Section

■ *Section 1* General

1.1 Application

1.1.1 The anchoring equipment specified in this Section is suitable only for use in reasonably sheltered conditions or in emergencies. If the equipment is intended to be used during operations in the open sea, or if the sea or weather conditions in the service area are subject to unusual hazards, e.g. typhoons, etc., the equipment will be specially considered in each case.

1.1.2 Where the Equipment Number exceeds 1140 the equipment is to be in accordance with Pt 3, Ch 13 of the Rules for Ships.

1.2 Definitions

1.2.1 The definitions for use throughout this Chapter are as indicated in the appropriate Section.

1.3 Symbols

1.3.1 The following symbols are used in this Chapter, unless otherwise stated:

b_i = mean breadth of deckhouse or superstructure tier, in metres

h_i = mean height of deckhouse or superstructure tier, in metres

A = area, in m^2, in profile view of the hull, superstructure and deckhouses above the design waterline. Deckhouses with breadth less than $B/4$ are to be ignored

B_o = the greatest moulded breadth, in metres, or for craft of composite construction, the extreme breadth excluding rubbing strakes or other projections

B_1 = the greatest breadth of the outer hulls of a multi-hull craft, in metres. It is to be measured between the points of intersection of the extension of the hull sides to the normal line of the wet deck

B_2 = the greatest breadth of the centre hull in trimaran type craft, in metres. It is to be measured between the points of intersection of the extension of the hull sides to the normal line of the wet deck

D_h = the sum of $b_i\ h_i \cos \theta_i$ for all deckhouses and superstructures tiers

G_A = air gap, as defined in Pt 5, Ch 1

α_1 = for **multi-hull** craft is the distance in metres, from the underside of the cross-deck structure to the underside of the first tier of deckhouse or superstructure
for **mono-hull** craft is the distance in metres, from the waterline to the underside of the first tier of deckhouse or superstructure

θ_i = angle of inclination aft, of tier of deckhouse front, with a line perpendicular to the static load waterline

Δ = loaded displacement, in tonnes.

1.4 Character of classification

1.4.1 To entitle a craft to the figure **1** in its character of classification, equipment in accordance with the requirements of this Chapter is to be provided. The regulations governing assignment of the character figure **1** for equipment are given in Pt 1, Ch 2,3.

1.4.2 For craft intended to be operated only in suitable areas or conditions which have been agreed by the Committee, as defined in Pt 1, Ch 2,3.5, equipment differing from these requirements may be approved if considered suitable for the particular service on which the craft is to be engaged.

1.4.3 Where the Committee has agreed that anchoring and mooring equipment need not be fitted in view of the particular service of the ship, the character letter **N** will be assigned, *see also* Pt 1, Ch 2,3.2.2.

1.4.4 Where the ship is intended to perform its primary designed service function only while it is anchored, moored, towed or linked, the character letter **T** will be assigned, *see also* Pt 1, Ch 2,3.2.2.

1.4.5 For classification purposes the character figure **1**, or either of the character letters **N** or **T**, are to be assigned.

■ *Section 2* Equipment Number

2.1 Equipment Number

2.1.1 The anchoring and mooring equipment is based on an Equipment Number, *EN*, which is to be calculated as given in 2.1.2 to 2.1.4.

2.1.2 **Mono-hull craft**

$EN = \Delta^{2/3} + 2\,(D_h + B_o\,\alpha_1) + 0{,}1A$

2.1.3 **Catamaran, Swath, SES and other twin hull craft**

$EN = \Delta^{2/3} + 2\,(D_h + B_o\,\alpha_1 + 2G_a\,B_1) + 0{,}1A$

2.1.4 **Trimarans**

$EN = \Delta^{2/3} + 2\,(D_h + B_o\,\alpha_1 + G_a\,(2B_1 + B_2)) + 0{,}1A$

2.2 Novel craft

2.2.1 Where a craft is of unusual form and proportions the requirement for equipment will be individually considered on the basis of the Rules.

