

1.1.2 Combustible materials and flammable liquid excluding fuel oil necessary for the propulsion engines are not to be stowed in the engine space.

1.1.3 Machinery spaces of category A and engine spaces are to be ventilated to prevent the build-up of explosive gases.

1.1.4 For yachts with wooden hulls, particular attention is to be paid in order to adopt adequate means to avoid oil absorption into the structures.

1.1.5 In order to contain the oil, it may be acceptable to fit a drip tray in way of the engine. The use of the engine bearers as a means of containment of the oil may be accepted provided that they are of sufficient height and have no limber holes.

Efficient means are to be provided to ensure that all residues of persistent oils are collected and retained on board for discharge to collection facilities ashore.

1.1.6 Means are to be adopted for the storage, distribution and utilisation of fuel oil in order to minimise the risk of fire.

1.1.7 Fuel oil, lubricating oil and other flammable liquids are not to be stored in fore peak tanks.

1.1.8 Fuel oil tanks situated within, or adjacent to, the boundaries of category A machinery spaces are not to contain fuel oil having a flashpoint of less than 60ºC.

1.1.9 Every fuel oil pipe which, if damaged, would allow oil to escape from a storage, settling or daily service tank situated above the double bottom is to be fitted with a cock or valve directly on the tank. Such cock or valve is to be capable of being closed locally and from a safe position outside the space in which such tanks are fitted in the event of fire occurring in the space (see also Ch 1, Sec 9, [9.6.3]).

1.1.10 Means are to be provided to stop fuel transfer pumps, fans~~, oil fired boilers~~ and separators from outside the machinery space.

2 Liquid petroleum gas for domestic purposes

2.1

2.1.1 Where gaseous fuel is used for domestic purposes, the arrangements for the storage, distribution and utilisation of the fuel is 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 yacht and the persons on board is preserved. The installation is to be in accordance with App 1 or other recognised national or international standards.

Hydrocarbon gas detectors and carbon monoxide detectors are to be provided.

2.1.2 Open flame gas appliances fitted on board for cooking, heating or any other purpose are to be in compliance with recognised international standards.

2.1.3 Materials which are fitted close to open flame cooking and heating appliances are to be non-combustible, except that the exposed surfaces of these materials are to be protected with a finish having a class 1 surface spread of flame rating when tested in accordance with ASTM D 635.

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 aluminium 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.

Table 1

Type of material	B15 Class Division	A-30 Class Division
Composite material	• two 25 mm layers of non-combustible high density mineral wool suitably alternated. The mineral wool is to have a minimum volumetric mass of 100 kg/m3. The outer surface of the mineral wool is to be suitably protected against any splashing from fuel oil or other flammable liquid, or • reinforced plastic of thickness not less than 13 mm with a final layer of self-extinguishing laminates (for a thickness not less than 1,5 mm)	• two 30 mm layers of non-combustible high density mineral wool suitably alternated. The mineral wool is to have a minimum volumetric mass of 130 kg/m^3. The outer surface of the mineral wool is to be suitably protected against any splashing from fuel oil or other flammable liquid.
Aluminium alloy plate		5,5 mm aluminium alloy plate thickness insulated with 80 mm of non-combustible high density mineral wool. The mineral wool is to have a minimum volumetric mass of 100 kg/m3. The outer surface of the mineral wool is to be suitably protected against any splashing from fuel oil or other flammable liquid.
Steel plate		4,0 mm steel plate thickness insulated with 50 mm of non-combustible high density mineral wool. The mineral wool is to have a minimum volumetric mass of 100 kg/m^3. The outer surface of the mineral wool is to be suitably protected against any splashing from fuel oil or other flammable liquid.

3 Class divisions

3.1 Class divisions

3.1.1 With reference to the classification of the various spaces referred to here, the following definitions are to be considered:

a) Control stations
- Spaces containing emergency sources of power and lighting
- Wheelhouse and chartroom
- Spaces containing the vessel's radio equipment
- Fire-extinguishing rooms
- Fire control rooms and fire-recording stations
- Control room for propulsion machinery when located outside the machinery space
- Spaces containing centralised fire alarm equipment

b) Corridors and lobbies
- Guest and crew corridors and lobbies

c) Accommodation spaces
- Cabins, dining rooms, lounges, offices, pantries containing no cooking appliances (other than equipment such as microwave cookers and toasters), and similar spaces

3.2 Protection of stairways, dumb waiters and lifts in accommodation and service spaces

3.2.1 Stairways are to be separated from other spaces by enclosures having class divisions at least A0. Stairways are to be of steel construction. Tasneef may consider different materials provided that equivalent fire resistance as for steel is ensured.

