PART

3

CHAPTER **5 Equipment**

SECTION **1 Anchoring, Mooring and Towing Equipment**

1 General

All vessels are to have a complete equipment of anchors and chains. The letter Ⓔ placed after the symbols of classification in the *Record*, thus: ✠ **A1** Ⓔ, will signify that the equipment of the vessel is in compliance with the requirements of the Rules, or with requirements corresponding to the service limitation noted in the vessel's classification, which have been specially approved for the particular service. The mass per anchor of bower anchors, given in 3-5-1/Table 1, is for anchors of equal mass. The mass of individual anchors may vary 7% plus or minus from the tabular mass, provided that the combined mass of all anchors is not less than that required for anchors of equal mass. The total length of chain required to be carried onboard, as given in 3-5-1/Table 1, is to be reasonably divided between the two bower anchors.

Cables which are intended to form part of the equipment are not to be used as check chains when the vessel is launched. The inboard ends of the cables of the bower anchors are to be secured by efficient means. Two bower anchors and their cables are to be connected and positioned, ready for use. Where three anchors are given in 3-5-1/Table 1, the third anchor is intended as a spare bower anchor and is listed for guidance only; it is not required as a condition of classification. Means are to be provided for stopping each cable as it is paid out, and the windlass should be capable of heaving in either cable. Suitable arrangements are to be provided for securing the anchors and stowing the cables.

3 Equipment Mass and Size *(2001)*

The requirements herein are intended for temporary mooring of a vessel within a harbor or other areas of sheltered water. The "Equipment Number" equation is based on 2.5 m/s (8.2 ft/s) current, 25 m/s (49 knots) wind and a scope of 6 through 10, the scope being the ratio of length of chain paid out to the water depth. Anchors and chains are to be in accordance with 3-5-1/Table 1 and the numbers, mass and sizes of these are to be regulated by the equipment number (*EN*) obtained from the following equation:

$$\text{Equipment Number} = k\Delta^{2/3} + mBh + nA$$

where

k = 1.0 (1.0, 1.012)

m = 2 (2, 0.186)

n = 0.1 (0.1, 0.00929)

Δ = molded displacement, as defined in 3-1-1/11.1

B = molded breadth, as defined in 3-1-1/5, in m (ft)

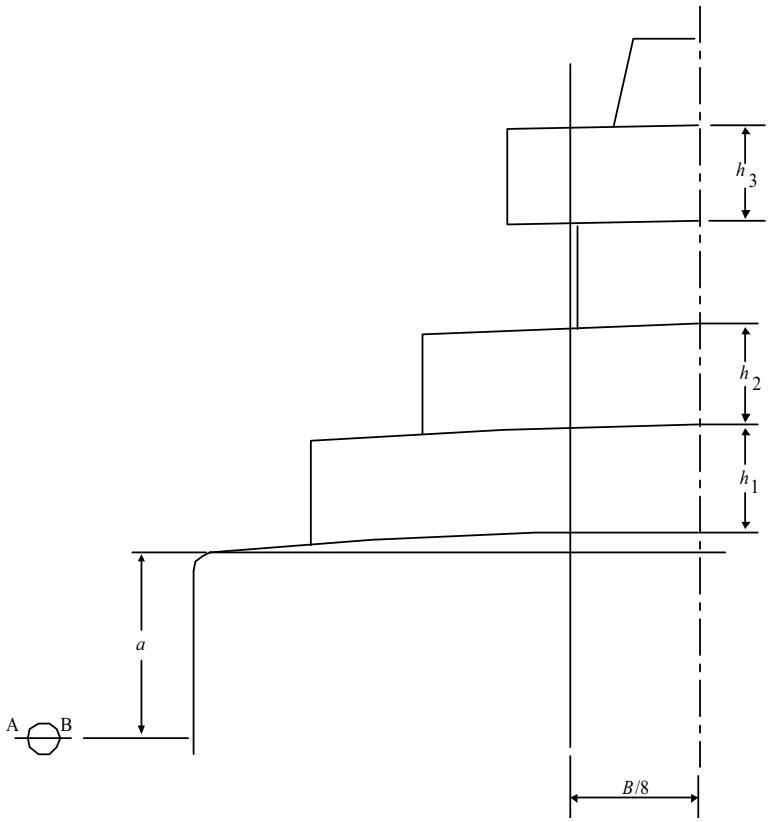
h = $a + h_1 + h_2 + h_3 + \ldots$, as shown in 3-5-1/Figure 1. In the calculation of h, sheer, camber and trim may be neglected

a = freeboard, in m (ft), from the summer load waterline amidships

$h_1, h_2, h_3 \ldots$ = height, in m (ft), on the centerline of each tier of houses having a breadth greater than $B/4$

A = profile area, in m^2 (ft^2), of the hull, superstructure and houses above the summer load waterline which are within the Rule length. Superstructures or deck houses having a breadth at any point no greater than $0.25B$ may be excluded. Screens and bulwarks more than 1.5 m (4.9 ft) in height are to be regarded as parts of houses when calculating h and A

FIGURE 1
Effective Heights of Deck Houses



5 Tests

Tests are to be in accordance with the requirements of Part 2, Chapter 2 for the respective sizes of anchors and chains. See Section 2-2-1 and Section 2-2-2.