■ *Section 3* Service group factors

3.1 General

3.1.1 The masses of anchors and the diameters and lengths of chain cable required by Table 5.5.1 and Table 5.6.1 respectively are for craft in **Service Group G4**.

3.2 G1 craft

3.2.1 For craft in **Service Group G1**, the equipment is generally to be that required for craft in **Service Group G2**; proposals for further reductions will be specially considered.

3.3 G2, G3 and G4 craft

3.3.1 For craft in **Service Groups G2**, **G3**, and **G4**, the mass of the anchor required by Table 5.5.1 may be multiplied by the following factors:

Service Group G2	0,60
Service Group G3	0,73
Service Group G4	1,00

3.3.2 The length and diameter of chain cable are to be those required by Table 5.6.1 corresponding to the reduced anchor mass given in Table 5.5.1.

3.3.3 Towlines and mooring lines are to be those required by Table 5.7.1 corresponding to the equipment number as determined from Section 2.

3.3.4 For service craft on particular duties, a further reduction in the mass of the anchor may be given in accordance with Section 4.

3.4 G5 craft

3.4.1 Craft in **Service Group G5** are considered for the purposes of this Chapter to be unrestricted in their service, and the equipment is to be in accordance with Pt 3, Ch 13 of the Rules for Ships.

3.5 G6 craft

3.5.1 **Service Group G6** covers yachts and patrol craft having unrestricted service.

3.5.2 For yachts, the mass of the anchors required by Table 5.5.1 may be multiplied by the craft type factor indicated in Section 4. The length and diameter of chain cable are to be those required by Table 5.6.1 corresponding to the reduced anchor mass given in Section 4.

3.5.3 For patrol craft, the equipment is to be in accordance with Pt 3, Ch 13 of the Rules for Ships for unrestricted service.

■ *Section 4* Craft type factors

4.1 General

4.1.1 The mass of the anchors required by Table 5.5.1 and corrected for service group factors in accordance with Section 3 (where applicable), are to be corrected by the craft type factors indicated in this Section.

4.2 Craft type factors

4.2.1 **Yachts** with an Equipment Numeral, *EN*, of less than or equal to 220 as determined in 2.1, may have the mass of the anchors as required by Table 5.5.1 reduced by the craft type factor, k_y, in accordance with the following:

$$k_y = \frac{EN}{500} + 0{,}56$$

4.2.2 For yachts with an Equipment Numeral, *EN*, in excess of 220, the craft type factor, k_y, is to be taken as unity.

4.2.3 **Pilot and Patrol** craft operating within **Service Group G1**, and which do not normally anchor in the course of their duties, with an Equipment Numeral *EN* of less than or equal to 220 as determined in 2.1, may have the mass of the anchor as required by Section 3 reduced by the craft type factor, k_{p1}, in accordance with the following:

$$k_{p1} = \frac{EN}{980} + 0{,}28$$

4.2.4 **Pilot and patrol** craft operating within **Service Group G2**, and which do not normally anchor in the course of their duties, with an Equipment Numeral *EN* of less than or equal to 100 as determined in 2.1.2, may have the mass of the anchor as required by Section 3 reduced by the craft type factor, k_{p2}, in accordance with Table 5.4.1.

Table 5.4.1 Craft type factor

Equipment Numeral, *EN*	Craft type factor, k_{p2}
$\geq 5 \leq 40$	0,8
$> 40 \leq 100$	0,9
> 100	1,0

■ *Section 5* Anchors

5.1 General

5.1.1 The Rules are based on the use of high holding power (HHP) type anchors.

5.1.2 When ordinary holding power anchors are used as bower anchors, the mass given in Table 5.5.1 is to be increased by 33 per cent.

