DNV·GL

RULES FOR CLASSIFICATION

Yachts

Edition January 2018
Amended July 2018

Part 3 Hull

Chapter 8 Hull equipment

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 January 2018 edition of DNVGL-RU-YACHT Pt.3 Ch.8.

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

Amendments July 2018

Only editorial changes have been made.

Changes January 2018, entering into force 1. July 2018

Topic	*Reference*	*Description*
Rule clarification	Sec.1 [5.3.1]	Delete misleading requirement/paragraph
	Sec.2 [1] and Sec.2 [3]	Implemented guidance notes with reference to LSA Code and DNVGL-ST-0377 for lifting appliances

Editorial corrections

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

CONTENTS

SECTION 1 ANCHORING AND MOORING EQUIPMENT

For symbols not defined in this section, see Ch.1 Sec.4.

1 General

1.1 Introduction

1.1.1 The requirements in this section apply to equipment and installation for anchoring and mooring.

1.1.2 Towlines and mooring lines are not subject to classification. Lengths and breaking strength are, however, given in the equipment tables as guidance.

1.2 Documents and certificates to be submitted

The documents and certificates to be submitted are specified in Ch.1 Sec.3.

1.3 General

1.3.1 The anchoring equipment required is the minimum considered necessary for temporary mooring of a vessel in moderate sea conditions when the yacht is awaiting berth, tide, etc. The equipment is therefore not designed to hold a yacht off fully exposed coasts in rough weather or for frequent anchoring operations in open sea. In such conditions the loads on the anchoring equipment will increase to such a degree that its components may be damaged or lost owing to the high energy forces generated.

1.3.2 The equipment numeral equation for anchoring equipment required under this section is based on an assumed current speed of 2.5 m/s, wind speed of 25 m/s and a scope of chain cable between 6 and 10, the scope being the ratio between length of chain paid out and water depth.

1.3.3 The anchoring equipment required by this section is designed to hold a yacht in good holding ground in conditions such as to avoid dragging of the anchor. In poor holding ground the holding power of the anchors will be significantly reduced.

1.3.4 It is assumed that under normal circumstances a yacht will use only one bow anchor and chain cable at a time.

1.3.5 For yachts with equipment number EN less than 205 the installation of the second anchor on board is not required, except for passenger yachts.

1.3.6 For yachts operating not more than 50 nautical miles from a port of refuge and class notation **R3** assigned equipment may be determined as for one numeral range lower than required in accordance with equipment numeral EN.

1.3.7 Windlasses and chain stoppers, if fitted, shall comply with rules for machinery, windlass, capstan, chain stopper, mooring and towing equipment.

1.3.8 For the substructures of windlasses, chain stoppers and mooring equipment, see Ch.7 Sec.6 [5].

2 Equipment numeral

2.1 Monohulls

For monohull yachts the equipment numeral shall be calculated as follows:

$$EN = \Delta^{2/3} + 2 \cdot \left(a \cdot B + \Sigma b_i \cdot h_i \cdot \sin\Theta_i\right) + 0.1 \cdot A$$

where:

a = distance [m], from design waterline, amidships, to the upper deck at side

b_i = actual breadth of deckhouses

h_i = height [m] on the centreline of each tier of superstructures and deckhouses corresponding to b_i (deck sheer, if any, shall be ignored)

For the lowest tier h shall be measured at centreline from the upper deck or from a notional deck line where there is local discontinuity in the upper deck.

Θ_i = angle of inclination of each front bulkhead, as shown in Figure 1

A = area [m^2], in profile view of the hull, superstructures and deck houses, above the design waterline within the length L and up to the height $a + \Sigma h_i$.

For sailing yachts the rig has to be appropriately considered when determining area A.

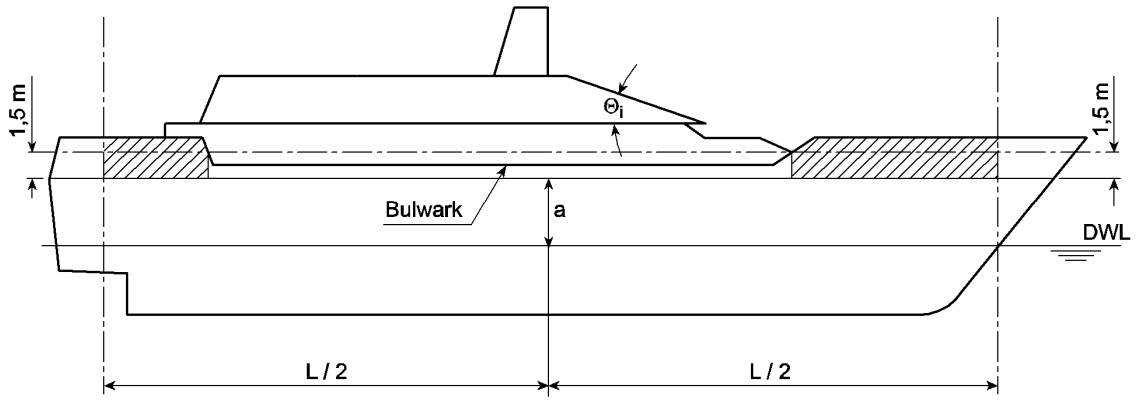

Figure 1 Profile view of hull, superstructure and deckhouses relevant for the equipment numeral

Screens of bulwarks 1.5 m or more in height above the deck at side shall be regarded as parts of houses when determining h_i and A, e.g. the areas specially marked in Figure 1.