7 Anchor Types

Anchors are to be of the stockless type. The mass of the head of a stockless anchor, including pins and fittings, is not to be less than three-fifths of the total mass of the anchor. Where specifically requested by the Owners, the Bureau is prepared to give consideration to the use of special types of anchors and where these are of proven superior holding ability, consideration may also be given to some reduction in the mass, up to a maximum of 25% from the mass specified in 3-5-1/Table 1. In such cases, the notation **RW** will be made in the *Record*.

9 Hawsers and Towlines

9.1 All Vessels *(1995)*

Except as indicated in 3-5-1/15.7, hawsers and towlines are not required as a condition of classification. The hawsers and towlines listed in 3-5-1/Table 2 are intended as a guide. Where the tabular breaking strength exceeds 490 kN (50,000 kgf, 110,200 lbf), the breaking strength and the number of individual hawsers given in the Table may be modified, provided their product is not less than that of the breaking strength and the number of hawsers given in the Table. For vessels having an *A*/*EN* ratio greater than 0.9 for SI or MKS units (9.7 for US units), the number of hawsers given in 3-5-1/Table 2 is to be increased by the number given below.

A/EN Ratio		*Increase number of hawsers by*
SI Units MKS Units	*U.S.Units*	
Above 0.9 up to 1.1	above 9.7 up to 11.8	1
Above 1.1 up to 1.2	above 11.8 up to 12.9	2
above 1.2	above 12.9	3

where

A = defined in 3-5-1/3

EN = determined by the equation in 3-5-1/3

11 Windlass Support Structure and Cable Stopper

11.1 General *(2004)*

Construction and installation of all windlasses used for anchoring are to be carried out in accordance with 4-1-1/5 and Section 4-5-1. Where fitted, an independent cable stopper and its components are to be adequate for the load imposed. The arrangements and details of the cable stopper are to be submitted for review.

The windlass supporting structures are to meet the requirements in 3-5-1/11.3. Where the mooring winch is integral with the windlass, it is to be considered as a part of the windlass for the purpose of said paragraph.

11.3 Support Structure *(2004)*

The windlass is to be bolted down to a substantial foundation, which is to meet the following load cases and associated criteria.

11.3.1 Operating Loads

11.3.1(a) Load on Windlass Support Structure (2006). The following load is to be applied in the direction of the chain.

With cable stopper not attached to windlass:	45% of B.S.
With cable stopper attached to windlass:	80% of B.S.
Without cable stopper:	80% of B.S.

B.S. = minimum breaking strength of the chain, as indicated in 2-2-2/Tables 2 and 3 of the *Rules for Materials and Welding (Part 2)*.

11.3.1(b) Load on Cable Stopper and Support Structure (2006). A load of 80% of B.S. is to be applied in the direction of the chain.

11.3.1(c) Allowable Stress (2006). The stresses in the structures supporting the windlass and cable stopper are not to exceed the yield point.

11.3.2 Sea Loads

11.3.2(a) Pressures. The following pressures and associated areas are to be applied (see 3-5-1/Figure 2):

- 200 kN/m^2 (20.4 tf/m^2, 4178 lbf/ft^2) normal to the shaft axis and away from the forward perpendicular, over the projected area in this direction,
- 150 kN/m^2 (15.3 tf/m^2, 3133 lbf/ft^2) parallel to the shaft axis and acting both inboard and outboard separately, over the multiple of f times the projected area in this direction,

  where f is defined as:

  f = $1 + B/H$, f need not be taken as greater than 2.5

  B = width of windlass measured parallel to the shaft axis

  H = overall height of windlass.

11.3.2(b) Forces. Forces in the bolts, chocks and stoppers securing the windlass to the deck are to be calculated. The windlass is supported by N groups of bolts, each containing one or more bolts, see 3-5-1/Figure 2.

i) *Axial Forces.* The aggregate axial force R_i in respective group of bolts (or bolt) i, positive in tension, may be calculated from the following equations:

$$R_{xi} = P_x \, hx_i \, A_i / I_x$$

$$R_{yi} = P_y \, hy_i \, A_i / I_y$$

and

$$R_i = R_{xi} + R_{yi} - R_{si}$$

where

P_x = force, kN (tf, lbf), acting normal to the shaft axis

P_y = force, kN (tf, lbf), acting parallel to the shaft axis, either inboard or outboard, whichever gives the greater force in bolt group i

h = shaft height above the windlass mounting, cm (in.)

x_i, y_i = x and y coordinates of bolt group i from the centroid of all N bolt groups, positive in the direction opposite to that of the applied force, cm (in.)

A_i = cross-sectional area of all bolts in group i, cm^2 (in^2)

I_x = $A_i\, x_i^2$ for N bolt groups

I_y = $A_i\, y_i^2$ for N bolt groups

R_{si} = static reaction at bolt group i, due to weight of windlass.

ii) *Shear forces.* Aggregated shear forces F_{xi}, F_{yi} applied to the respective bolt group i of bolts, and the resultant combined force F_i may be calculated from:

$$F_{xi} = (P_x - \alpha g M)/N$$

$$F_{yi} = (P_y - \alpha g M)/N$$

and

$$F_i = (F_{xi}^2 - F_{yi}^2)^{0.5}$$

where:

α = coefficient of friction (0.5)

M = mass of windlass, in tonnes (Ltons)

g = gravity: 9.81 m/sec^2 (32.2 ft/sec^2)

N = number of groups of bolts

The axial tensile/compressive and lateral forces from the above equations are also to be considered in the design of the supporting structure.