5.1.3 Where it is proposed to fit other types of anchor, the mass will be specially considered.

5.1.4 Craft other than yachts are to be provided with a single anchor on board which must be ready for immediate use.

5.1.5 In addition, the craft is to be supplied with one spare anchor located at each of the ports on its regular scheduled service, or alternatively the spare anchor may be carried on board.

5.1.6 **Yachts** are to be provided with two anchors on board. Each anchor must have the rule length of chain cable attached. Only one anchor is required to be ready for immediate deployment, i.e. around the capstan. The masses of anchors may be of the following combinations:

(a) The mass of the first anchor is to be not less than 100 per cent of the Rule value for the type of anchor concerned. The mass of the second anchor is to be not less than 70 per cent of the Rule value for the type concerned.

(b) The mass of each anchor is to be not less than 90 per cent of the Rule value for the type of anchor concerned.

5.1.7 The fitting of a single anchor on board yachts will be specially considered. The mass of the single anchor is to be not less than 100 per cent of the Rule value for the type of anchor concerned.

Table 5.5.1 Anchors

Equipment number		High holding power bower anchors	
Exceeding	Not exceeding	Number of anchors	Mass of anchor, in kg
—	5	1	11
5	10	1	13
10	15	1	17
15	20	1	22
20	25	1	27
25	30	1	32
30	35	1	37
35	40	1	44
40	45	1	52
45	50	1	59
50	70	1	80
70	90	1	117
90	110	1	154
110	130	1	197
130	150	1	240
150	175	1	292
175	205	1	360
205	240	1	428
240	280	1	495
280	320	1	585
320	360	1	675
360	400	1	765
400	450	1	855
450	500	1	968
500	550	1	1080
550	600	1	1193
600	660	1	1305
660	720	1	1440
720	780	1	1575
780	840	1	1710
840	910	1	1845
910	980	1	1980
980	1060	1	2138
1060	1140	1	2295

5.1.8 Anchors which must be specially laid the right way up, or which require the fluke angle or profile to be adjusted for varying types of sea bed, will not generally be approved for normal craft use. In such cases suitable tests may be required.

5.1.9 Anchors are to be of an approved design. The design of all anchor heads is to be such as to minimise stress concentrations, and in particular, the radii on all parts of cast anchor heads are to be as large as possible, especially where there is considerable change of section.

5.2 Materials

5.2.1 The requirements for anchor materials are contained in the *Rules for the Manufacture, Testing and Certification of Materials* (hereinafter referred to as the Rules for Materials).

5.2.2 Anchors made of stainless steels or aluminium alloy may be acceptable subject to special consideration.

5.2.3 Where aluminium alloy anchors are proposed, due consideration is to be given to the compatibility of such anchors with the materials of the chain cable, anchor shackle, etc., in order to avoid galvanic corrosion.

5.3 Testing

5.3.1 Testing of anchors is to be carried out in accordance with Chapter 10 of the Rules for Materials.

5.3.2 For holding power testing requirements relating to high holding power anchors, *see* Ch 10,1.7 of the Rules for Materials.

5.4 Anchor shackle

5.4.1 Steel anchor shackles are to be forged or cast steel of approved manufacturer.

5.5 Anchor stowage

5.5.1 Anchors are generally to be housed in suitable hawse pipes, or stowed in dedicated chocks on deck.

5.5.2 Hawse pipes and anchor pockets are to be in accordance with 9.3. Alternatively, roller fairleads of suitable design may be fitted. Where hawse pipes are not fitted, alternative arrangements will be specially considered.

5.6 Super high holding power (SHHP) type anchors

5.6.1 Proposals to use anchors of the SHHP type will be subject to special consideration.

5.6.2 Final acceptance will be dependent upon satisfactory strength and performance tests.

5.6.3 Anchors of designs for which approval is sought as super high holding power anchors are to be tested at sea to show that they have holding powers of at least four times those of approved standard stockless anchors of the same mass.