2.2 Multihulls

The equipment number shall be calculated as follows:

$$EN = K_m \cdot \Delta^{2/3} + 2 \cdot \left(a \cdot B + \Sigma_i\left(b_i \cdot h_i \cdot \sin\Theta_i\right) - S_t + 0.1 \cdot A\right.$$

where:

— for craft with *n* hulls:

$$K = 2^{1/3} \cdot \frac{\Sigma_{i=1}^{n} \left(B_i \cdot T_i\right)^{2/3}}{\left(\Sigma_{i=1}^{n} B_i \cdot T_i\right)^{2/3}}$$

S_t = transverse area, amidships, of the tunnel(s) existing between the hulls and the waterline

B_i, T_i = breadth and draught [m] of the hull *i*, measured amidship

n = total number of craft hulls.

3 Anchors

3.1 Arrangement

The two rule bower anchors shall be connected to their chain cables and positioned on board ready for use. It shall be ensured that each anchor can be stowed in the hawse and hawse pipe in such a way that it remains firmly secured in seagoing conditions.

3.2 Anchor design

3.2.1 Anchors shall be of approved type. The mass of the heads of patent (ordinary stockless) anchors, including pins and fittings, shall not be less than 60 per cent of the total mass of the anchor.

3.2.2 For stock anchors, the total mass of the anchor, including stock, shall comply with the values in Table 1. The mass of the stock shall be 20 percent of this total mass.

3.2.3 The mass of each individual bower anchor may vary by up to 7 percent above or below the required individual mass provided that the total mass of all the bower anchors is not less than the sum of the required individual masses.

3.3 High holding power anchors

3.3.1 Where special anchors are approved by the Society as high holding power anchors (HHP), the anchor mass may be 75 percent of the anchor mass as per Table 1. High holding power anchors are anchors which are suitable for the yacht's use at any time and which do not require prior adjustment or special placement on sea bed.

3.3.2 For approval as a high holding power anchor, satisfactory tests shall be made on various types of bottom and the anchor shall have a holding power at least twice that of a patent anchor (admiralty standard stockless) of the same mass. The tests shall be approved by the Society. Detailed requirements for the tests see [3.5] and [3.6].

3.3.3 Dimensioning of the chain cable and of the windlass shall be based on the undiminished anchor mass according to Table 2.

3.4 Super high holding power anchors

Where special anchors are approved by the Society as super high holding power anchors (SHHP), the anchor mass may be not less than 2/3 of the mass required for the HHP anchor it replaces.

The maximum allowed mass of SHHP-anchors is limited to the Society's type approval (currently 2700 kg).

3.5 Testing

3.5.1 The proof test load shall be as given in Table 1, dependent on the mass of equivalent anchor, defined as follows:

— 4/3 of the total mass of HHP anchors
— two (2) times the total mass of SHHP anchors.

For intermediate values of mass the test load shall be determined by linear interpolation.

3.5.2 The proof load shall be applied on the arm or on the palm at a distance from the extremity of the bill equal to 1/3 of the distance between it and the centre of the crown. The shackle shall be tested with the anchor.

For stockless anchors, both arms shall be tested simultaneously, first on one side of the shank and then on the other side.

For stocked anchors, each arm shall be tested individually.

3.5.3 The anchors shall withstand the specified proof load without showing signs of defects.

Table 1 Proof test load for anchors

Mass of anchor [kg]	*Proof test load [kN]*	*Mass of anchor [kg]*	*Proof test load [kN]*
50	23.2	550	125
55	25.2	600	132
60	27.1	650	140
65	28.9	700	149
70	30.7	750	158
75	32.4	800	166
80	33.9	850	175
90	36.3	900	182
100	39.1	950	191
120	44.3	1000	199
140	49.1	1050	208
160	53.3	1100	216
180	57.4	1150	224
200	61.3	1200	231
225	66.8	1250	239
250	70.4	1300	247
275	74.9	1350	255
300	79.6	1400	262
325	84.2	1450	270
350	88.8	1500	278
375	93.4	1600	292

Mass of anchor [kg]	*Proof test load [kN]*	*Mass of anchor [kg]*	*Proof test load [kN]*
400	97.9	1700	307
425	1031	1800	321
450	1073	1900	335
475	112	2000	349
500	116		

3.6 Additional requirements for HHP anchors and SHHP anchors

3.6.1 HHP and SHHP anchors shall be designed for effective hold of the sea bed irrespective of the angle or position at which they first settle on the sea bed after dropping from a normal type of hawse pipe. In case of doubt, a demonstration of these abilities may be required.