11.3.2(c) Stresses in Bolts. Tensile axial stresses in the individual bolts in each group of bolts i are to be calculated. The horizontal forces F_{xi} and F_{yi} are normally to be reacted by shear chocks. Where "fitted" bolts are designed to support these shear forces in one or both directions, the von Mises equivalent stresses in the individual "fitted" bolts are to be calculated and compared to the stress under proof load. Where pourable resins are incorporated in the holding down arrangements, due account is to be taken in the calculations.

11.3.2(d) Allowable Stress

i) *Bolts.* The safety factor against bolt proof strength is to be not less than 2.0.

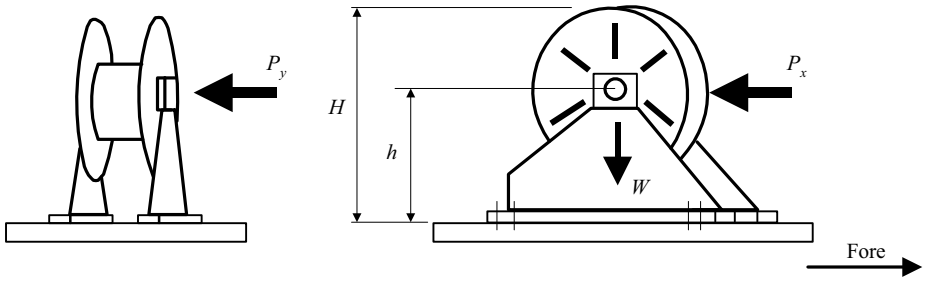
ii) *Supporting Structures.* The stresses in the above deck framing and the hull structure supporting the windlass are not to exceed the following values.

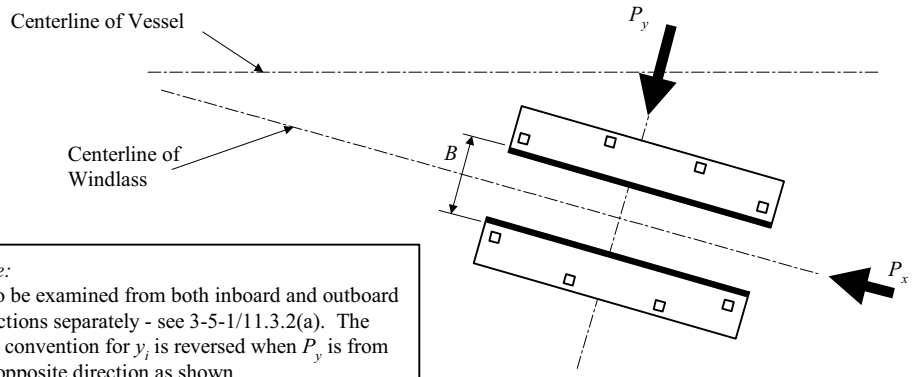
- Bending Stress 85% of the yield strength of the material
- Shearing Stress 60% of the yield strength of the material

11.5 Trial

See 3-7-2/1.

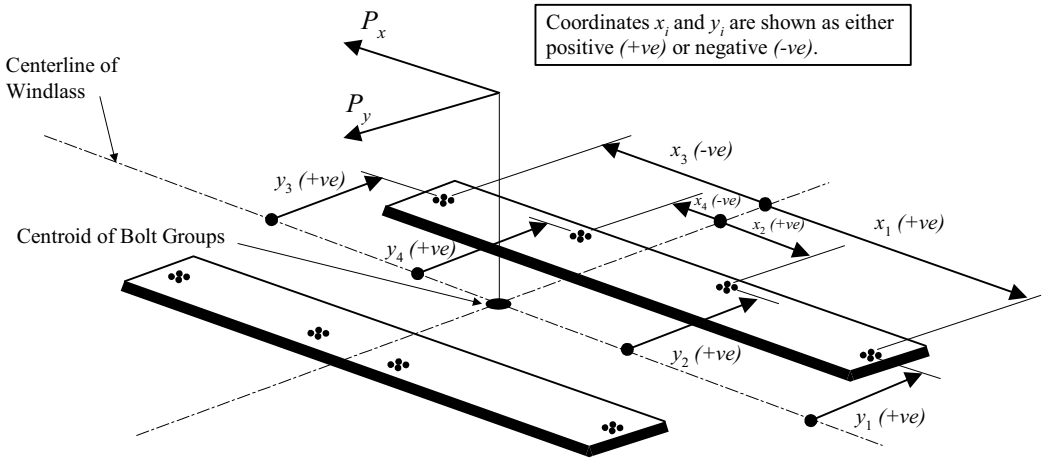
FIGURE 2
Direction of Forces and Weight *(2004)*





Note:
P_y to be examined from both inboard and outboard directions separately - see 3-5-1/11.3.2(a). The sign convention for y_i is reversed when P_y is from the opposite direction as shown.