5.7 Tolerances

5.7.1 The mass of each high holding power anchor given in Table 5.5.1 is for anchors of equal mass. The masses of individual anchors may vary by ±7 per cent of the masses given in the Table, provided that the total mass of the anchors is not less than would have been required for anchors of equal mass.

5.8 Identification

5.8.1 Identification of anchors which have been tested is to be in accordance with Ch 10,1.4 of the Rules for Materials.

■ *Section 6* Anchor cable

6.1 General

6.1.1 Anchor cable may be of stud link chain, short link chain, wire rope or fibre rope, subject to the requirements of this Section.

6.1.2 For each anchor required to be carried on board, *see* 5.1.6, a length of anchor cable, as indicated in Table 5.6.1, is to be provided.

6.2 Chain cable

6.2.1 The diameter of stud link chain cable is to be as indicated in Table 5.6.1.

6.2.2 Short link chain cable may be accepted provided that the breaking load is not less than that of stud link chain cable of the diameter required by Table 5.6.1.

6.2.3 Chain cables may be of mild steel, special quality steel or extra quality steel in accordance with the requirements of Ch 10 of the the Rules for Materials, and are to be graded in accordance with Table 5.6.2.

6.2.4 Grade U1 material having a tensile strength of less than 400 N/mm^2 is not to be used in association with high holding power anchors. Grade U3 material is to be used only for chain 20,5 mm or more in diameter.

6.2.5 In addition to 6.2.3 special consideration will be given to the use of chain cable of stainless steel. Stainless steel is to be of a suitable type, details of which are to be submitted for consideration.

6.2.6 The form and proportion of links and shackles are to be in accordance with Chapter 10 of the Rules for Materials.

Table 5.6.1 Chain cable

Mass of HHP bower anchor, in kg	Length of chain cable, in metres	Stud link chain cable diameter, in mm		
		Mild steel (Grade:1 or U1)	Special quality steel (Grade:U2)	Extra special quality steel (Grade:U3)
11	55	8	–	–
13	55	8	–	–
17	55	8	–	–
22	55	9	–	–
			–	–
27	55	9	–	–
32	82,5	9	–	–
37	82,5	11,2	–	–
			–	–
44	82,5	11,2	–	–
52	110	11,2	–	–
59	110	12,5	–	–
			–	–
80	110	12,5	–	–
117	110	14	12,5	–
154	110	16	14	–
				–
197	137,5	17,5	16	–
240	137,5	19	17,5	–
292	137,5	20,5	17,5	–
				–
360	137,5	22	19	–
428	165	24	20,5	–
495	165	26	22	20,5
585	165	28	24	22
675	192,5	30	26	24
765	192,5	32	28	24
855	192,5	34	30	26
968	192,5	36	32	28
1080	220	38	34	30
1193	220	40	34	30
1305	220	42	36	32
1440	220	44	38	34
1575	220	46	40	36
1710	247,5	48	42	36
1845	247,5	50	44	38
1980	247,5	52	46	40
2138	247,5	54	48	42
2295	247,5	56	50	44

Table 5.6.2 Grades of steel for use as chain cable

Grade	Material	Tensile strength (N/mm^2)
U1	Mild steel	300 – 490
U2 (a)	Special quality steel (wrought)	490 – 690
U2 (b)	Special quality steel (cast)	490 – 690
U3	Extra special quality steel	690 min

6.3 Testing

6.3.1 Chain cable with a diameter of 12,5 mm or above is to be certified by Lloyd's Register (hereinafter referred to as 'LR'). Chain cable with a diameter below 12,5 mm is to be certified by a recognised testing establishment.

6.3.2 All chain cables are to be tested at establishments and on machines recognized by the Committee and under the supervision of LR's Surveyors or other Officers recognized by the Committee, and in accordance with Chapter 10 of the Rules for Materials.

