DNV·GL

RULES FOR CLASSIFICATION

Yachts

Edition October 2016

Part 3 Hull

Chapter 1 Design principles

DNV GL AS

FOREWORD

DNV GL rules for classification contain procedural and technical requirements related to obtaining and retaining a class certificate. The rules represent all requirements adopted by the Society as basis for classification.

Any comments may be sent by e-mail to *rules@dnvgl.com*

CURRENT – CHANGES

This document supersedes the December 2015 edition.

Changes in this document are highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Main changes October 2016, entering into force as from date of publication

• Sec.2 Rule principles

— Adaptions made in wording, nomenclature and definitions to reflect principle changes have been made in Ch.4.

• Sec.3 Verification of compliance

— Sec.3 [1]: Set up for procedural requirements has been updated
— Sec.3 [2]: Documentation requirements have been modified
— Sec.3 [4]: Document requirements on products required to be certified have been implemented.

• Sec.4 Symbols and definitions

— Adaptions made in wording, nomenclature and definitions to reflect principle changes have been made in Ch.4.

Editorial corrections

In addition to the above stated changes, editorial corrections may have been made.

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SECTION 1 APPLICATION

1 Scope of application

1.1 General

1.1.1 Pt.3 applies to all types of yachts mentioned in Pt.1 Ch.2 Sec.3 Table 1.

1.1.2 Applicability of the rules to innovative designs shall be decided based on consideration of the technical background of the different requirements. Increased scope of analysis beyond what is defined in these rules may be required to ensure equivalent safety.

2 Rule application

2.1 Rule description

Class rules for hull structure are provided in Pt.3, Pt.5 and Pt.6.

Pt.5 covers application and additional requirements related to mandatory and optional yacht type notations in addition to novel designs, and is divided into yacht type groups reflecting the intention of the vessel. Each chapter contains three main parts:

— general application
— application of hull requirements
— ship type specific requirements covering all necessary disciplines, i.e. hull, stability, safety, etc.

Pt.6 contains all additional class notations, optional or mandatory.

2.2 Rule requirements

2.2.1 Part 3

The Pt.3 of the rules provides requirements common to all yacht types as follows:

— Ch.1: *Design principles*
— Ch.2: *General arrangement design*
— Ch.3: *Hull design loads*
— Ch.4: *Metallic hull girder strength and local scantlings*
— Ch.5: *Composite scantlings*
— Ch.6: *Finite element analysis*
— Ch.7: *Rudder, foundations and appendages*
— Ch.8: *Hull equipment*
— Ch.9: *Opening and closing appliances*
— Ch.10: *Stability*.

2.2.2 General criteria

The yacht arrangement, the proposed details and the offered scantlings shall comply with the requirements and the minimum scantlings given in the rules.

SECTION 2 RULE PRINCIPLES

1 General

1.1 Rule objectives

1.1.1 The objectives of Pt.3 are to establish requirements to mitigate the risks of major structural failure in order to improve the safety of life, environment and property and to contribute to the durability of the hull structure for the yacht's design life.

1.2 Rule application

1.2.1 Although mainly addressing hulls constructed from metallic materials, the safety philosophy behind these principles are also valid and implicit for hulls made composite materials, as particularly specified in Ch.5.

2 General assumptions

2.1 Application and implementation of the rules

2.1.1 Pt.3 addresses hull structural aspects of classification. Requirements related to the verification of compliance with the rules during construction and operation are given in Pt.2 and Pt.7 Ch.1 Sec.2, respectively. In order to achieve the safety level targeted by the rules, a number of aspects related to design, construction and operation of the yacht are assumed. A summary of these assumptions are given in Pt.1 Ch.1.

3 Design basis

3.1 General

3.1.1 This article specifies the design parameters and the assumptions about the yacht operation that are used as the basis of the design principles of the rules.

3.1.2 Yachts shall be designed to withstand, in the intact condition, the environmental conditions as defined in [3.5] anticipated during the design life, for the appropriate loading conditions. Structural strength shall be determined against buckling, yielding and fatigue. Ultimate strength calculations shall include ultimate hull girder capacity and ultimate strength of plates and stiffeners.

3.1.3 Vibrations in the hull structural elements are not considered in relation to the requirements for scantlings given in the rules. It is, however, assumed that special investigations are made to avoid harmful vibrations, causing structural failures (especially in after body and machinery space tank structures), malfunction of machinery and instruments or annoyance to crew and passengers.

3.1.4 Yachts shall be designed to have sufficient strength to withstand the loads due to flooded conditions.

3.1.5 Adequate fatigue strength shall be documented for specified fatigue life and design environments. Fatigue strength shall be assessed for yacht types and details found prone to fatigue according to Ch.4 App.D.

3.1.6 The design basis used for the design of each yacht shall be documented and submitted as part of the design review and approval. All changes of the design basis shall be formally advised.

3.2 Scope

3.2.1 The rules envisage primarily technical safety matters. Aesthetical and comfort aspects, are not considered and shall be subordinated to the safety requirements in conflict cases.

3.2.2 The requirements given in these rules do not substitute the independent judgement of professional designers. This is particularly valid for those aspects not addressed in these rules and for which the designers are solely responsible.

3.3 Design life

3.3.1 A design life of 25 years is assumed for selecting yacht design parameters. The specified design life is the nominal period that the yacht is assumed to be exposed to operating conditions.

3.4 Environmental conditions

3.4.1 North Atlantic wave environment

The ultimate limit state criteria is generally based on yachts sailing in the North Atlantic wave environment except for sailing yachts rigs.

3.4.2 Wind and current

The effects of wind and current with regard to the strength of the structure are not considered.

3.4.3 Ice

The effects of ice are covered by Pt.6.

3.4.4 Design temperatures

The rules assume that the structural assessment of hull strength members is valid for the design temperatures Pt.4 Ch.1 Sec.1 Table 2.

3.5 Internal environment

3.5.1 Liquids in tanks

A density of 1.025 t/m^3, or a higher value, if specified by the designer, shall be used as a minimum for tank design when filling of liquids for the strength assessment of all relevant tank structures.

For a fatigue assessment, a representative mean density throughout the yacht's life shall be used.

3.6 Maximum service speed

3.6.1 The maximum service speed shall be specified in the design specifications. Although the hull structure verification criteria take into account the service speed this does not relieve the responsibilities of the owner and personnel to properly handle the yacht and reduce speed or change heading in severe weather.

4 Design principles

4.1 Overall principles

4.1.1 Introduction

This sub-section defines the underlying design principles of the rules in terms of loads, structural capacity models and assessment criteria and also construction and in-service aspects.

4.1.2 General

The rules are based on the following overall principles:

— the safety of the structure can be assessed by addressing the potential structural failure mode(s) when the yacht is subjected to operational loads and environmental loads/conditions
— the design complies with the design basis, see Sec.3
— the structural requirements are based on consistent design load sets which cover the appropriate operating modes.

The yacht's structure is designed such that:

— it has a degree of redundancy. The yacht's structure should work in a hierarchical manner and, in principle, failure of structural elements lower down in the hierarchy do not result in immediate consequential failure of elements higher up in the hierarchy
— the incidence of in-service cracking is minimised, particularly in locations which affect the structural integrity or containment integrity, affect the performance of structural or other systems or are difficult to inspect and repair
— it has adequate structural redundancy to survive in the event that the structure is accidentally damaged to a minor impact leading to flooding of any compartment
— it has good access conditions during construction to assure satisfactory quality of weld, painting and safe survey/inspection by crew, Society, representatives and other relevant authorities
— it has good access conditions during the operational phase to allow adequate maintenance and safe periodical survey/inspection by crew, Society, representatives and other relevant authorities.