3.2.2 A stairway is to be provided with positive means of closure at all openings, except that:

a) an isolated stairway which penetrates a single deck only may be protected at one level only by at least B class divisions and self-closing door(s); and

b) stairways may be fitted in the open in a public space, provided they lie wholly within such public space.

In so far as is practical, stairway enclosures are not to give direct access to galleys, machinery spaces, service lockers (high fire risk category 8) or other enclosed spaces containing combustibles in which a fire is likely to originate.

A lift trunk is to be so fitted as to prevent the passage of flame from one 'tweendeck to another and is to be provided with means of closing to permit the control of draught and smoke.

3.2.3 *(1/1/2025)*

Dumb waiters are to be enclosed (trunk and door) at least in class A0 (B-15 for short range yachts).

3.3 Construction and arrangement of saunas

3.3.1 The perimeter of the sauna is to be of A class boundaries and may include changing rooms, showers and toilets. The sauna is to be insulated to A- 60 against other spaces except those inside of the perimeter. For infrared sauna the above mentioned fire divisions are not mandatory if less than 2kW and 150°C otherwise may be reduced to A0.

3.3.2 Bathrooms with direct access to saunas may be considered as part of them. In such cases, the door between the sauna and the bathroom need not comply with fire safety requirements.

3.3.3 Wooden linings on bulkheads and ceilings are permitted.

The ceiling above the oven is to be lined with a non- combustible plate with an air gap of at least 30 mm. The distance from the hot surfaces to combustible materials is to be at least 500 mm or the combustible materials are to be protected (e.g. non-combustible plate with an air gap of at least 30 mm).

Wooden benches are permitted.

The sauna door is to open outwards by pushing.

Electrically heated ovens are to be provided with a timer.

All spaces within the perimeter of the sauna shall be protected by a fire detection and alarm system and an automatic sprinkler system.

3.4 Construction and arrangement of Thermal Suite (e.g. Steam Room)

3.4.1 The perimeter of the thermal suite may include changing rooms, showers and toilets.

3.4.2 Bathrooms with direct access to the suite may be considered as part of it. In such cases, the door between the suite and the bathroom need not comply with fire safety requirements.

3.4.3 *(1/1/2025)*

If the steam generator of more than 5 kW is contained within the perimeter, the suite boundary is to be constructed to an A-0 standard ~~or B-0 for Yachts of less than 300 GT~~. If the steam generator of more than 5 kW is not contained within the perimeter, the steam generator is to be protected by A-0 standard divisions ~~or B-0 for Yachts of less than 300GT~~ and pipes leading to the discharge nozzles should be lagged.

3.4.4 If a suite arrangement contains a sauna then the requirements contained in [3.1] are applicable, regardless of the steam generator location.

3.4.5 All spaces within the perimeter are to be protected by a fire detection and alarm system.

3.5 Openings in A class divisions

3.5.1 The construction of all doors and door frames in A class divisions, with the means of securing them when closed, is to provide resistance to fire as well as the passage of smoke and flame, as far as practical, equivalent to that of the

APPENDIX 1 ALTERNATIVES, RELAXATIONS AND ADDITIONAL CONSIDERATIONS FOR YACHTS BELOW 500 GT

1 Fire prevention (Sec.2)

1.1 General

1.1.1 With reference to Sec 1, [7.1.3] the vapour barrier are to have low flame spread characteristic as far as it is practicable.

2 Fire containment (Sec 3)

2.1 Class divisions

2.1.1 With reference to Sec.3 as an alternative to [3.1.2] to [3.1.5] what below may be applied. For unrestricted yachts category A machinery spaces are to be totally enclosed by A-30 class boundaries. For short range yachts of any gross tonnage, category A machinery spaces are to be enclosed by B-15 class divisions.For unrestricted yachts and for yacht of more than 300GT in short range navigation the galley to be totally enclosed in B-15 class boundaries (bulkheads, side shell and deck heads). Windows within the exterior hull or superstructure within this boundary are not expected to meet "B-15" standards.The above class divisions are not necessary on the side of yachts having the hull structure made of steel.