FIGURE 3
Sign Convention *(2004)*



13 Hawse Pipes

Hawse pipes are to be of ample size and strength. They are to have full rounded flanges and the least possible lead, in order to minimize the nip on the cables. They are to be securely attached to thick doubling or insert plates by continuous welds the size of which are to be in accordance with Section 3-2-19 for the plating thickness and type of joint selected. When in position, they are to be thoroughly tested for watertightness by means of a hose in which the water pressure is not to be less than 2.06 bar (2.1 kgf/cm^2, 30 psi). Hawse pipes for stockless anchors are to provide ample clearances. The anchors are to be shipped and unshipped so that the Surveyor may be satisfied that there is no risk of the anchor jamming in the hawse pipe. Care is to be taken to ensure a fair lead for the chain from the windlass to the hawse pipes and to the chain pipes.

15 Bollard, Fairlead and Chocks *(2007)*

15.1 General

The arrangements and details of deck fittings used for mooring operations and/or towing operations at bow, sides and stern are to comply with the requirements of this section. The requirements for the supporting structures of these deck fittings are specified in 3-2-7/4.

15.3 Deck Fittings

The size of deck fittings is to be in accordance with recognized standards (e.g. ISO3913 Shipbuilding Welded Steel Bollards). The design load used to assess deck fittings and their attachments to the hull are to be in accordance with the requirements as specified in 3-2-7/4.

15.5 Safe Working Load (SWL)

The requirements on SWL apply for a single post basis (no more than one turn of one cable).

15.5.1 Mooring Operations

The SWL is not to exceed 80% of the design load per 3-2-7/4.3.1.

15.5.2 Towing Operations

The SWL used for normal towing operations (e.g., harbor/maneuvering) is not to exceed 80% of the design load per 3-2-7/4.3.2(a) and the SWL used for other towing operations (e.g., escort) is not to exceed the design load per 3-2-7/4.3.2(b). For deck fittings used for both normal and other towing operations, the design load of 3-2-7/4.3.2 is to be used.

15.5.3 Marking and Plan

15.5.3(a) Marking. The SWL of each deck fitting is to be marked (by weld bead or equivalent) on the deck fittings used for towing/mooring.

15.5.3(b) Plan. The towing and mooring arrangements plan mentioned in 3-5-1/15.7 is to define the method of use of mooring lines and/or towing lines.

15.7 Towing and Mooring Arrangements Plan

The SWL for the intended use for each deck fitting is to be noted in the towing and mooring arrangements plan available on board for the guidance of the Master.

Information provided on the plan is to include in respect of each deck fitting:

- Location on the ship;
- Fitting type;

- SWL;
- Purpose (mooring/harbor towing/escort towing); and
- Manner of applying towing or mooring line load including limiting fleet angles.

Note: Where the arrangements and details of deck fittings and their supporting structures are designed based on the mooring arrangements as permitted in Note 2 of 3-2-7/4.3.1(a), the arrangement of mooring lines showing number of lines together with the breaking strength of each mooring line are to be clearly indicated on the plan.

This information is to be incorporated into the pilot card in order to provide the pilot proper information on harbor/escorting operations.

15.9 Emergency Towing Arrangements *(1 January 1996)*

Tankers of 20,000 tonnes deadweight and above, including oil tankers, chemical tankers and gas carriers, are to be fitted with an emergency towing arrangement at both ends complying with Maritime Safety Committee Resolution MSC 35(63). Written approval by the flag Administration of the emergency towing arrangements will be accepted as evidence of compliance with this paragraph.

17 Chafing Chain for Emergency Towing Arrangements *(2005)*

17.1 Scope

These requirements apply to the chafing chain for chafing gear of two types of Emergency Towing Arrangement (ETA), those with a specified safe working load (SWL) of 1000 kN (ETA1000) and those with a specified safe working load of 2000 kN (ETA2000). Chafing chains other than those specified can be used subject to special agreement with the Bureau.

17.3 Qualification of Manufacturers

Chafing chain is to be manufactured by works approved by the Bureau, in accordance with 2-2-2/7.1 or in accordance with the ABS *Guide for Certification of Offshore Mooring Chain*.

17.5 Materials

Materials used for the manufacture of chafing chain are to meet the requirements of 2-2-2/7.11 or in accordance with the ABS *Guide for Certification of Offshore Mooring Chain*.

17.7 Design, Manufacture, Testing and Certification of Chafing Chain

17.7.1

Chafing chain is to be designed, manufactured, tested and certified in accordance with the requirements of Section 2-2-2 or in accordance with the ABS *Guide for Certification of Offshore Mooring Chain*.

17.7.2

The common link is to be of stud link type grade 2a, 2b or 3a, 3b Anchor Chain, or grade RQ3, RQ3S, RQ4 Mooring Chain.

17.7.3

The arrangement at the end connected to the strongpoint and the dimensions of the chafing chain are determined by the type of ETA. The other end of the chafing chain is to be fitted with a pear-shaped open link allowing connection to a shackle corresponding to the type of ETA and chain cable grade. A typical arrangement of this chain end is shown in 3-5-1/Figure 4.

