PART III CONSTRUCTION COMPONENTS

TITLE 61 MATERIALS AND PROCEDURES FOR THE HULL

SECTON 3 HULL EQUIPMENT

CHAPTERS

CONTENTS

CHAPTER A
MATERIALS FOR LIFTING APPLIANCES

CHAPTER CONTENTS

See RBNA Guidelines for Lifting Appliances.

CHAPTER B
MATERIALS FOR ANCHORING, MOORING AND TOWING

CHAPTER CONTENTS

B1. APPROACH

100. Application

101. The prescription of this Title 61 Section 3 apply for anchoring, mooring and towing materials and equipment required for Class Notation "E" subject to inspection at works in the manufacturers.

B2. ANCHORS
[IACS UR A.1.4]

100. Appication

101. This Subchapter B2 applies to the design, manufacturing and testing of anchors of vessels where the class notation "E" is required.

200. Types of Anchors
[A1.4.1]

201. **Ordinary anchors**

a. Ordinary anchors of “stockless” type are to be generally adopted and they are to be of appropriate design in compliance with the RBNA rules or practice of each individual type.

b. The mass of the heads of stockless anchors including pins and fittings are not to be less than 60% of the total mass of the anchor.

c. The mass, per anchor, of bower anchor given in Part II, Title 11, Section 3, Chapter D, Subchapter D2, Table T.D2.305.1 – Anchoring Equipment is required for anchors of equal mass.

The mass of individual anchor may vary to 7% of the Table mass provided that the total mass of anchors is not less than that required for anchors of equal mass.

202. **High holding power (HHP) anchors**

a. A “high holding power” anchor is to be suitable for ship’s use and is not to require prior adjustment or special placement on the sea bottom.

b. When special type of anchors designated “high holding power anchor” of proven superior holding ability are used as bower anchors, the mass of each anchor may be 75% of the mass required for ordinary stockless bower anchors in the part II, Title 11, Section 3, Chapter D2, Table T.D2.305.1.

c. For approval and/or acceptance as a HHP anchor satisfactory tests are to be made on various types of bottom, and the anchor is to have a holding power at least twice than of an ordinary stockless anchor of the same weight. Full scale tests are to be carried out at sea on various types of bottom and to be applied to anchors the weights of which are, as far as possible, representative of the full range of sizes proposed; for a definite group of the range the two anchors selected for testing (ordinary stockless anchors and HHP anchors) should be of approximately the same weight, and should be tested in association with the size of chain cable appropriate to this weight.

d. The length of cable with each anchor should be such that the pull on the shank remains practically horizontal, for this purpose a scope of 10 is

considered normal but a scope of not less than 6 may be accepted. Scope is defined as the ratio of length of cable to depth of water.

e. Three tests shall be taken for each anchor and nature of bed. The pull shall be measured by dynamometer. The stability of the anchor and ease of breaking out should be noted where possible. Tests are normally to be carried out from a tug but alternatively shore based tests may be accepted.

f. Measurements of pull based on RPM/bollard pull curve of tug may be accepted instead of dynamometer readings.

g. Tests in comparison with a previously approved HHP anchor may be accepted as a basis for approval.

h. For approval and/or acceptance of high holding power anchors of the whole range of weight, tests should be carried out on at least two - sizes of anchors and the weight of the maximum size to be approved could be accepted up to 10 times the weight of large size tested.

203. **Super high holding power (SHHP) anchors**

a. Definition**:** A super high holding power anchor is an anchor with a holding power of at least four times that of an ordinary stockless anchor of the same mass. A super high holding power anchor is suitable for restricted service vessels' use and does not require prior adjustment or special placement on the sea bed.

b. Limitations to Usage: The use of SHHP anchors is limited to restricted service vessels as defined by RBNA. The SHHP anchor mass should generally not exceed 1500kg.

c. Application: The unified requirement for the design of SHHP anchors applies down to EN ≥ 205. For EN < 205 the design criteria for SHHP anchors apply to the anchor mass given in Part II Title 11 Section 3 Chapter D2, D2.400 for ordinary stockless anchors, reduced as permitted in accordance with Part II, Title 11, Section , Chapter D, D2.505.

d. Anchor Design

d.1. Anchor Use: A super high holding power anchor is to be suitable for vessels in restricted service and is not to require prior adjustment or special placement on the sea bed.

d.2. Anchor Mass: When super high holding power anchors of the proven holding power given in e) below are used as bower anchors, the mass of each such anchor may be reduced to not less than 50% of the mass required for ordinary stockless anchors in Table T.D2.305.1 in Part II, Title 11, Chapter D, Subchapter D2.