2.1.2 With reference to Sec 3, [3.2] is not mandatory.

2.2 Ventilating systems

2.2.1 With reference to Sec 3 as an alternative to [4.1.2] what below may be applied. 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

2.3 Sauna

2.3.1 With reference to Sec.3 [3.3.3] what below may be applied. The insulation of sauna may be reduced to A-30.The insulation of sauna may be reduced to B-15 in case of short range yachts.

2.3.2 With reference to Sec.3 [3.3.3] what below may be applied. As an alternative to the automatic sprinkler system, a manual water spray system giving a coverage of 3.5 ltr/m2/min over the total area of the floor may be provided. Such a system may be taken from the fire main or be independent. Electrically driven fire pumps shall be provided with an emergency power supply.

2.4 Steam Room

2.4.1 *(1/1/2025)* With reference to Sec.3 [3.4.3] in case of yachts of less than 300GT the A-0 class may be replaced by B-0.

3 Means of Escape (Sec.5)

3.1 Means of escape form accommodation

3.1.1 In general the main and emergency means of escape have to be fully independent. In some exceptional situation there can be maximum of 4 meters of shared escape way.

Chapter 4
MISCELLANEOUS EQUIPMENT

SECTION 1 EQUIPMENT

1 Anchors

1.1 Application

1.1.1 General

The requirements of this Article apply to anchors and associated components (heads, shanks and shackles) made of cast or forged steel, or fabricated by welding from rolled steel.

1.1.2 Modified testing procedure for anchors of small mass

For anchors having mass lower than 100 kg, or 75 kg in the case of high holding power anchors, continuously produced by Manufacturers who have been approved by the Society for this purpose, a batch testing procedure is admitted, with random execution of the checks required for normal testing.

The composition of the batches is to be judged appropriate as regards the homogeneity of material, manufacturing, heat treatment and dimensions.

1.2 Design - Manufacture

1.2.1 General

Anchors are to be manufactured by recognised Manufacturers, according to approved plans or recognised standards; see Pt B, Ch 10, Sec 4, [3.2].

For approval and/or acceptance of high holding power (HHP) and super high holding power (SHHP) anchors , the type tests indicated in Pt B, Ch 10, Sec 4, [3.2] are to be carried out.

Steel forgings and castings for anchors is to comply with the applicable requirements of Ch 2, Sec 3 and Ch 2, Sec 4, respectively, and are to be manufactured by recognised Manufacturers.

1.2.2 Tolerances

If not otherwise specified on standards or on drawings demonstrated to be appropriate, the following assembly and fitting tolerances are to be applied.

The clearance either side of the shank within the shackle jaws is to be in accordance with Tab 1 depending on the anchor mass.

The shackle pin is to be a push fit in the eyes of the shackle, which are to be chamfered on the outside to ensure a good tightness when the pin is clenched over on fitting.

The shackle pin to hole tolerance is to be no more than 0,5mm for pins up to 57mm and 1,0 mm for pins of larger diameter.

The trunnion pin is to be a snug fit within the chamber and be long enough to prevent horizontal movement. The gap is to be no more than 1% of the chamber length.

The lateral movement of the shank is not to exceed 3 degrees (see Fig 1).

Table 1

Anchor mass (t)	Clearance (mm)
Up to 3	3
Over 3 up to 5	4
Over 5 up to 7	6
Over 7	12

Table 16 : Check of zinc continuity on wire coating

Diameter d of galvanised wire (mm)	Number of one-minute submersions **(1)**	
	Class A	Class B
0,6 ≤ d < 1,0	-	0,5
1,0 ≤ d < 1,5	1,5	1,0
1,5 ≤ d < 1,9	2,0	1,0
1,9 ≤ d < 2,5	2,0	1,5
2,5 ≤ d < 3,2	2,5	1,5
3,2 ≤ d < 3,7	3,0	2,0

(1) 1,5 submersion means one submersion lasting 1 minute followed by another lasting 30 seconds (the same criteria applies for the other numbers).

Tab 16 shows the minimum number of one-minute submersions, in relation to the wire diameter and galvanising class. After each submersion, the specimen is to be rinsed in running water so as to wash away unbonded copper deposits.

The test is regarded as satisfactory when the specimen does not show (beyond 25 mm from the immersed end) indications of bonded copper deposits, which would mean local lack of zinc coating on the steel surface.