3.6.2 The design approval of HHP and SHHP anchors is normally given as a type approval, and the anchors are listed in the *List of Approved Manufacturers and Type Approved Products, Hull Equipment*.

3.6.3 HHP anchors for which approval is sought shall be tested on sea bed to show that they have a holding power per unit of mass at least twice that of an ordinary stockless bower anchor.

3.6.4 SHHP anchors for which approval is sought, shall be tested on sea bed to show that they have a holding power per unit of mass at least four (4) times that of an ordinary stockless anchor.

3.6.5 If approval is sought for a range of anchor sizes, at least two sizes shall be tested. The mass of the larger anchor to be tested shall not be less than 1/10 of that of the largest anchor for which approval is sought. The smaller of the two anchors to be tested shall have a mass not less than 1/10 of that of the larger anchor to be tested.

3.6.6 Each test shall comprise a comparison between at least two anchors, one ordinary stockless anchor and one HHP or SHHP anchor. The mass of the anchors shall be as equal as possible.

3.6.7 The tests shall be conducted on at least three (3) different types of bottom, which normally shall be: soft mud or silt, sand or gravel, and hard clay or similar compacted material.

3.6.8 The tests are normally to be carried out by means of a tug. The pull shall be measured by dynamometer or determined from recently verified curves of the tug's bollard pull as function of propeller r.p.m.

The diameter of the chain cables connected to the anchors shall be as required for the equipment letter in question. During the test the length of the chain cable on each anchor shall be sufficient to obtain an approximately horizontal pull on the anchor. Normally, a horizontal distance between anchor and tug equal to 10 times the water depth will be sufficient.

3.7 Identification

3.7.1 The following marks shall be stamped on one side of the anchor:

— mass of anchor (excluding possible stock)
— HHP when approved as high holding power anchor
— SHHP when approved as super high holding power anchor
— certificate number
— date of test
— the Society's stamp.

4 Chain locker

The chain locker shall be of capacity and depth adequate to provide an easy direct lead of the cables through the chain pipes and self-stowing of the cables.

S = minimum stowing capacity

$$S = 1.1 \cdot d^2 \cdot \frac{\ell}{100\,000} \text{ [m}^3\text{]}$$

where:

d = chain diameter [mm] according to Table 2
ℓ = total length of stud link chain cable according to Table 2.

Table 2 Anchors, chain cables and ropes

Equipment numeral EN	*Two stockless bower anchors*	*Stud link chain cables*				*Recommended ropes*				
		Bower anchors				*Towline*		*Mooring ropes*		
	Mass per anchor	*Total length*	*Diameter* [1]			*Length*	*Breaking load*[2]	*Number*	*Length*	*Breaking load*[2]
			d_1	d_2	d_3					
	[kg]	*[m]*	*[mm]*	*[mm]*	*[mm]*	*[m]*	*[kN]*	–	*[m]*	*[kN]*
- 50	100	165	12.5	11	10	180	100	3	80	35
50-70	120	165	12.5	11	11	180	100	3	80	35
70-90	180	220	14	12.5	12.5	180	100	3	80	35
90-110	240	220	16	14	14	180	100	3	100	40
110-130	300	247.5	17.5	16	16	180	100	3	110	40
130-150	360	247.5	19	17.5	17.5	180	100	3	110	45
150-175	420	275	20.5	17.5	17.5	180	100	3	120	50
175-205	480	275	22	19	19	180	100	3	120	55
205-240	570	302.5	24	20.5	20.5	180	110	3	120	60

Equipment numeral EN	Two stockless bower anchors	Stud link chain cables				Recommended ropes				
		Bower anchors				Towline		Mooring ropes		
	Mass per anchor	Total length	Diameter [1]			Length	Breaking load[2]	Number	Length	Breaking load[2]
			d_1	d_2	d_3					
	[kg]	[m]	[mm]	[mm]	[mm]	[m]	[kN]	–	[m]	[kN]
240-280	660	302,5	26	22	20.5	180	130	4	120	65
280-320	780	330	28	24	22	180	150	4	120	70
320-360	900	357.5	30	26	24	180	175	4	140	80
360-400	1020	357.5	32	28	24	180	200	4	140	85
400-450	1140	385	34	30	26	180	225	4	140	95
450-500	1290	385	36	32	28	180	250	4	140	100
500-550	1440	412.5	38	34	30	190	275	4	140	110
550-600	1590	412.5	40	34	30	190	305	4	160	120
600-660	1740	440	42	36	32	190	340	4	160	130
660-720	1920	440	44	38	34	190	370	4	160	145
720-780	2100	440	46	40	36	190	405	4	160	160
780-840	2280	467.5	48	42	36	190	440	4	170	170
840-910	2460	467.5	50	44	38	190	480	4	170	185
910-980	2640	467.5	52	46	40	190	520	4	170	200
980-1060	2850	495	54	48	42	200	560	4	170	215
1060-1140	3060	495	56	50	44	200	600	4	180	230
1140-1220	3300	495	58	50	46	200	645	4	180	250
1220-1300	3540	522.5	60	52	46	200	690	4	180	270
1300-1390	3780	522.5	62	54	48	200	740	4	180	285
1390-1480	4050	522.5	64	56	50	200	785	4	180	305
1480-1570	4320	550	66	58	50	220	835	4	180	325
1570-1670	4590	550	68	60	52	220	890	5	190	325
1670-1790	4890	550	70	62	54	220	940	5	190	335
1790-1930	5250	577.5	73	64	56	220	1025	5	190	350
1930-2080	5610	577.5	76	66	58	220	1110	5	190	375
2080-2230	6000	577.5	78	68	60	240	1170	5	190	400
2230-2380	6450	605	81	70	62	240	1260	5	200	425