17.7.4

The chafing chain is to be able to withstand a breaking load not less than twice the SWL. For each type of ETA, the nominal diameter of common link for chafing chains is to comply with the value indicated below.

Type of ETA	*Nominal Diameter of Common Link, d, min.*	
	Grade 2	*Grade 3*
ETA1000	62 mm	52 mm
ETA2000	90 mm	76 mm

FIGURE 4
Typical Outboard Chafing Chain End *(2005)*

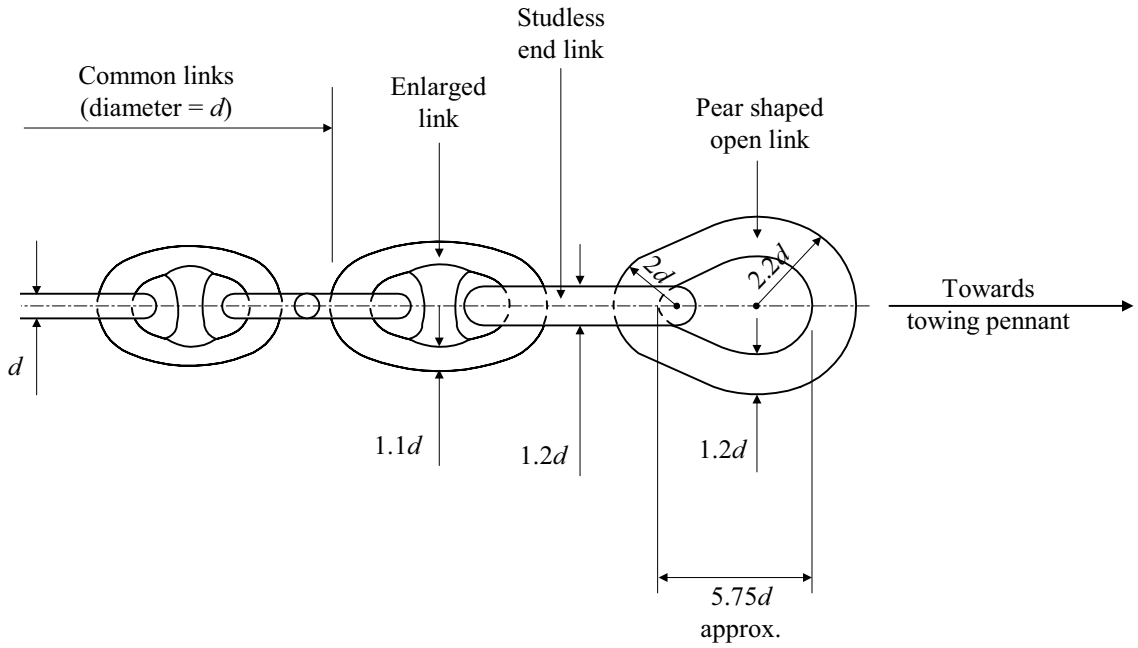


TABLE 1
Equipment for Self-propelled Ocean-going Vessels

SI, MKS Units

Equipment Numeral	*Equipment Number**	*Stockless Bower Anchors*		*Chain Cable Stud Link Bower Chain*			
					Diameter		
		Number	*Mass per Anchor, kg*	*Length, m*	*Normal-Strength Steel (Grade 1), mm*	*High-Strength Steel (Grade 2), mm*	*Extra High-Strength Steel (Grade 3), mm*
U6	150	2	480	275	22	19	
U7	175	2	570	302.5	24	20.5	
U8	205	3	660	302.5	26	22	20.5
U9	240	3	780	330	28	24	22
U10	280	3	900	357.5	30	26	24
U11	320	3	1020	357.5	32	28	24
U12	360	3	1140	385	34	30	26
U13	400	3	1290	385	36	32	28
U14	450	3	1440	412.5	38	34	30
U15	500	3	1590	412.5	40	34	30
U16	550	3	1740	440	42	36	32
U17	600	3	1920	440	44	38	34
U18	660	3	2100	440	46	40	36
U19	720	3	2280	467.5	48	42	36
U20	780	3	2460	467.5	50	44	38
U21	840	3	2640	467.5	52	46	40
U22	910	3	2850	495	54	48	42
U23	980	3	3060	495	56	50	44
U24	1060	3	3300	495	58	50	46
U25	1140	3	3540	522.5	60	52	46
U26	1220	3	3780	522.5	62	54	48
U27	1300	3	4050	522.5	64	56	50
U28	1390	3	4320	550	66	58	50
U29	1480	3	4590	550	68	60	52
U30	1570	3	4890	550	70	62	54
U31	1670	3	5250	577.5	73	64	56
U32	1790	3	5610	577.5	76	66	58
U33	1930	3	6000	577.5	78	68	60
U34	2080	3	6450	605	81	70	62
U35	2230	3	6900	605	84	73	64
U36	2380	3	7350	605	87	76	66
U37	2530	3	7800	632.5	90	78	68
U38	2700	3	8300	632.5	92	81	70
U39	2870	3	8700	632.5	95	84	73
U40	3040	3	9300	660	97	84	76