4.5 Identification marking and certification

4.5.1 Upon satisfactory completion of the required tests and examinations, the ropes, packed in the required length for supply, are to be tagged with lead seals stamped with the Society's brand and further indications, as necessary for identification with the respective test certificates.

4.5.2 The certificates are to contain the essential elements relevant to the rope characteristics, the results of the test and the stamps and markings mentioned in [4.5.1].

Special marking and certification methods may be agreed upon for supplies by Manufacturers granted the use of an alternative testing procedure.

5 Fibre ropes

5.1 Application

5.1.1 General

The requirements of this Article apply to natural and synthetic fibre ropes, intended for towing and mooring lines, or similar applications.

5.1.2 Continuous productions

In the case of continuous production, the Manufacturers may adopt an alternative procedure for testing and inspection subject to the approval of the Society.

5.2 Manufacture

5.2.1 General

Fibre ropes are to be manufactured in accordance with national or international standards recognised by the Society (see [5.3]).

The type and size of ropes are to be in accordance with the requirements specified for each application by the relevant part of the Rules or the approved plans relative to each installation.

5.2.2 Rope materials

Ropes are to be manufactured with natural or synthetic fibre; the natural fibre is to be of suitable type and consistency, free from defects or harmful imperfections. Synthetic fibres are to be of a type and quality which have been recognised as suitable for the intended application.

5.2.3 Manufacturing process and facilities

The manufacturing procedures and relevant facilities are to be suitable and such as to ensure production of the required quality.

The manufacturing process is to be recognised as appropriate by the Society.

No addition of other materials is to be made and treatments intended to increase the mass of the finished rope are not to be used; additions of suitable lubricants are to be kept to an absolute minimum.

Treatments intended to prevent decaying and moisture absorption are not to impair the quality of the fibre or the strength of the rope.

The required tests and examinations are to be performed with the appropriate machinery, equipment and procedures recognised by the Society; the testing machine is to be calibrated.

In particular the dynamometer is to be of a type allowing a constant rate of traverse of the moving element (see [5.4.4]). Other types of dynamometer may be considered by the Society in each case.

5.2.4 Quality of ropes - Dimensional tolerances

Ropes are to be free from harmful material or manufacturing defects. As regards lengths, tolerances, marking and packaging, reference is to be made to the requirements specified in the applied standards and in the purchase order.

5.3 Type of ropes

5.3.1 *(1/1/2025)*

In general, ropes should have either 3-4 strands (plain ropes) or 8 strands (plaited ropes); however, other types of construction may be considered for acceptance by the Society.

~~The diameter of mooring lines is to be not less than 20mm.~~

Ropes may be made of hemp, manila, sisal or synthetic fibres (see [5.2.2]).

The following types and qualities of ropes, complying with recognised standards, are acceptable:

- three- or four-strand hemp ropes, EN 1261
- three, four- and eight-strand manila and sisal ropes, ISO 1181
- three-strand polyamide ropes, ISO 1140
- three-strand polyester ropes, ISO 1141
- three, four- and eight-strand polypropylene ropes, ISO 1346.

5.4 Sampling and testing

5.4.1 Sampling

Acceptance tests are be performed on each rope length (defined as either one single length or multiple lengths manufactured with continuity).

Where the rope length is greater than 2000 m, the acceptance tests are to be carried out for every portion of 2000 m.

When the base material used has the same origin and characteristics, the acceptance tests required in [5.4] for each rope length may be performed for each rope construction and diameter.

Suitable sampling and identification procedures are to be adopted, to the Surveyor's satisfaction.

The tests and examinations under [5.4.2], [5.4.3] and [5.4.4] or [5.4.5] are to be performed for acceptance.

5.4.2 Visual examination and check of the diameter and construction

The check of diameter is to be performed during the breaking test. The sample is to be arranged on the testing machine and the diameter of rope (diameter of the circumscribed circumference) is to be measured under the reference load specified in Tab 17.

The visual examination and the check of correct construction and twist are to be performed by the Manufacturer, while random checks are carried out by the Surveyor to the extent deemed necessary.

The results are to comply with the applicable standards.

5.4.3 Check of the linear mass

The linear mass m is given by the formula:

$$m = \frac{m_0}{L}$$

where:

m_0 : Mass, in grams, of the test piece

L : Length, in metres, of the test piece under the reference load (see Tab 17), equal to:

$$L = \frac{D_p L_0}{D_0}$$

with:

D_0 : Initial distance (at least 0,5 m) between the reference marks spaced symmetrically about the mid-point of the test piece when this is laid out by hand on a flat surface

D_p : Distance between these marks measured under the reference load specified in Tab 17

L_0 : Initial total length of the test piece (laid out by hand on a flat surface).