4.1.3 Limit state design principles

The rules are based on the principles of limit state design.

Limit state design is a systematic approach where each structural element is evaluated with respect to possible failure modes related to the design scenarios identified. For each retained failure mode, one or more limit states may be relevant. By consideration of all relevant limit states, the limit load for the structural element is found as the minimum limit load resulting from all the relevant limit states.

The limit states are divided into the four categories: serviceability limit state, ultimate limit state, fatigue limit state and accidental limit state.

The rules include requirements for the relevant limit states of the various parts of the structure.

4.2 Design load scenarios

The structural assessment of the structure is based on the design load scenarios encountered by the yacht see Ch.3.

The design load scenarios are based on static and dynamic loads as given below:

— Static design load scenario:

  covers application of relevant static loads and typically covers load scenarios in harbour and sheltered water
— Static plus dynamic design load scenario:

covers application of relevant static loads and simultaneously occurring dynamic load components and typically cover load scenarios for seagoing operations

— Impact design load scenario:

covers application of impact loads such as slamming encountered during seagoing operations

— Fatigue design load scenario:

covers application of wave induced loads

— Accidental design load scenario:

covers application of some loads not occurring during normal operations, as accidental flooding of compartments

— Testing design load scenario:

covers application of tank testing loads.

4.3 Structural capacity assessment

4.3.1 General

The basic principle in structural design shall apply the defined design loads, identify plausible failure modes and employ appropriate capacity models to verify the required structural scantlings.

4.3.2 Capacity models

The strength assessment method shall be capable of analysing the failure mode in question to the required degree of accuracy.

The structural capacity assessment methods are in either a prescriptive format or require the use of more advanced calculations such as finite element analysis methods.

The formulae used to determine stresses, deformations and capacity are deemed appropriate for the selected capacity assessment method and the type and magnitude of the design load set.

The fatigue assessment method provides rule requirements to assess structural details against fatigue failure.

The fatigue capacity model is based on a linear cumulative damage summation (Palmgren-Miner's rule) in combination with a design S-N curve, a reference stress range and an assumed long-term stress distribution curve.

The fatigue capacity assessment models are in either a prescriptive format or require the use of more advanced calculations, such as finite element analysis methods. These methods account for the combined effects of global and local dynamic loads.

4.3.3 Intact structure

All strength calculations e.g. for flooding compartments, are based on the assumption that the structure is intact. (The residual strength of the yacht in a structurally damaged condition is generally not part of classification).

5 Rule design methods

5.1 General

5.1.1 Design methods

Scantling requirements are specified to cover the relevant limit states as necessary for various structural parts.

The criteria for the assessment of the scantlings are based on one of the following design methods:

— working stress/strain design (WSD) method (or permissible or allowable stress method)
— partial safety factor (PSF) method (or load and resistance factor design).

For both WSD and PSF, several design assessment conditions and corresponding acceptance criteria are given. These conditions are associated with the probability level of the (combined) loads.

— The WSD method has the following composition:

$$f(F_{stat}) + \psi_i f(F_{dyn\text{-}i}) \leq \eta_i f(R)$$

— The PSF method has the following composition:

$$\gamma_{stat\text{-}i} f(F_{stat}) + \psi_i \gamma_{dyn\text{-}i} f(F_{dyn\text{-}i}) \leq f(R)/\gamma_R$$

where:

$f(F_{stat})$ = function of the static loads acting on the structure
(e.g. load effects in terms of stresses)

$f(F_{dyn\text{-}i})$ = function of the simultaneously occurring dynamic loads
(e.g. local and global load components)

$f(R)$ = function of the characteristic structural resistance
(e.g. specified minimum yield stress or buckling capacity)

ψ_i = combination factor for simultaneousness of statistically independent dynamic loads

η_i = resistance (permissible utilisation) factor which includes consideration of uncertainties in loads, structural capacity and the consequence of failure

$\gamma_{stat\text{-}i}$ = partial safety factor that accounts for the uncertainties related to static loads

$\gamma_{dyn\text{-}i}$ = partial safety factor that accounts for the uncertainties related to dynamic loads

γ_R = partial safety factor that accounts for the uncertainties related to structural capacity.

The acceptance criteria for both the WSD method and PSF method are calibrated for the various requirements such that consistent and acceptable safety levels for all combinations of static and dynamic load effects are derived.

5.2 Minimum requirements

5.2.1 Minimum requirements specify the minimum scantling requirements which shall be applied irrespective of all other requirements.

The minimum requirements are usually in one of the following forms:

— minimum thickness
— minimum stiffness and proportions.

5.3 Load-capacity based requirements

5.3.1 General

In general, the WSD method is applied. In addition, the partial safety factor format is applied for this highly critical failure mode to better account for uncertainties related to static loads, dynamic loads and capacity formulations.

Load based prescriptive requirements provide scantling requirements for all plating, local supporting members, most primary supporting members and the hull girder and cover all structural elements including deckhouses, foundations for deck equipment.

In general, these requirements explicitly control one particular failure mode and hence several requirements may be applied to assess one particular structural member.

5.3.2 Design loads

The probability level of the dynamic global, local and impact loads is 10^{-8} and is derived using the long-term statistical approach.

The design load scenarios for structural verification apply the applicable simultaneously acting local and global load components. The relevant design load scenarios are given in Ch.3.

The simultaneously occurring dynamic loads are specified by applying a dynamic load combination factor to the dynamic load values given in Ch.3.

Design load conditions for the hull girder ultimate strength are given in Ch.4 Sec.2 [3.3].

The fatigue requirements are given in Ch.4 App.D.

The considered wave induced loads include:

— hull girder loads (i.e. vertical and horizontal bending moments)
— dynamic wave pressures
— dynamic pressure and forces.

The dynamic loads are taken at a probability level of 10^{-4}.

5.3.3 Structural response analysis

In general, the following approaches are applied for determination of the structural response to the applied design load combinations.

a) Beam theory:
   — used for prescriptive requirements.

b) FE analysis:
   — coarse mesh for global model
   — fine mesh for local models
   — very fine mesh for fatigue assessment.

5.4 Acceptance criteria

5.4.1 General

The specific acceptance criteria that is applied in the rule requirements is dependent on the probability level of the characteristic (combined) load.

5.4.2 Acceptance criteria

For the yield criteria the permissible stress is proportional to the specified minimum yield stress of the material.

The specific acceptance criteria applied in the partial safety factor or working stress design requirements, respectively are given in the detailed rule requirements.

For the buckling failure mode, the acceptance criteria are based on the control of stiffness and proportions as well as on the buckling utilisation factor.

SECTION 3 VERIFICATION OF COMPLIANCE

1 Procedural requirements

1.1 Newbuilding

1.1.1 For general requirements to:

— submission of documentation
— certification of products intended to be installed on board

see SHIP Pt.1 Ch.3.