TABLE 1 (continued)
Equipment for Self-propelled Ocean-going Vessels

SI, MKS Units

Equipment Numeral	*Equipment Number**	*Stockless Bower Anchors*		*Chain Cable Stud Link Bower Chain*			
					Diameter		
		Number	*Mass per Anchor, kg*	*Length, m*	*Normal-Strength Steel (Grade 1), mm*	*High-Strength Steel (Grade 2), mm*	*Extra High-Strength Steel (Grade 3), mm*
U41	3210	3	9900	660	100	87	78
U42	3400	3	10500	660	102	90	78
U43	3600	3	11100	687.5	105	92	81
U44	3800	3	11700	687.5	107	95	84
U45	4000	3	12300	687.5	111	97	87
U46	4200	3	12900	715	114	100	87
U47	4400	3	13500	715	117	102	90
U48	4600	3	14100	715	120	105	92
U49	4800	3	14700	742.5	122	107	95
U50	5000	3	15400	742.5	124	111	97
U51	5200	3	16100	742.5	127	111	97
U52	5500	3	16900	742.5	130	114	100
U53	5800	3	17800	742.5	132	117	102
U54	6100	3	18800	742.5	—	120	107
U55	6500	3	20000	770	—	124	111
U56	6900	3	21500	770	—	127	114
U57	7400	3	23000	770	—	132	117
U58	7900	3	24500	770	—	137	122
U59	8400	3	26000	770	—	142	127
U60	8900	3	27500	770	—	147	132
U61	9400	3	29000	770	—	152	132
U62	10000	3	31000	770	—	—	137
U63	10700	3	33000	770	—	—	142
U64	11500	3	35500	770	—	—	147
U65	12400	3	38500	770	—	—	152
U66	13400	3	42000	770	—	—	157
U67	14600	3	46000	770	—	—	162

* For intermediate values of equipment number, use equipment complement in sizes and weights given for the lower equipment number in the table.

TABLE 1
Equipment for Self-propelled Ocean-going Vessels

US Units

Equipment Numeral	*Equipment Number**	*Stockless Bower Anchors*		*Chain Cable Stud Link Bower Chain*			
					Diameter		
		Number	*Mass per Anchor, pounds*	*Length, fathoms*	*Normal-Strength Steel (Grade 1), inches*	*High-Strength Steel (Grade 2), inches*	*Extra High-Strength Steel (Grade 3), inches*
U6	150	2	1060	150	7/8	3/4	
U7	175	2	1255	165	15/16	13/16	
U8	205	3	1455	165	1	7/8	13/16
U9	240	3	1720	180	1 1/8	15/16	7/8
U10	280	3	1985	195	1 3/16	1	15/16
U11	320	3	2250	195	1 1/4	1 1/8	5/16
U12	360	3	2510	210	1 5/16	1 3/16	1
U13	400	3	2840	210	1 7/16	1 1/4	1 1/8
U14	450	3	3170	225	1 1/2	1 5/16	1 3/16
U15	500	3	3500	225	1 9/16	1 5/16	1 3/16
U16	550	3	3830	240	1 5/8	1 7/16	1 1/4
U17	600	3	4230	240	1 3/4	1 1/2	1 5/16
U18	660	3	4630	240	1 13/16	1 9/16	1 7/16
U19	720	3	5020	255	1 7/8	1 5/8	1 7/16
U20	780	3	5420	255	2	1 3/4	1 1/2
U21	840	3	5820	255	2 1/16	1 13/16	1 9/16
U22	910	3	6280	270	2 1/8	1 7/8	1 5/8
U23	980	3	6740	270	2 3/16	1 15/16	1 3/4
U24	1060	3	7270	270	2 5/16	2	1 13/16
U25	1140	3	7800	285	2 3/8	2 1/16	1 13/16
U26	1220	3	8330	285	2 7/16	2 1/8	1 7/8
U27	1300	3	8930	285	2 1/2	2 3/16	2
U28	1390	3	9520	300	2 5/8	2 5/16	2
U29	1480	3	10120	300	2 11/16	2 3/8	2 1/16
U30	1570	3	10800	300	2 3/4	2 7/16	2 1/8
U31	1670	3	11600	315	2 7/8	2 1/2	2 3/16
U32	1790	3	12400	315	3	2 5/8	2 5/16
U33	1930	3	13200	315	3 1/16	2 11/16	2 3/8
U34	2080	3	14200	330	3 3/16	2 3/4	2 7/16
U35	2230	3	15200	330	3 5/16	2 7/8	2 1/2
U36	2380	3	16200	330	3 7/16	3	2 5/8
U37	2530	3	17200	345	3 9/16	3 1/16	2 11/16
U38	2700	3	18300	345	3 5/8	3 3/16	2 3/4
U39	2870	3	19200	345	3 3/4	3 5/16	2 7/8
U40	3040	3	20500	360	3 7/8	3 5/16	3