5.4.4 Breaking test on full size specimen *(1/1/2025)*

The breaking load is to be determined by testing to destruction a sample of rope of sufficient length; in general, the gauge length of the sample is to be not less than 1800 and 900 mm for vegetable fibre ropes and synthetic fibre ropes, respectively.

After the visual and dimensional examination performed at the prescribed load (see [5.4.2]), the sample is subjected to a tension load, steadily increased until fracture occurs.

Depending upon the type of fibre used in manufacturing the ropes, the rate of application of the test load is to be 120-180 mm/min for vegetable fibre ropes and 50-100 mm/min for synthetic fibre ropes.

In the case of synthetic fibre ropes for mooring, the value of elongation A, expressed in percent as given by the following formula, is also to be checked:

$$A = \frac{D_f - D_i}{D_i}$$

where:

D_f : Distance between marks, on the test specimen, under a load equal to 75% of the minimum specified breaking strength.

D_f may be determined by stopping, for as short a time as possible, the action of the moving element, when the tensile load has reached 75% of the minimum specified breaking strength

D_i : Distance between marks measured under the initial reference load.

Table 17 : Load to be applied to ropes for the measurement of the linear mass and diameter

Nominal diameter (mm)	Reference load (kN) Tolerance: ± 5%	Nominal diameter (mm)	Reference load (kN) Tolerance: ± 5%
4	0,020	32	1,28
6	0,045	36	1,62
8	0,080	40	2,00
9	0,101	44	2,42
10	0,125	48	2,88
12	0,180	52	3,38
14	0,245	56	3,92
16	0,320	60	4,50
18	0,405	64	5,12
20	0,500	68	5,78
22	0,605	72	6,48
24	0,720	76	7,22
26	0,845	80	8,00

Nominal diameter (mm)	Reference load (kN) Tolerance: ± 5%	Nominal diameter (mm)	Reference load (kN) Tolerance: ± 5%
28	0,980	88	9,68
30	1,13	96	11,5

Alternative types of test pieces and testing procedures, in accordance with recognised standards, may be considered by the Society.

The measured breaking load is to be not less than those of the standards listed in [5.3.1].

If the test piece breaks at the terminals (clamp or splice), the test requirements are considered to have been met if the measured break occurs at a load not less that 90% of the minimum breaking load given by the reference standard. It is not to be assumed that the actual breaking load of the specimen is represented by multiplying the result by 10/9.

~~The value of elongation A, for which no minimum requirements are given, is used only for determination of the equivalence between synthetic and natural fibre ropes with the formula given in Pt B, Ch 1, Sec 3, and therefore for definition of the minimum breaking load of the synthetic fibre ropes for mooring, in relation to the Equipment Number of the yacht.~~

5.4.5 Breaking test on individual yarns

When the breaking test on full size test pieces cannot be performed, alternative test procedures may be considered and, if used, they are to be reported in the relevant testing documentation.

To this end, the procedure outlined in Annex B to ISO Standard 2307 is appropriate.

5.5 Identification, marking and certification

5.5.1 Upon satisfactory completion of the required tests and examinations, the ropes, packed in the required length for supply, are to be tagged with lead seals stamped with the Society's brand and further indications, as necessary for identification with the respective test certificates.

5.5.2 The certificates are to contain the essential elements relevant to the rope characteristics, the results of the test and the stamps and markings mentioned in [5.5.1].

Special marking and certification procedures may be agreed upon for supplies by Manufacturers granted the use of an alternative testing procedure.

6 Side scuttles, windows and their glass panes

6.1 Application

6.1.1 The requirements of this Article apply to fixed frames, window frames, dead covers and glass panes.

The types of sidescuttles and windows which, in relation to their position, are to be tested are indicated in Pt B, Ch 1 Sec.1 [5.6].

6.2 Manufacture

6.2.1 General

Sidescuttles and windows which are subject to inspection are to be manufactured in accordance with approved plans or standards and specifications recognised by the Society.

Manufacturing procedures are to be of appropriate type, to the Surveyor's satisfaction.

6.2.2 Frame materials

Materials are to be of appropriate type and properties, as required in the approved plans or applicable standards.

They are to comply with the requirements of Chapter 2, in relation to the type of material and the nature of the product.