6.3.3 Test certificates showing particulars of size and weight of cable and of the test loads applied are to be furnished. These certificates are to be examined by the Surveyors when the cables are placed on board the craft.

6.4 Wire rope

6.4.1 When the Equipment Number does not exceed 500 for craft in **Service Groups G1**, **G2** and **G3**, steel wire rope may be accepted in lieu of chain cable under the following conditions:

(a) A length of chain of the diameter specified in Table 5.6.1 is to be fitted to the anchor. The total length of chain is to be not less than 10 per cent of the total required by Table 5.6.1. In no case is the length of chain attached to an anchor to be less than 9 metres.

(b) The wire rope used in lieu of chain cable is to have a breaking load of not less than that of the chain cable it replaces.

(c) The combined length of the chain cable specified in (a) and the wire is to be not less than the length of chain cable required by Table 5.6.1.

(d) Thimbles are to be fitted at both ends of the wire rope, as appropriate.

(e) Suitable precautions are to be taken to reduce the wear on the wire rope at fairleads, etc.

6.4.2 Steel wire ropes are to be manufactured, tested and certified as required by Chapter 10 of the Rules for Materials.

6.5 Fibre rope

6.5.1 When the Equipment Number does not exceed 100, polyamide (or other equivalent synthetic fibre) rope may be accepted in lieu of wire rope, subject to compliance with 6.4.1(a) to (d).

6.5.2 Fibre ropes are to be manufactured, tested and certified as required by Chapter 10 of the Rules for Materials.

6.5.3 Synthetic fibre ropes are to be ultra-violet inhibited as necessary, dependent upon their type.

6.6 Cable clench

6.6.1 Provision is to be made for securing the inboard ends of the cables to the structure. This attachment is to have a working strength of not less than 10 per cent of the breaking strength of the chain cable, and the structure to which it is attached is to be adequate for this load. Attention is drawn to the advantages of arranging that the cable may be slipped from an accessible position outside the chain cable locker. The proposed arrangement for slipping the chain cable, if constructed outside the chain locker, must be made watertight.

6.7 Cable stopping and release arrangements

6.7.1 It is recommended that suitable bow chain stoppers be provided. The scantlings of these chain stoppers are outwith the scope of the Rules, however the structure in way is to be designed with due regard to the applied loading. Support under chain stopping arrangements is to be to the satisfaction of the Surveyor.

6.8 Cable locker

6.8.1 Adequate storage is to be provided to accommodate the full length of anchor cable.

6.8.2 The chain locker is to be of a capacity and depth adequate to provide an easy direct lead for the cable into the chain pipes, when the cable is fully stowed. Chain or spurling pipes are to be of suitable size and provided with chafing lips. The port and starboard cables are to be separated by a division in the locker.

6.8.3 Chain lockers fitted abaft the collision bulkhead are to be watertight and the space to be efficiently drained.

■ *Section 7* Mooring ropes and towlines

7.1 Mooring ropes

7.1.1 Craft under 90 m in length are to be equipped with mooring ropes in accordance with Table 5.7.1.

7.1.2 The lengths of individual mooring lines in Table 5.7.1 may be reduced by up to seven per cent of the Table length, provided that the total length of mooring lines is not less than would have resulted had all lines been of equal length. Proposals to fit individual mooring lines of reduced length to suit the particular service will be specially considered.

7.2 Materials

7.2.1 Mooring lines may be of steel wire rope, natural fibre or synthetic fibre. The diameter, construction and specification of wire or natural fibre mooring lines are to comply with the requirements of Chapter 10 of the Rules for Materials. Where it is proposed to use synthetic fibre ropes, the size and construction will be specially considered.

7.3 Testing and certification

7.3.1 Mooring ropes are to be tested and certified in accordance with Chapter 10 of the Rules for Materials.

7.4 Towlines

7.4.1 Towlines are not required for classification other than for craft which are required to comply with the *IMO Code of Safety for High Speed Craft.* The details given in Table 5.7.1 are for guidance purposes only.