Equipment numeral EN	*Two stockless bower anchors*	*Stud link chain cables*				*Recommended ropes*				
		Bower anchors				*Towline*		*Mooring ropes*		
	Mass per anchor	*Total length*	*Diameter* [1]			*Length*	*Breaking load*[2]	*Number*	*Length*	*Breaking load*[2]
			d_1	d_2	d_3					
	[kg]	*[m]*	*[mm]*	*[mm]*	*[mm]*	*[m]*	*[kN]*	–	*[m]*	*[kN]*
2380-2530	6900	605	84	73	64	240	1355	5	200	450
2530-2700	7350	605	87	76	66	260	1455	5	200	480
2700-2870	7800	632.5	90	78	68	260	1470	6	200	480
2870-3040	8300	632.5	92	81	70	260	1470	6	200	490
3040-3210	8700	632.5	95	84	73	280	1470	6	200	500
3210-3400	9300	660	97	84	76	280	1470	6	200	520
3400-3600	9900	660	100	87	78	280	1470	6	200	555
3600-3800	10500	660	102	90	78	300	1470	6	200	590
3800-4000	11100	687.5	105	92	81	300	1470	6	200	620

1) d_1 = chain diameter grade VL K 1 (ordinary quality)
d_2 = chain diameter grade VL K 2 special quality)
d_3 = chain diameter grade VL K 3 (extra special quality)
2) see [5.1.1]

The total stowage capacity shall be distributed on two chain lockers of equal size for the port and starboard chain cables. The shape of the base areas shall as far as possible be quadratic with a maximum edge length of 33 *d*. As an alternative, circular base areas may be selected, the diameter of which shall not exceed 30 – 35 *d*.

Above the stowage of each chain locker in addition a free depth of

h = 1500 [mm]

shall be provided, where practicable.

The chain locker boundaries and their access openings shall be watertight to prevent flooding of adjacent spaces, where essential installations or equipment are arranged, in order to not affect the proper operation of the yacht after accidental flooding of the chain locker.

Spurling pipes and cable lockers shall be watertight up to the weather deck.

Spurling pipes through which anchor cables are led shall be provided with permanently attached closing appliances to minimize water ingress.

Where means of access is provided, it shall be closed by a substantial cover and secured by closely spaced bolts.

Adequate drainage facilities of the chain locker shall be provided.

The scantlings of the structural elements of chain locker are determined with a design pressure according to p_{T3} of Ch.3 Sec.3 [3.3] with the distance h_3 of load centre from the top of chain locker pipe.

The minimum thickness of plating is 5.0 mm. For steel chain locker plating a corrosion addition of 2.0 mm shall be applied. If made from aluminium the chain locker shall be protected against the direct contact of chain cable.

Where the chain locker boundaries are also tank boundaries their scantlings of stiffeners and plating shall be determined as for tanks in accordance with Ch.4 Sec.4 [2].

5 Mooring equipment

5.1 Ropes

The towlines and mooring ropes specified in Table 2 and the content of [5.1.1] to [5.1.4] are recommendations, only; compliance with these items is not a condition of class.

5.1.1 Breaking load

For towlines and mooring lines, steel wire ropes as well as fibre ropes made of natural or synthetic fibres or wire ropes consisting of steel wire and fibre cores may be used. Nominal breaking loads specified in Table 1 are valid for wire ropes only. Where ropes of synthetic fibre are used, the breaking load shall be increased above the table values. The extent of increase depends on the material quality.

The required diameters of synthetic fibre ropes used in lieu of steel wire ropes may be taken from Table 3.

Regardless of the breaking load recommended in Table 1, the diameter of fibre ropes should not be less than 20 mm.