Chapter 2

Pleasure > 24m LLL < 500GT

SECTION 2 MACHINERY - ALTERNATIVES, RELAXATIONS, ADDITIONAL CONSIDERATIONS TO THE REQUIREMENTS SET IN PT C, CH 1

1 Diesel Engine *(1/1/2025)*

1.1 Pleasure Duty engines

1.1.1 With reference to Pt C, Ch 1, Sec 2, [1.6], in addition to medium and light duty, the pleasure duty as defined below may be assigned. The same relaxations foreseen for light and medium duty apply also to pleasure duty. The parameters for pleasure duty are:

- 500 <= O_{AMAX} <= 1000
- 50<= O_{PMAX} <=100
- Ic >= 0.2
- O_{AMIN} = 500

2 Gears *(1/1/2025)*

2.1 Pleasure Duty gears

2.1.1 With reference to Pt C, Ch 1, Sec 6, [1.3], in addition to medium and light duty, the pleasure duty as defined below may be assigned.The same relaxations foreseen for light and medium duty apply also to pleasure duty. The parameters for pleasure duty are those in [1.1.1] and with reference to Pt C Ch 1 Sec 6 Tab.2 the safety coefficient to be used are:

- K_A = 1.1
- S_H = 1,0
- S_F = 1,1
- L_{h10a23} (following ISO 281-1) >= 3000h

3 Propeller

3.1 Drawing approval

3.1.1 With reference to Pt C, Ch 1, Sec 8, [1.3], for propeller with diameter of less than 1.5m the approval of the drawing is not required.

4 Piping

4.1 Use of welded and threaded metallic joints

4.1.1 With reference to Pt C, Ch 1, Sec 10, Tab 15, use of welded and threaded metallic joints in piping systems.

For yachts oh less than 300GT sleeve tapered threaded joint are acceptable on pipes of class II and III with outside diameter of not more than 60mm if conveying fluid having flash point of more than 60°C.

For yachts oh less than 300GT sleeve parallel threaded joint are acceptable on pipes of class III with outside diameter of not more than 60mm if conveying fluid having flash point of more than 60°C.

SECTION 3 ELECTRICAL INSTALLATION AND AUTOMATION SYSTEMS - ALTERNATIVES, RELAXATIONS AND ADDITIONAL CONSIDERATIONS TO REQUIREMENTS SET IN PT C, CH 2 AND PT C, CH 3.

1 General

1.1 Application

1.1.1 In addition to Pt C, Ch 2, App 1 and Pt C, Ch 3, App1, the following maybe be applied.

2 Electrical Installations

2.1 General Design Requirements (Section 2)

2.1.1 With reference to Pt C, Ch 2, Sec 2, [1.7] and Tab 5 are not mandatory. As an alternative the following may be applied: enclosures for electrical equipment are to be mechanically strong and rigid, and mounted so that the equipment will not be affected by the distortion, vibration or movement of the vessel's structure that occur during normal operation of the vessel.

2.2 System Design (Section 3)

2.2.1 With reference to Pt C, Ch 2, Sec 3, [3.4.1], [3.9.4] are not mandatory.

2.2.2 With reference to Pt C, Ch 2, Sec 3, [~~7~~6.5], as an alternative what at [~~3~~2.~~1~~2.3] may be applied.

2.2.3 The selection, arrangement and characteristics of the circuit protections are to be such that the maximum continuity of service to healthy circuits under fault conditions are ensured.

This may be achieved through selective operations of the various protective devices, the coordination between the electrical charac~~-~~teristics of the protected circuit or apparatus and the tripping characteristics of the protective devices.

3 Automation Systems

3.1 Application

3.1.1 ~~With reference to~~ Pt C, Ch 3, Sec 2, [1.1.6] is not mandatory.

3.1.2 ~~With reference to~~ Pt C, Ch 3, Sec 3 ~~is not mandatory.~~and Appendix 3 are applicable as far as it is practicable and in particular for yachts of less than 300GT in general for the other Sections of Chapter 3 specific relaxations and alternative considerations may be done.

3.1.3 With reference to [3.1.1] and [3.1.2], the Society reserves the right to apply Pt C, Ch 3 (as a whole or partially) in the case of non-conventional design or if it is deemed necessary, for the safety of the yacht, the evaluation of the system, equipment or components. A set of documents to be sent to the Society have to be agreed accordingly at the first stage of a new project.