2 Documentation requirements

2.1

2.1.1 In order to obtain a class certificate, documentation shall be submitted as required by Table 1.

Table 1 Documentation requirements

Object	*Documentation type*	*Additional description*	*Info*
Vessel arrangement	Z010 – General arrangement plan		FI
Sacrificial anodes	M050 – Cathodic protection specification, calculation and drawings	In ballast tanks	FI
	Z030 – Arrangement plan		AP
	C030 – detailed drawing	Fastening of anodes in ballast tanks	AP
Welding	H140 – Welding tables		AP
Hull structure	H020 – Design load plan		FI
	H030 – Tank and capacity plan		FI
	H050 – Structural drawing	Decks and inner bottom	AP
	H050 – Structural drawing	Transverse bulkheads	AP
	H050 – Structural drawing	Longitudinal bulkheads	AP
	H050 – Structural drawing	Fore ship	AP
	H050 – Structural drawing	Engine room area	AP
	H050 – Structural drawing	Aft ship	AP
	H052 – Midship section drawing		AP
	H060 – Shell expansion drawing		AP
	H061 – Framing plan		AP
	H062 – Longitudinal section drawing		AP
	H082 – Longitudinal strength analysis		FI
	H120 – Docking arrangement plan		FI
Stern frame	H050 – Structural drawing		AP
Bottom	H050 – Structural drawing	Foundations of retractable bottom equipment, including supporting structure and watertight boundaries	AP
	Z030 – Arrangement plan	Retractable bottom equipment, including resulting loads acting on the supporting structure, and details of sealings	FI

Object	*Documentation type*	*Additional description*	*Info*
Superstructure	H050 – Structural drawing		AP
Deck house structures	H050 – Structural drawing		AP
Supporting structures for heavy or loaded objects	H050 – Structural drawing	If static force > 50 kN or static bending moment at deck | 100 kNm	AP
Internal access	Z030 – Arrangement plan	Permanent means of access to the internal structure of tanks and compartments	FI
Anchoring arrangement	H100 – Equipment number calculation		AP
	Z030 – Arrangement plan	Including main dimensions and design loads (SWL, equipment weight, brake rendering load and chain breaking load) and foot print loads	FI
	Z090 – Equipment list	Covering windlasses, anchors, grade of anchor chain, type and breaking load of chain, wire and fibre ropes	AP
Anchor windlass supporting structure; mooring winch supporting structure; anchor chain stopper supporting structure	H050 – Structural drawing	Including foundation above deck and fixation (bolts, chocks and shear stoppers), SWL, equipment weight, brake rendering load and chain/wire breaking load and foot printloads	AP
Mooring arrangements	Z030 – Arrangement plan	Plan providing information for each item regarding: — location on the yacht — fitting types — dimensions — safe working load — maximum breaking strength of the towing and mooring lines — the purpose (mooring/harbour towing etc.) — manner of applying the lines including limiting fleet angles	FI

Object	*Documentation type*	*Additional description*	*Info*
Towing arrangement	Z030 – Arrangement plan	Plan providing information for each item regarding: — location on the yacht — fitting type — dimensions — safe working load — maximum breaking strength of the towing lines — manner of applying the towing line including limiting fleet angles	FI
	Z250 – Procedure	Emergency procedure covering SOLAS II-1/3-4	FI
Mooring equipment supporting structures; towing equipment supporting structures	H050 – Structural drawing	Including foundation above deck, fixation to deck and fittings	AP
Hull equipment	Z030 – Arrangement plan	Including main dimensions and design loads (safe working loads, equipment weight, brake rendering load and wire breaking load) and foot print loads	FI
Masts and rigging	Z030 – Arrangement plan		AP
	C010 – Design criteria	Safe working load	AP
Masts	C030 – Detailed drawing	Including derrick posts	AP
Rigging	C030 – Detailed drawing	Including minimum breaking strength	AP
Masts and rigging supporting structures	H050 – Structural drawing	In way of masts, post and standing rigging fastenings	AP
Cranes	Z030 – Arrangement plan	Including: — main dimensions — limiting positions of movable parts — location on board during operation and in parked position	FI

Object	*Documentation type*	*Additional description*	*Info*
Shipboard cranes	C010 – Design criteria	Including: — load charts including safe working loads and corresponding arms — dynamic coefficients — self weights and positions of center of gravity	FI
	Z250 – Procedure	Information about the operation of the derrick booms, i.e. how the derricks are intended to be simultaneously serve one hatch. Including working position for each derrick	FI
Shipboard crane pedestals; offshore crane pedestals	H050 – Structural drawing		AP
Shipboard crane stowage arrangement; offshore crane storage arrangement	H050 – Structural drawing	Including design loads and reaction forces in transit condition.	AP
Offshore cranes	C010 – Design criteria	Including: — load charts including safe working loads and corresponding arms — dynamic coefficients	FI
Shipboard crane supporting structures; offshore crane supporting structures	H050 – Structural drawing	Including design loads and reaction forces: — during operation — in stowed position	AP
External watertight integrity	B200 – Freeboard plan		AP
	B220 – Freeboard calculation		FI
Shell doors and ramps	C030 – Detailed drawing	Including securing and locking devices. Including specification of design pressure	AP
	I200 – Control and monitoring system documentation	Water leakage monitoring system	AP
	Z030 – Arrangement plan	Bow, stern and side doors	FI
Cargo hatches	C030 – Detailed drawing	Including covers and opening, closing, sealing, securing and locking devices	AP

Object	*Documentation type*	*Additional description*	*Info*
Service hatches	C030 – Detailed drawing	Hatch covers, securing devices and locking devices. Inlcuding specification of design pressure	AP
Ventilation systems	C030 – Detailed drawing	Ventilators including closing appliances	AP
Protection of crew	Z030 - Arrangement plan	Guard rails and bulwarks	FI
	H050 – Structural drawing	Guard rails and bulwarks	AP
External drain system	S010 - Piping diagram		AP
Internal watertight doors and hatches	Z030 – Arrangement plan	Including for each appliance: Size, design principle (sliding, hinged), pressure rating and fire rating. Including remote control positions	AP
Windows	C030 – Detailed drawing	Including main dimensions, deadlights and method of attachment, and specification of glazing material and design pressure	AP
	Z030 – Arrangement plan	Including type of glass, frames, references to standards, and deadlights where applicable	AP
Engine rooms	Z240 – Calculation report	For vessels with periodically unmanned machinery space: filling time calculation, see K400	FI
Propeller nozzles	H050 – Structural drawing		AP
Propeller shaft brackets	H050 – Structural drawing		AP
Box collers	H050 – Structural drawing	Foundations including supporting structures and watertight boundaries	AP
	Z030 – Arrangement plan	Including details of sealing	FI
AP = For approval; FI = For information ACO = As carried out; L = Local handling; R = On request; TA = Covered by type approval; VS = Vessel specific			

For general requirements for documentation, including definition of the info codes, see SHIP Pt.1 Ch.3 Sec.1.
For a full definition of the documentation types, see SHIP Pt.1 Ch.3 Sec.2.

3 Certification requirements

3.1

In order to obtain a class certificate, products that are intended to be installed on board shall be certified as required by Table 2.