e. Anchor Holding Power: For approval and/or acceptance as a SHHP anchor satisfactory full scale tests are to be made confirming that the anchor has a holding power of at least four times that of an ordinary stockless anchor or at least two times that of a previously approved HHP anchor, of the same mass. The tests are also to verify that the anchor withstands the test without permanent deformation.

e.1. Anchor Holding Power Tests

i. The full scale tests required by e) are to be carried out at sea on three types of bottom; normally, soft mud or silt, sand or gravel and hard clay or similar compounded material.

i.1. The tests are to be applied to anchors of mass which are as far as possible representative of the full range of sizes proposed.

i.2. For a definite group within the range, the two anchors selected for testing (ordinary stockless and SHHP anchors) should be approximately the same mass and should be tested in association with the size of chain required for the anchor mass and anchor type.

i.3. Where an ordinary stockless anchor is not available, a previously approved HHP anchor may be used in its place.

i.4. The length of the cable with each anchor should be such that the pull on the shank remains practically horizontal. For this purpose a scope of 10 is considered normal.

i.5. Three tests shall be taken for each anchor and each type of bottom. The pull shall be measured by dynamometer. The stability of the anchor and ease of breaking out should be noted where possible.

i.6. Tests are to be carried out from a tug but alternatively shore based tests may be accepted.

i.7. Measurements of pull, based on the RPM/bollard pull curve of the tug may be accepted as an alternative to dynanometer.

i.8. Tests in comparison with a previously approved SHHP anchor may be also accepted as a basis for approval.

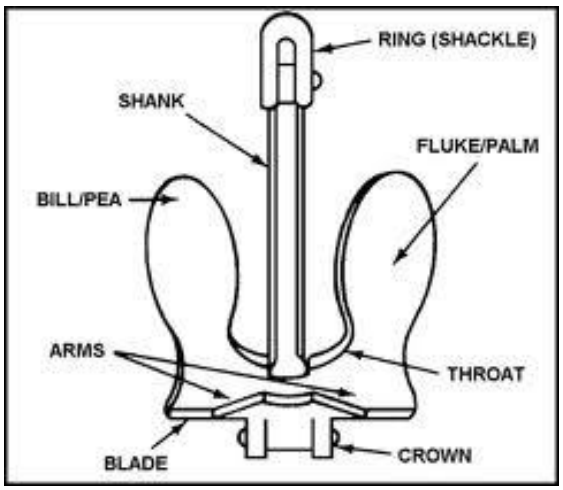
i.9. If approval is sought for a range of anchor sizes, then at least three anchor sizes are to be tested, indicative of the bottom, middle and top of the mass range.

ii. The holding power test load is not to exceed the proof load of the anchor.

Guidance

Figure F.B2.203.1 shows the anchor component nomenclature in English

FIGURE F.B.203.1 – NOMENCLATURE OF ANCHOR COMPONENTS



End of guidance

300. Materials for anchors [IACS UR W29 2.1]

201. All anchors are to be manufactured from materials meeting the requirements as indicted below:

a. Cast steel anchor flukes, shanks, swivels and shackles are to be manufactured and tested in accordance with the requirements of Part III, Title 61, Section 2, Chapter C and comply with the requirements for castings for welded construction. The steel is to be fine grain treated with Aluminium. If test programme B is selected in B2.700 below then Charpy V notch (CVN) impact testing of cast material is required. Special consideration is to be given to the use of other grades of steels for the manufacture of swivels.

b. Forged steel anchor pins, shanks, swivels and shackles are to be manufactured and tested in accordance with the requirements of Part III, Title 61, Section 2, Chapter D. Shanks, swivels and shackles are to comply with the requirements for carbon and carbon-manganese steels for welded construction. Special consideration is to be given to the use of other grades of steels for the manufacture of swivels.

c. Rolled billets, plate and bar for fabricated steel anchors are to be manufactured and tested in accordance with the requirements of Part III, Title 61, Section 2, Chapter B.

d. Rolled bar intended for pins, swivels and shackles are to be manufactured and tested in accordance with the requirements of Part III, Title 61, Section 2, Chapter D or Part III, Title 61, Section 2, Chapter B).

400. Materials for SHHP anchors

401. In addition to the requirements of B2.300 above, SHHP anchors are to be produced in accordance with the material toughness requirements of as below: [**UR W29 2.2]**

402. All SHHP anchors are to be manufactured from materials meeting the requirements of the IACS URs as follows:[**A1.4.4]**

a. **Welded Steel Anchors**

a.1. Part III, Title 61, Section 2, Chapter B;

a.2. Part III, Title 61, Section 2, Chapter E. A pproval of consumables for welding normal and higher strength hull structural steel

b. **Cast Steel Anchors**:

b.1. Part III, Title 61, Section 2, Chapter C (IACS UR W8 Hull and machinery steel castings);

c. Anchor Shackles

c.1. Part III, Title 61, Section 2, Chapter D;

c.2. Part III, Title 61, Section 2, Chapter C.