SECTION 4 FIRE PROTECTION - ALTERNATIVES , RELAXATIONS, ADDITIONAL CONSIDERATIONS TO THE REQUIREMENTS SET IN PT ~~B~~C, CH 4

1 General

1.1 Application

1.1.1 This Alternatives, Relaxations, Additional consideration to Pt C, Ch 4, Sec 1 to Sec 9 are in addition to those of Pt C, Ch 4, App 1.

2 Fire containment

2.1 Class divisions

2.1.1 With reference to Pt C, Ch 4, Sec 3 as an alternative to [3.1.2] to [3.1.5] and [2.1.1] of Pt C, Ch.4, App 1 what below may be applied.

For yachts exceeding 300 GT built of composite material and alluminium, category A machinery spaces are to be totally enclosed by B-15 class boundaries.

For the foregoing yachts, galleys are to be totally enclosed by B-0 class boundaries (bulkheads, side shell and deck heads). Windows within the exterior hull or superstructure within this boundary are not expected to meet "B-0" standards. It is not necessary to extend the fire insulation below the minimum waterline.

For yachts of less than 300GT what above is not mandatory.

2.1.2 *(1/1/2025)*

Pt C, Ch 4, Sec 3, [3.2.3] is not mandatory.

2.1.3 With reference to Pt C, Ch 4, Sec 3 as an alternative to [4.1.2] and [2.2.1] of Pt C, Ch 4, App 1 what below may be applied.

For yachts exceeding 300 gross tonnage, 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) or the walls are equivalent to B-15 class divisions for machinery spaces and B-0 class divisions for galleys to a point at least 5 metres from the space concerned.

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.

The requirements above also apply to ventilation ducts for accommodation spaces passing within category A machinery spaces.

For yachts of less than 300GT what above is not mandatory.

2.1.4 With reference to Pt C, Ch 4, Sec 3, [4.1.9] the above means may be avoided for openings located at least 1m above the freeboard deck and 0,5m above the 1st tier superstructure deck or above.

3 PROTECTION OF SPACES CONTAINING VEHICLES OR CRAFT WITH FUEL IN THEIR TANKS OR LOCKERS STORING SUCH FUELS

3.1 General

3.1.1 With reference to Pt C, Ch 4, Sec 6 as an alternative to [2] what below may be applied.

Chapter 8
SECURE YACHT

APPENDIX 2 ALTERNATIVES, RELAXATIONS AND ADDITIONAL CONSIDERATIONS FOR YACHTS OF LESS THAN 24M LLL

1 General

1.1 -General

1.1.1 -No specific relaxations are foreseen.

Chapter 9
ICE CLASS

SECTION 1 GENERAL

1 General

1.1

1.1.1 *(1/1/2025)*

The requirements for the assignment of the ICE Class contained in Pt F of Rules for the Classification of Ships are in principle applicable. ~~Where other parts of the Rules for the Classification of Ships are recalled in Pt F of Rules for the Classification of Ships, they have to be intended as the relevant part of the present Rules.~~

~~Structural arrangement deeply different from the one adopted in Pt F of Rules for the Classification of Ships will be subject to special considerations.~~

~~For materials of the hull different from steel the relevant strength its resistance to the abrasion due to the ice will be evaluated.~~

1.1.2 *(1/1/2025)*

Where other parts of the Rules for the Classification of Ships are recalled in Pt F of Rules for the Classification of Ships, they have to be intended as the relevant part of the present Rules.

1.1.3 *(1/1/2025)*

Structural arrangement deeply different from the one adopted in Pt F of Rules for the Classification of Ships will be subject to special considerations.In particular the extension of the fore region for Ice Class ID may be specially considered and in any case should not to be taken less than 0.25L

1.1.4 *(1/1/2025)*

For materials of the hull different from steel the relevant strength its resistance to the abrasion due to the ice will be evaluated.

1.1.5 *(1/1/2025)*

Underwater lights may be installed in the reinforced thickness ice belt provided that they do not interrupt reinforced structures and are located inside a watertight box with thickness at least 2mm higher than those of the surrounding structures. Relevant details to be sent for approval

1.1.6 *(1/1/2025)*

Portlights shall not be installed in the reinforced thickness ice belt and they shall not interrupt reinforced structures Relevant details to be sent for approval. The portlights located in the area of reinforced beams are to be welded to the hull and have a metallic deadlight.