Table 2 Certification requirements

Object	*Certificate type*	*Issued by*	*Certification standard**	*Additional description*
Anchors	PC	Society		
	MC	Society		
Anchor chains	PC	Society		Including accessories, e.g. swivels. Content shall include the following: — grade of chain, method of manufacture, condition of supply and reference to material certificate — results of proof load test, breaking load test and, where applicable, mechanical tests — identification marking.
	MC	Society		
	MC	Society		Bars for K2 and K3 anchor chain cable.
Anchor steel wire ropes	MC	Manufacturer		
Anchor fibre ropes	MC	Manufacturer		
Anchor chain joining shackles	PC	Society		
	MC	Society		
Anchor windlasses	PC	Society		
	MC	Manufacturer		Cable lifter
				Drum
				Shaft
				Clutch
				Brake
				Gear
	MC	Manufacturer		Frame

Object	*Certificate type*	*Issued by*	*Certification standard**	*Additional description*
Anchor chain stoppers	MC	Society		Material certificate issued by manufacturer is acceptable if type approved.
Shell doors control and monitoring system	PC	Society		
Internal watertight doors contrl and monitoring system	PC	Society		
* Unless otherwise specified the certification standard is the rules. PC = Product Certificate, MC = Material certificate				

4 Documentation requirements - products required to be certified

In order to obtain product certificates as required by Table 2, documentation shall be submitted as required by Table 3.

Table 3 Documentation requirements - products required to be certified

Object	*Documentation type*	*Additional description*	*Info*
Anchors	C010 - Design criteria	Applicable if different from standard or from previously approved design.	FI, TA
	C030 - Detailed drawing		AP, TA
	C040 - Design analysis		FI, TA
Anchor chain stoppers	C010 - Design criteria		FI, TA
	C020 - Assembly or arrangement drawing		FI, TA
	C030 - Detailed drawing		AP, TA
	C040 - Design analysis		FI, TA
Anchor windlasses	C010 - Design criteria		FI, TA
	C020 - Assembly or arrangement drawing		FI, TA
	C030 - Detailed drawing	Cable lifter, drum, shaft, gear, brake, clutch and frame.	AP, TA
	C040 - Design analysis		FI, TA
	C050 - Non-destructive testing (NDT) plan		AP, TA
Shell doors control and monitoring system	I200 - Control and monitoring system documentation		AP
Internal watertight doors control and monitoring system	I200 - Control and monitoring system documentation		

AP = For approval; FI = For information

ACO = As carried out; L = Local handling; R = On request; TA = Covered by type approval; VS = Vessel specific

For general requirements for documentation, including definition of the info codes, see SHIP Pt.1 Ch.3 Sec.1. For a full definition of the documentation types, see SHIP Pt.1 Ch.3 Sec.2.

5 Equivalence procedures

5.1 Rule applications

5.1.1 These rules apply to yachts of normal form, proportion, speed and structural arrangements. Relevant design parameters defining the assumptions made are given in Sec.2 [3].

5.1.2 Special consideration shall be given to the application of the rules incorporating design parameters which are outside the design basis as specified in Sec.2 [3], for example, increased fatigue life.

5.2 Novel designs

5.2.1 Yachts of novel design, i.e. those of unusual form, proportion, speed and structural arrangement outside those specified in Sec.2, shall be specially considered according to the contents of [5.2.2] to [5.2.4]. Relevant requirements in Pt.5 are applicable mandatory based on given hull shape.

5.2.2 Information shall be submitted to the Society to demonstrate that the structural safety of the novel design is equivalent or better than that of the rules.

5.2.3 In such cases, the Society shall be contacted at an early stage in the design process to establish the applicability of the rules and additional information required for submission.

5.2.4 Dependent on the nature of the deviation, a systematic review may be required to document equivalence with the rules.

5.3 Alternative calculation methods

5.3.1 Where indicated in specific sections of the rules, alternative calculation methods to those shown in the rules may be accepted provided it is demonstrated that the scantling and arrangements are of equivalent or better reliability to those derived using the rules.

SECTION 4 SYMBOLS AND DEFINITIONS

1 Primary symbols and units

1.1 General

1.1.1 Unless otherwise specified, the general symbols and their units used in these rules are those defined in Table 1.

Table 1 Primary symbols

Symbol	*Meaning*	*Units*
F	forces and concentrated loads	kN
M	bending moment	kNm
Q	shear forces	kN
a	acceleration	g
c	coefficient	-
m	mass	t
p	pressure	kPa
g	gravity acceleration	9.81 m/s^2
ρ	density of seawater	1.025 t/m^3
x	*X* coordinate along longitudinal axis, see [3.6]	m
y	*Y* coordinate along transverse axis, see [3.6]	m
z	*Z* coordinate along vertical axis, see [3.6]	m
γ	partial safety factor	-
σ	normal stress	MPa
τ	shear stress	MPa

2 Symbols

2.1 Yacht's main data

2.1.1 Unless otherwise specified, symbols regarding yacht's main data and their units used in these rules are those defined in Table 2.

Table 2 Yacht's main data

Symbol	*Meaning*	*Units*
L	rule length	m
L_{LL}	freeboard length	m
L_S	subdivision length	m
B	moulded breadth of yacht	m
B_W	moulded breadth of the design waterline at draught T.	m
H	moulded depth of yacht	m
D_{LL}	moulded freeboard depth of yacht	m
T	moulded draught	m
T_H	maximum draught of the canoe body	m
T_{LL}	moulded freeboard draught	m
T_{dam}	deepest equilibrium water line in damage condition	m
Δ	displacement of the yacht at draught T or T_H ,respectively	t
C_B	block coefficient at draught T	-
$C_{B\text{-}LL}$	block coefficient at draught T_{LL}, as defined in the International Convention of Load Lines (ICLL)	-
V_0	expected maximum speed	knot
n	life time	years
x, y, z	X, Y, Z coordinates of the calculation point with respect to the reference coordinate system	m

2.2 Materials

2.2.1 Unless otherwise specified, symbols regarding materials and their units used in these rules are those defined in Table 3. Definitions for composite materials are given in Ch.5.

Table 3 Metallic materials

Symbol	*Meaning*	*Units*
R_{eH}	specified minimum yield strength	MPa
$R_{p0,2}$	specified minimum 0.2% proof stress	MPa
R_Y	specified minimum yield strength or 0.2% proof stress, respectively	MPa
R_m	specified minimum tensile strength	MPa
E	young's modulus	MPa
G	shear modulus	MPa
ν	poisson's ratio	-

2.3 Loads

2.3.1 Unless otherwise specified, symbols regarding loads and their units used in these rules are those defined in Table 4, Table 5 and Table 6.

Table 4 Load factors and coefficients

Symbol	*Meaning*	*Units*
c_0	wave coefficient	-
c_{RW}	service range coefficient	-
c_V	velocity coefficient	-
a_o	common acceleration parameter	-
a_z	vertical acceleration	g
a_y	transverse acceleration	g
a_x	longitudinal acceleration	g
f_p	probability factor	-
Q	probability level	-
Q_0	probability level, reference value	-

Table 5 Hull girder loads

Symbol	*Meaning*	*Units*
$M_{SW,j}$	vertical still water bending moment, *j = max, min, f* (hog, sag, damaged condition)	MNm
$M_{WV,j}$	vertical wave bending moment, *j = h, s, f* (hog, sag, damaged condition)	MNm
M_{WH}	horizontal wave bending moment	MNm
M_{WT}	torsional wave moment	MNm
Q_{SW}	vertical still water shear force	MN
Q_{SWf}	vertical still water shear force, in damaged condition	MN
Q_{WV}	vertical wave shear force	MN
Q_{WVf}	vertical wave shear force, in damaged condition	MN

Table 6 Local loads

Symbol	*Meaning*	*Units*
p_S	sea pressure on hull and weather exposed structures	kPa
p_{SL}	bottom slamming pressure	kPa
p_{BK}	hydrodynamic design pressure on bilge keel	kPa
p_D	pressure on deck	kPa
p_{T1}	design pressure for tanks	kPa
p_{T2}	maximum static design pressure for tanks	kPa
p_{T3}	design pressure for filled spaces, e.g. chain locker	kPa
p_{WT}	design pressure on watertight partitions	kPa
F_E	single point force	kN
F_{imp}	helicopter landing impact	kN

2.4 Scantlings

2.4.1 Unless otherwise specified, symbols regarding scantlings and their units used in these rules are those defined in Table 7 and Table 8.