7.5 Bollards, fairleads and bull rings

7.5.1 Means are to provided to enable mooring lines to be adequately secured on board the craft. It is recommended that the total number of suitably placed bollards on either side of the craft and/or the total brake holding power of mooring winches should be capable of holding not less than 1,5 times the sum of the maximum breaking strengths of the mooring lines required or recommended. Attention is drawn to the existence of a number of National Standards for bollards and fairleads, and to the importance of ensuring that their seating arrangements, including the supporting hull structure, are efficiently constructed and adequate for the intended loads.

7.6 Towing requirements

7.6.1 Craft which are to comply with the *IMO Code of Safety for High Speed Craft* are to be provided with adequate arrangements to enable the craft to be towed in the worst intended environmental conditions. It is recommended that other craft comply with this requirement.

7.7 Towing bitts

7.7.1 Where towage is to be from more than one point a suitable bridle is to be provided.

7.7.2 Details of the structural scantlings, arrangements, loadings and design assumptions for the towing bitts are to be submitted for consideration.

7.7.3 The towing arrangements should be such that damage to the towline or bridle from abrasion is minimised.

Table 5.7.1 Towlines and mooring lines

Equipment Number		Towline (*See* Notes)		Mooring lines		
Exceeding	Not exceeding	Minimum length, in metres	Minimum breaking strength, in kN	Number of lines	Minimum length of each line, in metres	Minimum breaking strength, in kN
–	5	90	19,9	2	55	13,9
5	10	90	22,5	2	55	17,6
10	15	90	27,7	2	55	21,5
15	20	90	32,9	2	55	24,5
20	25	110	38,1	2	55	26,6
25	30	110	43,3	2	55	28,2
30	35	110	48,5	2	55	29,6
35	40	135	53,7	2	55	30,8
40	45	135	58,9	2	70	31,8
45	50	135	64,1	2	85	32,7
50	70	180	71,0	2	100	35,5
70	90	180	82,1	2	100	39,3
90	110	180	93,2	2	110	43,1
110	130	180	104,3	2	110	46,6
130	150	180	115,3	2	120	50,2
150	175	180	127,8	2	120	54,4
175	205	180	143,0	2	120	58,8
205	240	180	161,1	2	120	64,2
240	280	180	181,8	3	120	71,1
280	320	180	204,0	3	140	78,5
320	360	180	226,1	3	140	85,8
360	400	180	248,3	3	140	93,2
400	450	180	273,2	3	140	100,5
450	500	180	300,9	3	140	107,9
500	550	180	328,6	4	160	112,8
550	600	180	356,3	4	160	117,7
600	660	180	386,8	4	160	122,6
660	720	180	420,1	4	160	127,5
720	780	180	453,3	4	170	132,4
780	840	180	486,5	4	170	137,3
840	910	180	522,5	4	170	142,2
910	980	180	561,3	4	170	147,1
980	1060	180	602,9	4	180	156,9
1060	1140	180	647,2	4	180	166,7

NOTES
1. Towline specified for guidance only, *see* 7.4.1.
2. Wire ropes used for towlines and mooring lines are generally to be of a flexible construction with not less than:
   144 wires in six strands with seven fibre cores for strengths up to 490 kN
   222 wires in six strands with one fibre core for strengths exceeding 490 kN
   The wires to be laid around the fibre centre of each strand are to be up in not less than two layers.
3. Wire ropes for towlines and mooring lines used in association with mooring winches (on which the rope is stored on the winch drum) are to be of suitable construction.
4. Irrespective of strength of requirements, no fibre rope is to be less than 12 mm diameter.

7.8 Mooring winches

7.8.1 Mooring winches where provided are to be suitable for the intended purpose. Supports under the winches are to be to the Surveyor's satisfaction.