5.1.2 Type of wire ropes

Wire ropes shall be of the following type:

— 144 wires (6 × 24) with 7 fibre cores for breaking loads of up to 500 kN
  type: standard
— 216 wires (6 × 36) with 1 fibre core for breaking loads of more than 500 kN
  type: standard

Where wire ropes are stored on mooring winch drums, steel cored wire ropes may be used e.g.:

— 6 × 19 with 1 steel core
  type: Seale
— 6 × 36 with 1 steel core
  type: Warrington-Seale

5.1.3 Length

The length of the individual mooring ropes may be up to 7 per cent less than that given in Table 2, provided that the total length of all the wires and ropes is not less than the sum of the required individual lengths.

5.1.4 Alternatives

For individual mooring lines with a breaking load above 500 kN the following alternatives may be applied:

— The breaking load of the individual mooring lines specified in Table 1 may be reduced with corresponding increase of the number of mooring lines, provided that the total breaking load of all lines aboard ship is not less than the rule value as per Table 1. No mooring line, however, should have a breaking load of less than 500 kN.
— The number of mooring lines may be reduced with corresponding increase of the breaking load of the individual mooring lines, provided that the total breaking load of all lines aboard ship is not less than the rule value specified in Table 1; however, the number of lines should not be less than six (6).

Table 3 Equivalent diameters of steel wire and synthetic fibre ropes

Steel wire ropes[1]	*Steel wire ropes*	*Synthetic fibre ropes*		
	Polyamide[2]	*Polyamide*	*Polyester*	*Polypropylene*
Diameter [mm]	*Diameter [mm]*	*Diameter [mm]*	*Diameter [mm]*	*Diameter [mm]*
12	30	30	30	30
13	30	32	32	32
14	32	36	36	36
16	32	40	40	40
18	36	44	44	44
20	40	48	48	48
22	44	48	48	52
24	48	52	52	56
26	56	60	60	64
28	60	64	64	72
32	68	72	72	80
36	72	80	80	88
40	72	88	88	96

1) according to ISO 2232 or similar
2) regular laid ropes of refined polyamide monofilaments and filament fibres.

5.2 Shipboard fittings (mooring bollards and bitts, fairleads, stand rollers, chocks)

5.2.1 The selection of shipboard fittings shall be made by the shipyard in accordance with an industry standard accepted by the Society. When the shipboard fitting is not selected from an accepted industry standard, the design load used to assess its strength and its attachment to the ship shall be in accordance with [5.3].

5.2.2 Shipboard fittings for mooring shall be located on longitudinals, beams and/or girders, which are part of the deck construction so as to facilitate efficient distribution of the mooring load. Other arrangements may be accepted provided the strength is confirmed adequate for the service.

5.2.3 The SWL of each shipboard fitting shall be included in the towing and mooring arrangement plan available on board for the guidance of the captain. It is recommended that the SWL is marked (by weld bead or equivalent) on the deck fittings used for mooring.

5.3 Supporting hull structure for mooring equipment

5.3.1 Unless greater safe working load is specified by the designer, the minimum design loads applied to shipboard fittings and supporting hull structures shall be according to:

a) in the case of normal towing in harbour or manoeuvring operations, 125% of the maximum towline load as indicated on the towing and mooring arrangement plan
b) in the case of towing service other that experienced in harbour or manoeuvring operations, such as escort service, the nominal breaking strength of towline
c) in the case of mooring operations, 125% of the nominal breaking strength of the mooring line or towline according to Table 1 for the ship's corresponding equipment number EN.

The design load to be applied to supporting hull structures for mooring winches, etc. shall be 1.25 times the intended maximum brake holding load and, for capstans, 1.25 times the maximum hauling in force.

The design load shall be applied through the mooring line according to the arrangement shown on the towing and mooring arrangements plan, see Figure 2.

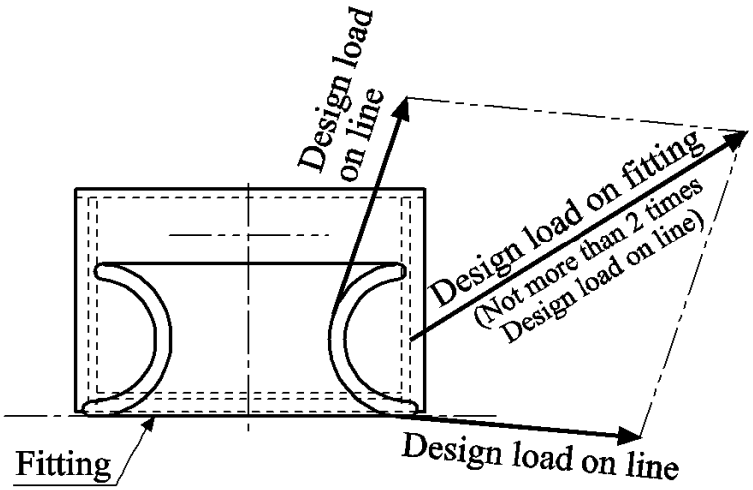

Figure 2 Application of design loads

The acting point of the mooring force on shipboard fittings shall be taken at the attachment point of a mooring line or at a change in its direction.