Table 7 Hull girder scantlings

Symbol	*Meaning*	*Units*
γ_S	partial safety factor for the still water bending moment	-
γ_W	partial safety factor for the vertical wave bending moment	-
M_U	vertical hull girder ultimate bending capacity as specified in Ch.4 Sec.2 [3.3]	MNm
Q_U	vertical hull girder ultimate shear capacity as specified in Ch.4 Sec.2 [3.2]	MN
I_y	vertical moment of inertia of hull girder (about its horizontal neutral axis)	m^4
I_z	horizontal moment of inertia of hull girder (about its vertical neutral axis)	m^4
Z	vertical hull girder section modulus (at any point of the hull transverse section)	m^3
z_n	vertical distance from BL to horizontal neutral axis	m

Table 8 Local scantlings

Symbol	*Meaning*	*Units*
ψ	combination factor for simultaneousness of statistically independent dynamic loads	-
γ_S	partial safety factor for still water hull girder stress components	-
γ_W	partial safety factor for dynamic hull girder stress components	-
σ_L	hull girder bending stress	MPa
τ_L	shear stress due to hull girder bending	MPa
γ	local stress coefficient	-
f_L	stress coefficient due to superimposed hull girder stresses	-
γ_m	safety factor for structural resistance	-
f_m	material factor for isotropic material	-
s	stiffener spacing (see Ch.4 Sec.3 [6.1])	mm
ℓ	span of stiffeners or primary supporting member (PSM) (see Ch.4 Sec.3 [6])	m
S	PSM spacing (see Ch.4 Sec.3 [6])	m
ℓ_b	bracket arm length	m
t'	nominal plate thickness (without corrosion addition)	mm
t_c	corrosion addition	mm
t	required plate thickness (including corrosion addition)	mm

Symbol	Meaning	Units
t_{min}	minimum plate thickness (including corrosion addition)	mm
t_{off}	offered plate thickness (including corrosion addition)	mm
h_w	web height of stiffener or PSM	mm
t_w	web thickness of stiffener or PSM	mm
b_f	face plate width stiffener or PSM	mm
t_f	face plate/flange thickness of stiffener or PSM	mm
h_{stf}	height of stiffener (without plating)	mm
b_{eff}	effective breadth of attached plating	mm
A_{eff}	sectional area of stiffener or PSM, with effective breadth of attached plating	cm^2
A_{shr}	shear sectional area of stiffeners or primary supporting members	cm^2
I	moment of inertia of the stiffener, with attached plating about its neutral axis parallel to the plating	cm^4
I_p	polar moment of inertia of stiffener about its connection to plating	cm^4
I_ω	sectional moment of inertia of stiffener or primary supporting member about its connection to plating	cm^6
W	offered section modulus	cm^3

3 Definitions

3.1 Principal particulars

3.1.1 Rule length *L*

The rule length L is the distance, in m, measured on the design waterline at displacement Δ.

3.1.2 Freeboard length L_{LL}

The freeboard length L_{LL}, in m, shall be taken as 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or as the length from the fore side of the stem to the axis of the rudder stock on that waterline, if that be greater.

For yachts without a rudder stock, the length L_{LL} shall be taken as 96% of the waterline at 85% of the least moulded depth.

In yachts designed with a rake of keel the waterline on which this length is measured shall be parallel to the designed waterline.

Where the stem contour is concave above the waterline at 85% of the least moulded depth, both the forward end of the extreme length and the forward side of the stem shall be taken at the vertical projection to that waterline of the aftermost point of the stem contour (above that waterline).

3.1.3 Subdivision length L_S (according to SOLAS 2009, Chapter II-1, Reg. 2)

The subdivision length L_S of the yacht is the greatest projected moulded length of that part of the yacht at or below decks limiting the vertical extent of flooding with the ship at the deepest subdivision draught.

3.1.4 Breadth *B*

The breadth *B* in m is the greatest moulded breadth of the yacht. For yachts with unusual cross section the breadth will be specially considered.

3.1.5 Breadth B_W

The breadth B_W in m is the maximum moulded breadth of the design waterline at draught *T*.

3.1.6 Moulded depth *H*

the moulded depth, is the vertical distance, in m, amidships, from the moulded baseline to the moulded deck line of the uppermost continuous deck measured at deck at side. On yachts with a rounded gunwale or sheer strake, *H* shall be measured to the continuation of the moulded deck line.

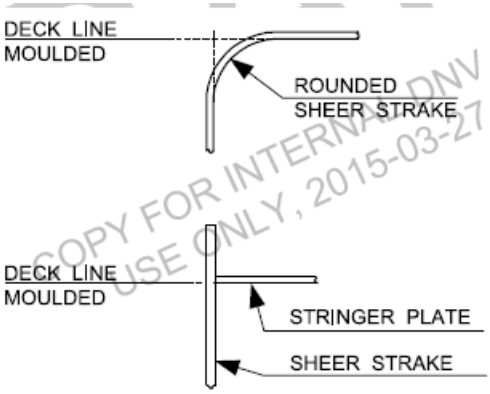

Figure 1 Deck corners

3.1.7 Moulded freeboard depth D_{LL}

The moulded freeboard depth D_{LL} is the least moulded depth taken as the vertical distance, in m, from the top of the keel to the top of the freeboard deck beam at side.

Where the freeboard deck is stepped and the raised part of the deck extends over the point at which the moulded depth shall be determined, the moulded depth shall be measured to a line of reference extending from the lower part of the deck along a line parallel with the raised part.

3.1.8 Draughts *T* and T_H

The draught *T* in m is the vertical distance amidships from base line to design waterline.

The hull draught T_H in m is the maximum draught of the canoe body of the yacht at displacement Δ.

3.1.9 Depth *H*

The moulded depth *H* in m is the vertical distance amidships measured from the base line to top of the freeboard deck beam at side.

3.1.10 Displacement

The displacement Δ of the yacht representing the mass in t, corresponding to the underwater volume of the yacht at draught *T* in seawater with a density of 1.025 t/m^3.

For sailing yachts the displacement is the weight of the yacht in ready for use condition, including sails, equipment and crew, but without consumables and with empty fresh water and fuel tanks. If the sailing yacht is carrying water ballast the weights of those ballast tanks shall be considered as completely filled that are most effective for upwind sailing.

3.1.11 Rated speed v_0

The speed v_0 is the expected maximum speed, in knots, of the yacht in calm water at the draught T at the maximum propeller RPM and corresponding engine MCR (maximum continuous rating).