7.8.2 Mooring winches are to be fitted with drum brakes, the strength of which is sufficient to prevent unreeling of the mooring line when the rope tension is equal to 80 per cent of the breaking strength of the rope as fitted on the first layer on the winch drum, *see also* 7.5.1.

■ *Section 8*
Windlass design and testing

8.1 General

8.1.1 A windlass, capstan or winch of sufficient power and suitable for the size of anchor cable is to be fitted to the craft. Where Owners require equipment significantly in excess of Rule requirements, it is their responsibility to specify increased windlass power.

8.1.2 Windlasses may be hand or power operated, subject to the requirements of 8.2.3.

8.1.3 Where steel wire rope is used in lieu of chain cable, a suitable winch with sufficient drum capacity to store the length of wire rope fitted is to be provided.

8.1.4 The windlass, anchoring capstans and winches are to be of types approved by LR.

8.1.5 On craft equipped with anchors having a mass of over 50 kg windlass(es) of sufficient power and suitable for the type and size of chain cable are to be fitted. Arrangements with anchor davits will be specially considered.

8.2 Performance

8.2.1 The following performance criteria are to be used as a design basis for the windlass:

(a) The windlass is to have sufficient power to exert a continuous duty pull of:
$28{,}00 d_c^2$ N – for Grade U1 chain, with $d_c < 14$ mm
$36{,}79 d_c^2$ N – for Grade U1 chain, with $d_c \geq 14$ mm
$41{,}68 d_c^2$ N – for Grade U2 chain
$46{,}60 d_c^2$ N – for Grade U3 chain
over a period of $0{,}12 L_c$ minutes. The test period need not be taken longer than 30 minutes
where
d_c is the chain diameter, in mm
L_c is the total length of chain cable on board, in metres, as given by Table 5.6.1.

(b) The windlass is to have sufficient power to exert, over a period of at least two minutes, a pull equal to the greater of:
(i) short-term pull:
1,5 times the continuous duty pull as defined in 8.2.1(a).
(ii) anchor breakout pull:
$12{,}18 W_a + 7{,}0 L_c d_c^2/100$ N
where
W_a is the mass of bower anchor(kg) as given in Table 5.5.1.

(c) In the absence of a chain stopper, the windlass, with its braking system in action and in conditions simulating those likely to occur in service, is to be able to withstand, without permanent deformation or brake slip, a load, applied to the cable, given by:
$K_b d_c^2 (44 - 0{,}08 d_c)$ N
where
K_b = 7,85 for Cable Grade U1
= 11,00 for Cable Grade U2
= 15,70 for Cable Grade U3.

(d) Where a chain stopper is fitted, the windlass braking system is to have sufficient brake capacity to ensure safe stopping when paying out the anchor and chain. It is the Master's responsibility to ensure that the chain stopper is in use when riding at anchor. At clearly visible locations on the bridge and adjacent to the windlass control position, the following notice is to be displayed adjacent to the windlass control position, and at clearly visible locations on the bridge if the windlass can be operated remotely:
'The brake is rated to permit controlled descent of the anchor and chain only. The chain stopper is to be used at all times whilst riding at anchor.'
The performance criteria are to be verified by means of shop tests in the case of windlasses manufactured on an individual basis. Windlasses manufactured under LR's Type Approval Scheme for Marine Engineering Equipment will not require shop testing on an individual basis.

8.2.2 Windlass performance characteristics specified in 8.2.1 and 8.3.2 are based on the following assumptions:

(a) one cable lifter only is connected to the drive shaft,
(b) continuous duty and short term pulls are measured at the cable lifter,
(c) brake tests are carried out with the brakes fully applied and the cable lifter declutched,
(d) the probability of declutching a cable lifter from the motor with its brake in the off position is minimized,
(e) hawse pipe efficiency assumed to be 70 per cent.

8.2.3 Hand-operated winches are only acceptable if the effort required at the handle does not exceed 15 kgf for raising one anchor at a speed of not less than 2 m/min and making about thirty turns of the handle per minute.