For bollards, the acting point of the design load shall be taken at least equivalent to the diameter of the pipe above deck level. Special designs have to be evaluated individually.

With these specified design loads, the stresses induced in the supporting structure and

welds shall not exceed the following permissible values:

$$\textit{Normal stress} = R_y$$

$$\textit{Shear stress} = \frac{R_y}{\sqrt{3}}$$

SECTION 2 OUTFITTING

1 Life saving appliances

1.1

Arrangement and operation of lifeboats and other life-saving appliances are subject to the requirements of the competent flag administration.

1.2

The design appraisal and testing of life boats with their launching appliances and of other life saving appliances are not part of classification. However, approval of the hull structure in way of the launching appliances taking into account the forces from the above appliances is part of classification.

Guidance note:

Drawing approval and survey according to the LSA Code, if applicable, may be required.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2 General masts and rigging

2.1 General

2.1.1 See Pt.6 Ch.1.

2.2 Signal and radar masts

2.2.1 Drawings of masts, mast substructures and hull connections shall be submitted for approval.

2.2.2 Other masts as well as special designs shall, as regards dimensions and construction, in each case be individually agreed with the Society.

3 Loading and lifting gear

The design appraisal and testing of loading and lifting gear on yachts are not part of classification.

However, approval of the hull structure in way of loading and lifting gear taking into account the forces from the gear is part of classification.

Guidance note:

Upon customer's request, drawing approval and survey according to DNVGL-ST-0377 may be applied for.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4 Protection of the crew

4.1

Guard rails or bulwarks shall be provided at the boundaries of exposed freeboard and superstructure decks.

4.2

The height of the bulwarks or guard rails shall be at least 1 m from the deck. Where this height would interfere with the normal operation of the ship, a lesser height may be approved if the flag administration is satisfied that adequate protection is provided. From classification point of view 900 mm is deemed acceptable for sailing yachts.

4.3

Guard rails shall comply with the following:

— Fixed, removable or hinged stanchions shall be fitted not more than 2.2 m apart (maximum 1.5 m for passenger yachts, respectively).
— At least every third stanchion shall be supported by a bracket or stay.
— Guard rail stanchions shall not be welded to the shell plating. In the case of ships with rounded gunwales the guard rail supports shall be placed on the flat of the deck.
— Removable or hinged stanchions shall be capable of being locked in the upright position.
— Steel wire ropes may be accepted in lieu of the courses except for the top course (hand rail).
— Wires shall be made taut by means of turnbuckles.

4.4

Scantlings of stanchions and courses which comply with ISO 5480, or equivalent standards are accepted.

4.5

Equivalent construction of sufficient strength are accepted with the design force F_{st}, in N, as point load, applied perpendicular to the stanchion at top rail.

Passenger yachts	900 N
yachts, in general	750 N
sailing yachts, in general	450 N

The bending stresses and equivalent stresses in metal stanchions and metal substructures shall not be exceeded.

$$\sigma_{perm} = \frac{R_y \cdot f_m}{\gamma \cdot \gamma_m}$$

where:

γ = 1.4
γ_m = 1.1
f_m = see Ch.4 Sec.3
R_y = Yield strength

For composite stanchions and substructures the allowable strains according to Ch.5 Sec.4 shall not be exceeded.

A practical strength test may be required (instead of or in addition to the above) with the proof force F_{proof}, in N:

$$F_{proof} = F_{st} \cdot \gamma \cdot \gamma_m$$

where:

γ = 1.4 for metal stanchions
= 3.0 for composite stanchions
γ_m = 1.1.

F_{proof} shall be applied perpendicular to the stanchion at top rail.

The acceptance criteria for this test are:

— no or negligible permanent deformation for metal stanchions
— without major damage or total failure for composite stanchions.

4.6

Guard rails fitted on superstructure and freeboard decks shall have at least three (3) courses. The openings below the lowest course of the guard rails shall not exceed 230 mm. The other courses shall be not more than 380 mm apart.

4.7

For sailing yachts the guard rails shall in general consist of multi strand wire ropes elements with a minimum guaranteed breaking load of 33 kN and a minimum outer diameter of 8 mm including possible coating. Lower rails than the top rail shall have at least 60% of the break load and 60% of the diameter. Other type of tension elements for the purpose as installing as guard rail are subject to agreement of the Society. Guard rails shall be equipped with a device to control their tension in an easy way.

SECTION 3 SIDE SHELL DOORS AND STERN DOORS

1 General

1.1

These requirements are for the arrangement, strength and securing of side shell doors, abaft the collision bulkhead and to stern doors leading into enclosed spaces.

1.2

Securing device is a device used to keep the door closed by preventing it from rotating about its hinges.

1.3

Supporting device is a device used to transmit external or internal loads from the door to a securing device and from the securing device to the ship's structure, or a device other than a securing device, such as a hinge, stopper or other fixed device, that transmits loads from the door to the yacht's structure.