For sailing yachts refer to Ch.3 Sec.2

3.1.12 Block coefficient

The block coefficient C_B at draught T, based on the length L is given by the formula:

$$C_B = \frac{\Delta}{1.025 \cdot L \cdot B_W \cdot T}$$

where:

$C_{b\text{-}LL}$ = the block coefficient as defined in the International Convention of Load Lines:

= $C_{B-LL} = \frac{\nabla}{L_{LL} \cdot B \cdot T_{LL}}$

∇ = Volume of the moulded displacement, excluding bossings, taken at the moulded draught T_{LL}.

3.2 Definition of decks

3.2.1 Bulkhead deck

Bulkhead deck is the deck above flooded waterline up to which transverse watertight bulkheads are extended to.

3.2.2 Freeboard deck

Freeboard deck is the uppermost complete deck exposed to weather and sea, which has permanent means of closing all exposed openings, in general. It is the deck upon which the freeboard calculation is based.

In case of a discontinuous freeboard deck, the lowest line of the exposed deck and the continuation of that line parallel to the upper part of the deck is taken as the freeboard deck. At the option of the owner and subject to the approval of the Administration, a lower deck may be designated as the freeboard deck provided it is a complete and permanent deck continuous in a fore and aft direction at least between the machinery space and peak bulkheads and continuous athwart ships. When this lower deck is stepped the lowest line of the deck and the continuation of that line parallel to the upper part of the deck is taken as the freeboard deck. When a lower deck is designated as the freeboard deck, that part of the hull which extends above the freeboard deck is treated as a superstructure so far as concerns the application of the conditions of assignment and the calculation of freeboard.

3.2.3 Internal or accommodation deck

Internal deck or accommodation deck is a deck not carrying goods which is inside closed structures and normally serves as a basis for usual crew or guest accommodation, including public area of passenger vessels.

3.2.4 Main deck

Main deck is the uppermost complete deck of the hull. It may be stepped.

3.2.5 Shelter deck

Shelter decks are not accessible to guests or passengers and are not subject to sea pressure. Crew can access such deck with care and taking account of the admissible load, which shall be clearly indicated.

3.2.6 Strength deck

Strength deck is the uppermost continuous deck or the part of a deck (after special consideration of its effectiveness) which form the upper flange of the effective longitudinal hull girder.

3.2.7 Weather deck

Weather decks are all free decks and parts of decks exposed to the sea.

3.3 Position 1 and Position 2

3.3.1 Position 1

Position 1 includes:

— exposed freeboard and raised quarter decks
— exposed superstructure decks situated forward of 0.25 L_{LL} from FP_{LL}.

3.3.2 Position 2

Position 2 includes:

— exposed superstructure decks situated aft of 0.25 L_{LL} from FP_{LL} and located at least one standard height of superstructure above the freeboard deck
— exposed superstructure decks situated forward of 0.25 L_{LL} from FP_{LL} and located at least two standard heights of superstructure above the freeboard deck.

3.4 Standard height of superstructure

3.4.1 The standard height of superstructure is defined in Table 9.

Table 9 Standard height of superstructure

Freeboard length L_{LL}, in m	*Standard height h_S, in m*	
	Raised quarter deck	*All other superstructures*
$L_{LL} \leq 30$	0.9	1.8
75	1.2	1.8
$L_{LL} > 125$	1.80	2.30

The standard heights at intermediate lengths of yachts shall be obtained by linear interpolation.

3.4.2 A tier is defined as a measure of the extent of a deckhouse. A deckhouse tier consists of a deck and external bulkheads.

3.5 Operation definition

3.5.1 Sheltered water

Sheltered waters are generally calm stretches of water when the wind force does not exceed 6 Beaufort scale, i.e. harbours, estuaries, roadsteads, bays, lagoons.

3.6 Reference coordinate system

3.6.1 The yacht's geometry, motions, accelerations and loads are defined with respect to the following right-hand coordinate system, see Figure 2:

$Origin$ = at the intersection among the longitudinal plane of symmetry of yacht, the aft end of L and the baseline

X_{axis} = longitudinal axis, positive forwards

Y_{axis} = transverse axis, positive towards portside
Z_{axis} = vertical axis, positive upwards.

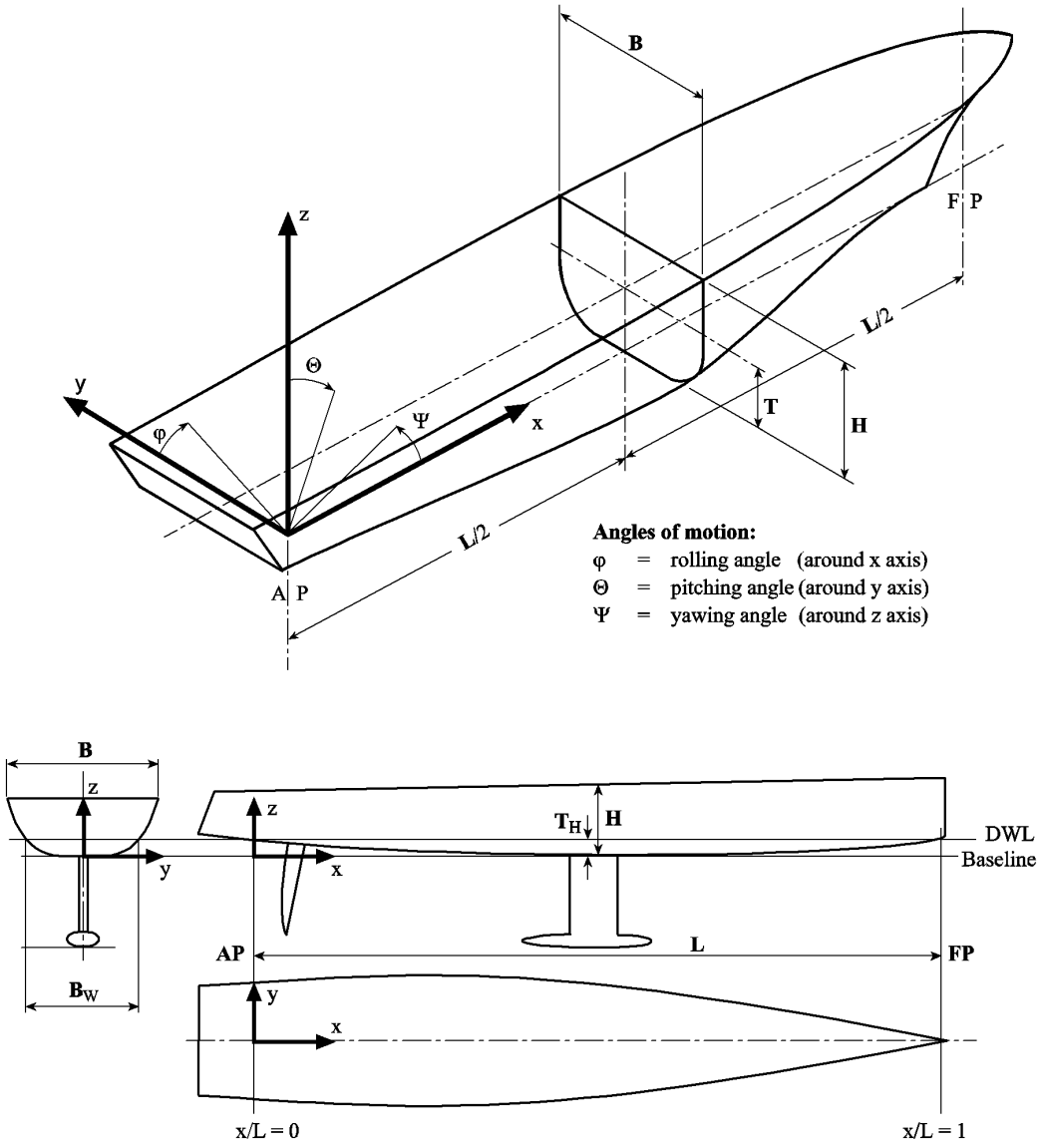

Figure 2 Reference coordinate system

3.6.2 Moulded base line

Moulded base line means line parallel to the design waterline, tangent to the moulded point

— sailing yachts: of the largest canoe body draft T_H
— all other yachts: of keel plate or the top of skeg at the middle of length L.