8.2.4 Winches suitable for operation by hand as well as by external power are to be so constructed that the power drive cannot activate the hand drive.

8.3 Tests and trials

8.3.1 Where shop testing is not possible and Type Approval has not been obtained, calculations demonstrating compliance with 8.2.1 are to be submitted together with detailed plans and an arrangement plan showing the following components:

- Shafting.
- Gearing.
- Brakes.
- Clutches.

8.3.2 During trials on board the craft the windlass should be shown to be capable of raising the anchor from a depth of 82,5 m to a depth of 27,5 m at a mean speed of 9 m/min. Where the depth of water in the trial area is inadequate, or the anchor cable is less than 82,5 m, suitable equivalent simulating conditions will be considered as an alternative.

8.4 Seatings

8.4.1 The windlass is to be efficiently bedded and secured to the deck. The thickness of the deck in way of the windlass is to be increased, and adequate stiffening is to be provided, to the Surveyor's satisfaction. The structural design integrity of the bedplate is the responsibility of the Builder and windlass manufacturer.

■ *Section 9*
Structural details

9.1 General

9.1.1 An easy lead of the cables from the windlass to the anchors and chain lockers is to be arranged. Where cables pass over or through stoppers, these stoppers are to be manufactured from ductile material and be designed to minimise the probability of damage to, or snagging of, the cable. They are to be capable of withstanding without permanent deformation a load equal to 80 per cent of the Rule breaking load of the cable passing over them.

9.2 Bulbous bow and wave piercing bow arrangements

9.2.1 The shell plating is to be increased in thickness at the fore end of the bulb and in other areas likely to be damaged by the anchors and chain cables. The increased plate thickness is to be the same as that required for plated stems by Parts 6, 7 and 8 of the Rules for steel, aluminium alloy and composite materials respectively.

9.3 Hawse pipes and anchor recesses

9.3.1 Hawse pipes, bow rollers and other deck gear, of adequate size and construction, are to be provided for handling and securing the anchors and are to be efficiently attached to the structure and arranged to give an easy lead to the cable.

9.3.2 The hawse pipes are to be of sufficient size and thickness, and arranged to give an easy lead for the cable to the windlass.

9.3.3 Hawse pipes and anchor pockets are to be of ample thickness and of a suitable size and form to house the anchors efficiently, preventing, as much as practicable, slackening of the cable or movements of the anchor being caused by wave action. The shell plating and framing in way of the hawse pipes are to be reinforced as necessary, *see* 9.5.1. Substantial chafing lips are to be provided at shell and deck. These are to have sufficiently large, radiused faces to minimise the probability of cable links being subjected to high bending stresses. Alternatively, roller fairleads of suitable design may be fitted. Where unpocketed rollers are used, it is recommended that the roller diameter be not less than eleven times the chain diameter. Where hawse pipes are not fitted, alternative arrangements will be specially considered.

9.4 Spurling pipes

9.4.1 Satisfactory means are to be provided to prevent inadvertent flooding of chain lockers. It is recommended that steel plates in halves, hooked over the spurling pipe tops, be provided on top of which cement may be laid before lashing a canvas cover. Suitable alternatives will be considered.

9.4.2 The design of the windlass is to be such that the following requirements or equivalent arrangements will minimise the probability of the chain locker or forecastle being flooded in bad weather:

(a) a weathertight connection can be made between the windlass bedplate, or its equivalent, and the upper end of the chain pipe, and

(b) access to the chain pipe is adequate to permit the fitting of a cover or seal, of sufficient strength and proper design, over the chain pipe while the craft is at sea.

9.5 Local reinforcement

9.5.1 The thickness of shell plating determined in accordance with the Rule requirements is to be increased locally by not less than 50 per cent in way of hawse pipes.

9.5.2 Supports under windlasses and winches are to be suitably reinforced.