TABLE 1 (continued)
Equipment for Self-propelled Ocean-going Vessels

US Units

Equipment Numeral	*Equipment Number**	*Stockless Bower Anchors*		*Chain Cable Stud Link Bower Chain*			
					Diameter		
		Number	*Mass per Anchor, pounds*	*Length, fathoms*	*Normal-Strength Steel (Grade 1), inches*	*High-Strength Steel (Grade 2), inches*	*Extra High-Strength Steel (Grade 3), inches*
U41	3210	3	21800	360	3 15/16	3 7/16	3 1/16
U42	3400	3	23100	360	4	3 9/16	3 1/16
U43	3600	3	24500	375	4 1/8	3 5/8	3 3/16
U44	3800	3	25800	375	4 1/4	3 3/4	3 5/16
U45	4000	3	27100	375	4 3/8	3 7/8	3 7/16
U46	4200	3	28400	390	4 1/2	3 15/16	3 7/16
U47	4400	3	29800	390	4 5/8	4	3 9/16
U48	4600	3	31100	390	4 3/4	4 1/8	3 5/8
U49	4800	3	32400	405	4 3/4	4 1/4	3 3/4
U50	5000	3	33900	405	4 7/8	4 3/8	3 7/8
U51	5200	3	35500	405	5	4 3/8	3 7/8
U52	5500	3	37200	405	5 1/8	4 1/2	3 15/16
U53	5800	3	39200	405	5 1/8	4 5/8	4
U54	6100	3	41400	405	—	4 3/4	4 1/4
U55	6500	3	44000	420	—	4 7/8	4 3/8
U56	6900	3	47400	420	—	5	4 1/2
U57	7400	3	50700	420	—	5 1/8	4 5/8
U58	7900	3	54000	420	—	5 3/8	4 3/4
U59	8400	3	57300	420	—	5 5/8	5
U60	8900	3	60600	420	—	5 3/4	5 1/8
U61	9400	3	63900	420	—	6	5 1/8
U62	10000	3	68000	420	—	—	5 3/8
U63	10700	3	72500	420	—	—	5 5/8
U64	11500	3	78000	420	—	—	5 3/4
U65	12400	3	85000	420	—	—	6
U66	13400	3	92500	420	—	—	6 1/8
U67	14600	3	101500	420	—	—	6 3/8

* For intermediate values of equipment number, use equipment complement in sizes and weights given for the lower equipment number in the table.

TABLE 2
Towline and Hawsers for Self-propelled Ocean-going Vessels

SI & MKS Units

Equipment Numeral	*Equipment Number**	*Towline Wire or Rope*			*Hawsers*			
			Breaking Strength,			*Length of Each,*	*Breaking Strength,*	
		Length, m	*KN*	*kgf*	*Number*	*m*	*kN*	*kgf*
U6	150	180	98.0	10000	3	120	54.0	5500
U7	175	180	112.0	11400	3	120	59.0	6000
U8	205	180	129.0	13200	4	120	64.0	6500
U9	240	180	150.0	15300	4	120	69.0	7000
U10	280	180	174.0	17700	4	140	74.0	7500
U11	320	180	207.0	21100	4	140	78.0	8000
U12	360	180	224.0	22800	4	140	88.0	9000
U13	400	180	250.0	25500	4	140	98.0	10000
U14	450	180	277.0	28200	4	140	108.0	11000
U15	500	190	306.0	31200	4	160	123.0	12500
U16	550	190	338.0	34500	4	160	132.0	13500
U17	600	190	370.0	37800	4	160	147.0	15000
U18	660	190	406.0	41400	4	160	157.0	16000
U19	720	190	441.0	45000	4	170	172.0	17500
U20	780	190	479.0	48900	4	170	186.0	19000
U21	840	190	518.0	52800	4	170	201.0	20500
U22	910	190	559.0	57000	4	170	216.0	22000
U23	980	200	603.0	61500	4	180	230.0	23500
U24	1060	200	647.0	66000	4	180	250.0	25500
U25	1140	200	691.0	70500	4	180	270.0	27500
U26	1220	200	738.0	75300	4	180	284.0	29000
U27	1300	200	786.0	80100	4	180	309.0	31500
U28	1390	200	836.0	85200	4	180	324.0	33000
U29	1480	220	888.0	90600	5	190	324.0	33000
U30	1570	220	941.0	96000	5	190	333.0	34000
U31	1670	220	1024.0	104400	5	190	353.0	36000
U32	1790	220	1109.0	113100	5	190	378.0	38500
U33	1930	220	1168.0	119100	5	190	402.0	41000
U34	2080	240	1259.0	128400	5	200	422.0	43000
U35	2230	240	1356.0	138300	5	200	451.0	46000
U36	2380	240	1453.0	148200	5	200	480.0	49000
U37	2530	260	1471.0	150000	6	200	480.0	49000
U38	2700	260	1471.0	150000	6	200	490.0	50000
U39	2870	260	1471.0	150000	6	200	500.0	51000
U40	3040	280	1471.0	150000	6	200	520.0	53000