3.7 Glossary

3.7.1 Definitions of terms

Table 10 Definition of terms

Terms	*Definition*
accommodation deck	an enclosed deck used for the accommodation of the crew or passengers
aft end	hull region abaft of 0.1 *L* (from the aft perpendicular)
aft peak	the area aft of the aft peak bulkhead
aft peak bulkhead	the first main transverse watertight bulkhead forward of the stern
aft peak tank	the compartment in the narrow part of the stern aft of the aft peak bulkhead
aft perpendicular	aft perpendicular AP coincides with a moulded point on the waterline at the distance aft of FP of the respective length L, L_{LL}, L_S
amidships	the middle of the length *L* (at 0.5 *L* from the aft perpendicular)
anchor	a device which is attached to anchor chain at one end and lowered into the sea bed to hold a yacht in position; it is designed to grip the bottom when it is dragged by the yacht trying to float away under the influence of wind and current; usually made of casting
ballast tank	a compartment used for the storage of water ballast
base line	a line parallel to the slope of the keel intersecting the top of the keel or lower edge of keel rabbet for composite yachts at amidships
bilge keel	a piece of plate set perpendicular to a yacht's shell along and in way of the outer boundary of bottom to reduce the rolling motion
boss	the boss of the propeller is the central part to which propeller blades are attached and through which the shaft end passes
bottom/bottom shell	the shell envelope plating between keel and the chines
bow	the structural arrangement and form of the forward end of the yacht
bow door	collective term for the outer and the inner bow door normally leading to a complete or long forward enclosed superstructure
bower anchor	an anchor carried at the bow of the yacht
bracket	an extra structural component used to increase the strength of a joint between two structural members
bracket toe	the narrow end of a tapered bracket
bridge	an elevated superstructure having a clear view forward and at each side, and from which a yacht is steered
buckling panel	elementary plate panel considered for the buckling analysis
builder	the party contracted by the owner to build a yacht in compliance with the specifications including rules
bulb profile	a stiffener utilising an increase in steel mass on the outer end of the web instead of a separate flange

Terms	*Definition*
bulkhead	a structural partition wall sub-dividing the interior of the yacht into compartments
bulkhead deck	a deck (above flooded waterline) up to which transverse watertight bulkheads are extended to
bulkhead stool	the lower or upper base of a corrugated bulkhead
bulkhead structure	the transverse or longitudinal bulkhead plating with stiffeners and girders
bulwark	the vertical plating immediately above the upper edge of the yacht's side surrounding the exposed decks
bunker	a compartment for the storage of fuel oil used by the yacht's machinery
cable	a rope or chain attached to the anchor
camber	the upward rise of the weather deck from both sides towards the centreline of the yacht
carlings	a stiffening member used to supplement the regular stiffening arrangement
casing	the covering or bulkhead around or about any space for protection
centreline girder	a longitudinal member located on the centreline of the yacht
chain locker	a compartment usually at the forward end of a yacht which is used to store the anchor chain
chain pipe	a section of pipe through which the anchor chain enters or leaves the chain locker
chain stopper	a device for securing the chain cable when riding at anchor
chine	if no clearly identified chine exists, the hull point at which the tangent to the shell is inclined 50° to the horizontal
cofferdams	see Ch.2
collar plate	a patch used to, partly or completely, close a hole cut for a longitudinal stiffener passing through a transverse web
collision bulkhead	the foremost main transverse watertight bulkhead
companionway	a weathertight entrance leading from a deck to spaces below
compartment	an internal space bounded by bulkheads or plating
corrugation	plating arranged in a corrugated fashion
cross ties	large transverse structural members joining longitudinal bulkheads or joining a longitudinal bulkhead with double side structures and used to support them against hydrostatic and hydrodynamic loads
deadweight	difference between displacement Δ and lightweight
deck	a structure element which is inclined to horizontal less than 45° that defines the upper or lower boundary of a compartment
deck structure	the deck plating with stiffeners, girders and supporting pillars
deck transverse	transverse PSM at the deck
deckhouse	a deckhouse is a decked structure on the freeboard deck which does not comply with the definition of a superstructure

Terms	*Definition*
deep tank	any tank which extends between two decks or the shell/inner bottom and the deck above or higher
design waterline	the waterline corresponding to the maximum displacement of the yacht with no lift or propulsion machinery active
designer	a party who creates documentation submitted to the Society necessary for approval or for information. The designer can be the builder or a party contracted by the builder or owner to create this documentation
discharges	any piping leading through the yacht's sides for conveying bilge water, circulating water, drains etc.
displacement	the displacement Δ of the yacht representing the mass at draught T or T_H, respectively
docking bracket	a bracket located in the double bottom to locally strengthen the bottom structure for the purposes of docking
double bottom structure	the shell plating with stiffeners below the top of the inner bottom and other elements below and including the inner bottom plating
doubler	small piece of plate which is attached to a larger area of plate that requires strengthening in that location. Usually at the attachment point of a stiffener
enclosed superstructure	the superstructure with bulkheads forward and/or aft fitted with weather tight doors and closing appliances
engine room bulkhead	a transverse bulkhead either directly forward or aft of the engine room
EPP	elementary plate panel, the smallest plate element surrounded by structural members, such as stiffeners, PSM, bulkheads, etc.
face plate	the section of a stiffening member attached to the plate via a web and is usually parallel to the plated surface
flange	the section of a stiffening member, typically attached to the web, but is sometimes formed by bending the web over. It is usually parallel to the plated surface
flat bar	a stiffener comprised only of a web
floor	a bottom transverse member
flush deck yacht	a yacht which has no superstructure on the freeboard deck
fore end	the hull region forward of 0.9 L (from the aft perpendicular)
fore peak	the area of the yacht forward of the collision bulkhead
fore peak deck	a short raised deck extending aft from the bow of the yacht
forecastle	a short superstructure situated at the bow
forward perpendicular	forward perpendicular FP coincides with the fore side of the stem on the waterline on which the respective length L, L_{LL}, L_S is measured
foundation	a device transferring loads from a heavy or loaded object to the vessel structure
frame spacing	frame spacing a measured from moulded edge to moulded edge of frames
freeboard deck	the deck upon which the freeboard calculation is based (refer to [3.2])
freeing port	an opening in the bulwarks to allow water shipped on deck to run freely overboard