2 Arrangement

2.1

Stern doors and side shell doors may be either below or above the freeboard deck. For passenger yachts stern doors shall be situated above the freeboard deck.

2.2

Side shell doors and stern doors shall be so fitted as to ensure tightness and structural integrity commensurate with their location and the surrounding structure.

2.3

Where the sill of any side shell door is below the uppermost load line, the arrangement shall be specially considered.

2.4

Doors should preferably open outwards.

Doors which open inwards shall be especially approved.

2.5

In case of ice strengthening see DNVGL-RU-SHIP Pt.6 Ch.6.

3 Strength criteria

3.1 Primary structure and securing and supporting devices

3.1.1 Scantlings of the primary members, securing and supporting devices of doors shall be designed to withstand the design loads defined in [4] using load case LCA with increased material factor γ_m of 1.375.

3.1.2 The buckling strength of primary members shall be verified according to Ch.4 App.B.

3.1.3 For steel to steel bearings in securing and supporting devices, the nominal bearing pressure calculated by dividing the design force by the projected bearing area shall not exceed 0.8 R_{eH}, where R_{eH} is the yield stress of the bearing material. For other bearing materials, the permissible bearing pressure shall be determined according to the manufacturer's specification.

3.1.4 The arrangement of securing and supporting devices shall be such that threaded bolts do not carry support forces. The maximum tension stress in way of threads of bolts not carrying support forces shall be less than 0.5 R_Y.

4 Design loads

The design forces considered for the scantlings of primary members, securing and supporting devices of side shell doors and stern doors shall be not less than the greater of the values determined by the following equations:

— design forces for securing or supporting devices of doors opening inwards:

external force: $F_e = A \cdot p_s + F_p$ [kN]

internal force: $F_i = F_0 + 10 \cdot W$ [kN]

— design forces for securing or supporting devices of doors opening outwards:

external force: $F_e = A \cdot p_s$ [kN]

internal force: $F_i = F_0 + 10 \cdot W + F_p$ [kN]

— design forces for primary members:

external force: $F_e = A \cdot p_s$ [kN]

internal force: $F_i = F_0 + 10 \cdot W$ [kN]

A = area of the door opening, in m^2

W = mass of the door, in t

F_p = total packing force, in kN, where the packing line pressure is normally not to be taken less than 5 kN/m

F_o = max (F_c ; 5 A) [kN]

F_c = accidental force, in kN due to loosened tender etc., to be uniformly distributed over the area A and not to be taken less than 300 kN. For small doors such as bunker doors and pilot doors, the value of F_c may be appropriately reduced.

However, the value of F_c may be taken as zero, provided an additional structure such as an inner ramp is fitted, which is capable of protecting the door from accidental forces due to loosened cargo/tenders

p_s = external design pressure for the yacht's side according to Ch.3. shall be determined at the centre of gravity of the door opening with height h_G above base line [m]. p_{Sdyn} shall not be less than 25 kPa

h_G = height of centre of area, in m.

Where doors also serve as platforms, the design deck load shall not be less than 5.0 kPa.

5 Scantlings

5.1 General

5.1.1 The strength of doors shall be commensurate with that of the surrounding structure.

5.1.2 Doors shall be adequately stiffened and means shall be provided to prevent lateral or vertical movement of the doors when closed.

5.1.3 Additional to the requirements given in [5.1.1] and [5.1.2] the following shall be observed:

— Where doors also serve as platforms, the design of the hinges and supporting structures shall take into account the deck loads and possible buoyancy forces considering the yacht's angle of trim and heel.
— Shell door openings shall have well-rounded corners and adequate compensation shall be arranged with web frames and stringers or equivalent above and below.

5.2 Plating and secondary stiffeners

5.2.1 The thickness of the door plating shall not be less than the side shell thickness according to Ch.4 Sec.3 [5] using door stiffener spacing, but in no case less than the required minimum thickness of the plating according to Ch.4 Sec.4 [4].

5.2.2 The section modulus of horizontal or vertical stiffeners shall not be less than that required for framing at the position of the door according to Ch.4 Sec.4 [4]. Consideration shall be given, where necessary, to differences in fixity between yacht's frames and doors stiffeners.

5.3 Primary structure

5.3.1 The door’s secondary stiffeners shall be supported by primary members constituting the main stiffening of the door.

5.3.2 The primary members of the door and the hull structure in way shall have sufficient stiffness to ensure integrity of the boundary support of the door.

6 Securing and supporting of side shell and stern doors

6.1 General

6.1.1 Doors shall be fitted with adequate means of securing and supporting so as to be commensurate with the strength and stiffness of the surrounding structure. The hull supporting structure in way of the doors shall be suitable for the same design loads and design stresses as the securing and supporting devices. Where packing is required, the packing material shall be of a comparatively soft type, and the supporting forces shall be carried by the steel structure only. Other types of packing may be considered. The maximum design clearance between securing and supporting devices is generally not to exceed 3 mm.