TABLE 2 (continued)
Towline and Hawsers for Self-propelled Ocean-going Vessels

SI & MKS Units

Equipment Numeral	*Equipment Number**	*Towline Wire or Rope*			*Hawsers*			
			Breaking Strength,			*Length of Each, m*	*Breaking Strength,*	
		Length, m	*KN*	*kgf*	*Number*		*kN*	*kgf*
U41	3210	280	1471.0	150000	6	200	554.0	56500
U42	3400	280	1471.0	150000	6	200	588.0	60000
U43	3600	300	1471.0	150000	6	200	618.0	63000
U44	3800	300	1471.0	150000	6	200	647.0	66000
U45	4000	300	1471.0	150000	7	200	647.0	66000
U46	4200	300	1471.0	150000	7	200	657.0	67000
U47	4400	300	1471.0	150000	7	200	667.0	68000
U48	4600	300	1471.0	150000	7	200	677.0	69000
U49	4800	300	1471.0	150000	7	200	686.0	70000
U50	5000	300	1471.0	150000	8	200	686.0	70000
U51	5200	300	1471.0	150000	8	200	696.0	71000
U52	5500	300	1471.0	150000	8	200	706.0	72000
U53	5800	300	1471.0	150000	9	200	706.0	72000
U54	6100	300	1471.0	150000	9	200	716.0	73000
U55	6500	300	1471.0	150000	9	200	726.0	74000
U56	6900	300	1471.0	150000	10	200	726.0	74000
U57	7400	300	1471.0	150000	11	200	726.0	74000
U58	7900	—	—	—	12	200	736.0	75000
U59	8400	—	—	—	12	200	736.0	75000
U60	8900	—	—	—	13	200	736.0	75000
U61	9400	—	—	—	14	200	736.0	75000
U62	10000	—	—	—	15	200	736.0	75000
U63	10700	—	—	—	16	200	736.0	75000
U64	11500	—	—	—	17	200	736.0	75000
U65	12400	—	—	—	18	200	736.0	75000
U66	13400	—	—	—	19	200	736.0	75000
U67	14600	—	—	—	21	200	736.0	75000

* For intermediate values of equipment number, use equipment complement in sizes and weights given for the lower equipment number in the table.

TABLE 2
Towline and Hawsers for Self-propelled Ocean-going Vessels

US Units

		Towline Wire or Rope		*Hawsers*		
Equipment Numeral	*Equipment Number**	*Length, Fathoms*	*Breaking Strength, Pounds*	*Number*	*Length of Each Fathoms*	*Breaking Strength, Pounds*
U6	150	98	22000	3	66	12100
U7	175	98	25100	3	66	13200
U8	205	98	29100	4	66	14300
U9	240	98	33700	4	66	15400
U10	280	98	39000	4	77	16500
U11	320	98	46500	4	77	17600
U12	360	98	50300	4	77	19800
U13	400	98	56200	4	77	22000
U14	450	98	62200	4	77	24200
U15	500	104	68800	4	88	27600
U16	550	104	76000	4	88	29800
U17	600	104	83300	4	88	33100
U18	660	104	91200	4	88	35300
U19	720	104	99200	4	93	38600
U20	780	104	107800	4	93	41900
U21	840	104	116400	4	93	45200
U22	910	104	125600	4	93	48500
U23	980	109	135500	4	98	51800
U24	1060	109	145500	4	98	56200
U25	1140	109	155400	4	98	60600
U26	1220	109	166000	4	98	63900
U27	1300	109	176500	4	98	69400
U28	1390	109	187800	4	98	72800
U29	1480	120	199700	5	104	72800
U30	1570	120	211500	5	104	75000
U31	1670	120	230000	5	104	79400
U32	1790	120	249500	5	104	84900
U33	1930	120	262500	5	104	90400
U34	2080	131	283000	5	109	94800
U35	2230	131	305000	5	109	101400
U36	2380	131	326500	5	109	108000
U37	2530	142	330500	6	109	108000
U38	2700	142	330500	6	109	110200
U39	2870	142	330500	6	109	112400
U40	3040	153	330500	6	109	116800

TABLE 2 (continued)
Towline and Hawsers for Self-propelled Ocean-going Vessels

US Units

		Towline Wire or Rope		*Hawsers*		
Equipment Numeral	*Equipment Number*•	*Length, Fathoms*	*Breaking Strength, Pounds*	*Number*	*Length of Each Fathoms*	*Breaking Strength, Pounds*
U41	3210	153	330500	6	109	124600
U42	3400	153	330500	6	109	132300
U43	3600	164	330500	6	109	138900
U44	3800	164	330500	6	109	145500
U45	4000	164	330500	7	109	145500
U46	4200	164	330500	7	109	147700
U47	4400	164	330500	7	109	149900
U48	4600	164	330500	7	109	152100
U49	4800	164	330500	7	109	154300
U50	5000	164	330500	8	109	154300
U51	5200	164	330500	8	109	156500
U52	5500	164	330500	8	109	158700
U53	5800	164	330500	9	109	158700
U54	6100	164	330500	9	109	160900
U55	6500	164	330500	9	109	163100
U56	6900	164	330500	10	109	163100
U57	7400	164	330500	11	109	163100
U58	7900	—	—	11	109	165300
U59	8400	—	—	12	109	165300
U60	8900	—	—	13	109	165300
U61	9400	—	—	14	109	165300
U62	10000	—	—	15	109	165300
U63	10700	—	—	16	109	165300
U64	11500	—	—	17	109	165300
U65	12400	—	—	18	109	165300
U66	13400	—	—	19	109	165300
U67	14600	—	—	21	109	165300

* For intermediate values of equipment number, use equipment complement in sizes and weights given for the lower equipment number in the table.