Terms	*Definition*
gangway	the raised walkway between superstructure, such as between the forecastle and bridge, or between the bridge and poop
girder	a collective term for primary supporting members (PSM)
gunwale	the upper edge of the yacht's sides
gusset	a plate, usually fitted to distribute forces at a strength connection between two structural members
hatchways	openings, generally rectangular, in a yacht's deck affording access into the compartment below
hawse pipe	steel pipe through which the hawser or cable of anchor passes, located in the yacht's bow on either side of the stem
hawser	large steel wire or fibre rope used for towing or mooring
HP	bulb profile in accordance with the Holland profile standard
hull	the outer boundary of the enclosed spaces of the craft, except for the superstructure
IACS	International Association of Classification Societies
ICLL	International Convention on Load Lines, 1966, as amended
IMO	International Maritime Organisation
independent tank	a self-supporting tank
intercostal	non continuous member between stiffeners or PSM
internal deck	see accommodation deck
keel	a) the main structural member or backbone of a yacht running longitudinally along the centreline of the bottom (usually a flat plate stiffened by a vertical plate on its centreline inside the shell) b) keel of a sailing yacht
keel line	refer to base line
knuckle	a discontinuity in a structural member
lightening hole	a hole cut in a structural member to reduce its weight
lightweight	displacement, in t, complete in all respects, but without cargo, consumable, stores, passengers and crew and their effects, and without any liquids on board except machinery and piping fluids, such as lubricants and hydraulics, at operating levels
limber hole	a small drain hole cut in a frame or plate to prevent water or oil from collecting
local supporting members	local stiffening members which only influence the structural integrity of a single panel, e.g. deck beams
locking arrangement	preventive measures ensuring that cleats and supports as applicable always remain in position when engaged
longitudinal centreline bulkhead	a longitudinal bulkhead located on the centreline of the yacht
longitudinal hull girder structural members	structural members that contribute to the longitudinal strength of the hull girder

Terms	*Definition*
main deck	the uppermost complete deck of the hull, which may be stepped
manhole	a round or oval hole cut in decks, tanks etc., for the purpose of providing access
margin plate	the outboard strake of the inner bottom and when turned down forms the outer boundary of the double bottom
MARPOL	IMO International Convention for the Prevention of Pollution from yachts, 1973and Protocol of 1978, as amended
midship area	the hull region between 0.4 *L* and 0.6 *L* (from the aft perpendicular)
moulded	the term moulded depends on the construction material of the hull: — steel and aluminium: referring to inner edge of the shell — all other materials: referring to outer edge of the shell
moulded base line	refer to base line
notch	a discontinuity in a structural member, generally caused by welding
oil fuel tank	a tank used for the storage of fuel oil
owner	the party that has assumed all duties and responsibilities for registration and operation of the yacht and who on assuming such responsibilities has agreed to take over all the duties and responsibilities on delivery of the yacht from the builder with valid certificates prepared for the owner
pillar	a vertical support placed between decks where the deck is unsupported by the shell or bulkhead
pipe tunnel	the void space running in the midship fore and aft lines between the inner bottom and shell plating forming a protective space for bilge, ballast and other lines extending from the engine room to the tanks
plate panel	unstiffened plate surrounded and supported by structural members, such as stiffeners, PSM, bulkheads, etc. see also EPP
plating	sheet supported by stiffeners, primary supporting members or bulkheads
poop	the space below an enclosed superstructure at the extreme aft end of a yacht
primary supporting member (PSM)	member of the beam, girder or stringer type which provide the overall structural integrity of the hull envelope and tank boundaries, e.g. double bottom floors and girders, transverse side structure, deck transverses, bulkhead stringers
safe working load (SWL)	the maximum load which the lifting appliance is certified to lift at any specified outreach
scallop	a hole cut into a stiffening member to allow continuous welding of a plate seam
scarfing bracket	a bracket used between two offset structural items
scantlings	the physical dimensions of a structural item
scupper	any opening for carrying off water from a deck, either directly or through piping
scuttle	a small opening in a deck or elsewhere usually fitted with a cover or lid or a door for access to a compartment
securing device	a device used to keep the door closed by preventing it from rotating about its hinges

Terms	*Definition*
sheer line	intersection line of shell and main deck or the line at which the tangent to the side shell is inclined 45° to the horizontal
sheer strake	the top strake of a yacht's side shell plating
shelf plate	a horizontal plate located on the top of a bulkhead stool
shell	bottom, side and transom
shell envelope plating	the shell plating forming the effective hull girder exclusive the decks
shelter deck	not accessible decks which are not subject to sea pressure (refer to [3.2])
shipboard crane	lifting appliances onboard and similar units intended for use within harbours areas and when at sea
side, side shell	the shell envelope plating between chine and sheer line
side frame	a vertical member attached to the side shell
single bottom structure	defined as the bottom shell plating with stiffeners and girders
skylight	a deck opening fitted with or without a glass port light and serving as a ventilator for engine room, quarters, etc.
SOLAS	IMO International Convention for the Safety of Life at Sea, 1974 as amended
spaces	separate compartments including tanks
stay	bulwark (and hatch coaming) brackets
stem	the piece of bar or plating at which a yacht's outside plating terminates at forward end
stern frame	the heavy strength member in single or triple screw yachts, combining the rudder post
stern tube	a tube through which the shaft passes to the propeller acts as an after bearing for the shafting. It may be water or oil lubricated
stiffener	a collective term for secondary supporting structural members
stool	a structure supporting tank bulkheads
strake	a course, or row, of shell, deck, bulkhead, or other plating
strength deck	the uppermost deck or the part of a deck which form the upper longitudinal hull girder
stringer	horizontal girders linking vertical web frames
stringer plate	the outside strake of deck plating
superstructure	a decked structure located above the main deck, with lateral walls inboard of the side of more than 4 per cent of the local breadth. Structures located on the main deck and whose walls are not in the same longitudinal plane as the side shell below may be regarded as a superstructure, if inclined inside
support	load carrying devices designed for transfer of acting forces
supporting device	a device used to transmit external or internal loads from a door, hatch or ramp to a securing device and from the securing device to the yacht's structure (e.g. securing device, hinge, stopper or other fixed devices)
supporting structure	strengthening of the vessel structure, e.g. a deck, in order to accommodate loads and moments from a heavy or loaded object

Terms	*Definition*
SWL	safe working load
tank	generic term for spaces intended to carry liquid, such as, seawater, fresh water, fuel oil etc.
topside tank	the tank that normally stretches along the length of the yacht's side
towing pennant	a long rope which is used to effect the tow of a yacht
transom	the structural arrangement and form of the aft end of the yacht between bottom, sides and deck
transverse ring	all transverse material appearing in a cross section of the yacht's hull, in way of a double bottom floor, vertical web and deck transverse girder
transverse web frame	the primary transverse girders which join the yachts longitudinal structure
tripping bracket	a bracket used to strengthen a structural member under compression against torsional forces
void	an enclosed empty space in a yacht
wash bulkhead	a perforated or partial bulkhead in a tank
watertight	means having scantlings and arrangements capable of preventing the passage of water in any direction under the head of water likely to occur in the worst situation at equilibrium, including intermediate stages of flooding
weather deck	a deck or section of deck exposed to the elements which has means of closing weathertight, all hatches and openings
weathertight	means that in any sea conditions water will not penetrate into the yacht
web	the section of a stiffening member attached perpendicular to the plated surface
web frame	transverse PSM including deck transverse
windlass	a winch for lifting and lowering the anchor chain

CHANGES – HISTORIC

December 2015 edition

This is a new document.

The rules enter into force 1 July 2016.

DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

SAFER, SMARTER, GREENER