A means shall be provided for mechanically fixing the door in the open position.

6.1.2 Only the active supporting and securing devices having an effective stiffness in the relevant direction shall be included and considered to calculate the reaction forces acting on the devices. Small and/or flexible devices such as cleats intended to provide load compression of the packing material are not generally to be included in the calculations called for in [6.2.2]. The number of securing and supporting devices is generally to be the minimum practical whilst taking into account the redundancy requirements given in [6.2.3] and the available space for adequate support in the hull structure.

6.2 Scantlings

6.2.1 Securing and supporting devices shall be adequately designed so that they can withstand the reaction forces according to [3.1.1].

6.2.2 The distribution of the reaction forces acting on the securing and supporting devices may require to be verified by direct calculations taking into account the flexibility of the hull structure and the actual position and stiffness of the supports. This is, for instance, the case when the door is supported statically undetermined.

6.2.3 The arrangement of securing and supporting devices in way of these securing devices shall be designed with redundancy so that in the event of failure of any single securing or supporting device the remaining devices are capable of withstanding the reaction forces for load case LCA, see [3.1].

6.2.4 All load transmitting elements in the design load path, from door through securing and supporting devices into the yacht structure, including welded connections, shall be of the same strength standard as required for the securing and supporting devices.

7 Arrangement of securing and locking devices

7.1 Systems for operation

7.1.1 Securing devices shall be simple to operate and easily accessible.

7.1.2 Securing devices shall be equipped with mechanical locking arrangement (self locking or separate arrangement), or shall be of the gravity type. The opening and closing systems as well as securing and locking devices shall be interlocked in such a way that they can only operate in the proper sequence.

7.1.3 Doors which are located partly or totally below the freeboard deck with clear opening area greater than 6 m^2 shall be provided with an arrangement for remote control, from a convenient position above the freeboard deck, of:

— the closing and opening of the doors
— associated cleats, support and locking devices.

For doors which are required to be equipped with a remote control arrangement, the open/closed position of the door and every closing device (cleats, support and locking device) shall be indicated at the remote control station.

7.1.4 Indication of the open/closed position of every securing and locking device shall be provided at the remote control stations. The operating panels for operation of doors shall be inaccessible to unauthorized persons. A notice plate, giving instructions to the effect that all securing devices shall be closed and locked before leaving harbour, shall be placed at each operating panel and shall be supplemented by warning indicator lights.

7.1.5 Where hydraulic securing devices are applied, the system shall be mechanically lockable in closed position. This means that, in the event of loss of the hydraulic fluid, the securing devices remain locked. The hydraulic system for securing and locking devices shall be isolated from other hydraulic circuits, when in closed position.

7.2 Systems for indication/monitoring

7.2.1 Indicator lights shall be provided on the bridge and at the operating console for indication that the doors are closed and the locking and securing devices are in their correct positions. Deviations from the correct closed, locked and secured condition shall be indicated by optical and audible alarms.

The indicator panel shall be provided with:

— a power failure alarm
— an earth failure alarm
— a lamp test and
— separate indication for door closed, door locked, door not closed and door not locked.

Switching the indicator lights off is not permitted.

7.2.2 The indicator system shall be designed on the self-monitoring principle and shall be alarmed by visual and audible means if the door is not fully closed and not fully locked or if securing devices become open or locking devices become unsecured. The power supply for the indicator system shall be independent of the power supply for operating and closing doors. The sensors of the indicator system shall be protected from water, icing and mechanical damages. Degree of protection: at least IP 56.

7.2.3 The indication panel on the navigation bridge shall be equipped with a selector switch harbour/sea voyage so arranged that alarm is given if the yacht leaves harbour with the door not closed and with any of the securing devices not in the correct position.

7.3 Operating and maintenance manual

7.3.1 An operating and maintenance manual according to IACS unified requirement S9 for the door shall be provided on board and contain necessary information on:

— description of the door system and design drawings
— service conditions, e.g. service restrictions, emergency operations, acceptable clearances for supports
— maintenance and function testing
— register of inspections and repairs.

Guidance note:

It is recommended that inspections of the door supporting and securing devices should be carried out by the ship's staff at monthly intervals and/or following incidents that could result in damage, including heavy weather and/or contact in the region of the shell doors. Any damages recorded during such inspections should be reported to the Society.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

7.3.2 Documented operating procedures for closing and securing the doors shall be kept on board and posted close to the door.

CHANGES – HISTORIC

October 2016 edition

This document supersedes the December 2015 edition of DNVGL-RU-YACHT Pt.3 Ch.8.

Amendments July 2017

Editorial changes have been made.

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

• Sec.2 Outfitting

— Sec.2 [4.5]: Better, clear wording for requirement.

December 2015 edition

This is a new document.

The rules enter into force 1 July 2016.

About DNV GL

DNV GL is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.

SAFER, SMARTER, GREENER