403. The base steel grades in welded SHHP anchors are to be selected with respect to the Material Grade requirements for Class II in Part II, Title 11, Section 2, Chapter C, Subchapter C2. The welding consumables are to meet the toughness for the base steel grades in accordance with Part III, Title 61, Section 2, Chapter E. The toughness of the anchor shackles for SHHP anchors is to meet that for Grade 3 anchor chain in accordance with Part III, Title 61, Section 3, B.4. The toughness of steel castings for SHHP anchors is

to be not less than a Charpy V-notch energy average of 27 J at 0 degree

404. **Fabricated Anchors**: fabricated anchors are to be manufactured in accordance with approved welding procedures using approved welding consumables and carried out by qualified welders.

500. Requirements for manufacture of anchors [IACS UR W29]

501. The requirements of the present B2.500 apply to the materials, manufacture and testing, and certification of anchors, shanks and anchor shackles produced from cast or forged steel, or fabricated by welded rolled steel plate and bars. Frequent reference is made to Part II, Title 11, Section 3, Chapter D. With regard to holding power tests at sea for high holding power (HHP) and super high holding power (SHHP) anchors, refer to Part II, Title 11, Section 3, Chapter D.

502. The types of anchor covered include:

a. Ordinary anchors. Refer to Part III, Title 61, Section 3, B.3

a.1. Stockless anchors

a.2. Stocked anchors

b. HHP anchors. Refer to Part III, Title 61, Section 3, B.3 .

c. SHHP anchors, not exceeding 1500kg in mass. Refer to Part III, Title 61, Section 3, B.3

d. Any changes to the design made during manufacture are to have prior written agreement from the Classification RBNA.

503. **Tolerance**

a. If not otherwise specified on standards or on drawings demonstrated to be appropriate, the following assembly and fitting tolerance are to be applied.

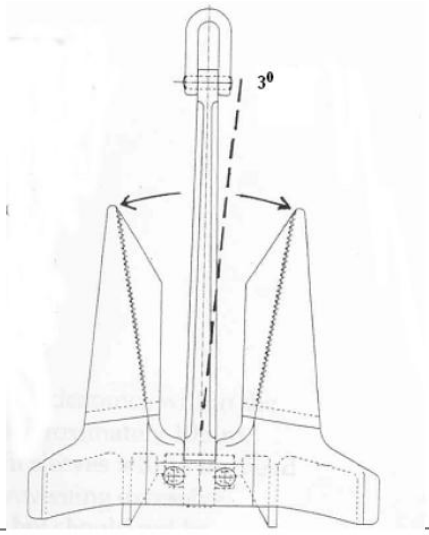
b. The clearance either side of the shank within the shackle jaws is to be no more than 3mm for small anchors up to 3 tonnes weight, 4mm for anchors up to 5 tonnes weight, 6mm for anchors up to 7 tonnes weight and is not to exceed 12 mm for larger anchors.

c. The shackle pin is to be a push fit in the eyes of the shackle, which are to be chamfered on the outside to ensure a good tightness when the pin is clenched over on fitting. The shackle pin to hole tolerance is to be no more than 0.5mm for pins up to 57mm and 1.0mm for pins of larger diameter.

d. The trunnion pin is to be a snug fit within the chamber and be long enough to prevent horizontal movement. The gap is to be no more than 1% of the chamber length.

e. The lateral movement of the shank is not to exceed 3 degrees, see Figure F.B2.403.1.

FIGURE F.B2.403.1



504. **Welding of anchors**: Welded construction of fabricated anchors is to be done in accordance with procedure approved by the RBNA. Welding is to be carried out by qualified welders, following the approved welding procedures qualified in accordance with Part III, Title 61, Section 2, Chapter F, using consumables manufactured in accordance with the requirements of Part III, Title 61, Section 2, Chapter E. NDE is to be carried in accordance with the requirements of B2.700 Product tests.

505. Heat treatment: components for cast or forged anchors are to properly heat treated; fully annealed; normalised or normalised and tempered in accordance with Part III, Title 61, Section 2, Chapter D and Chapter C ((IACS UR W7) and Part III, Title 61, Section 2, Chapter C (IACS UR W8). Fabricated anchors may require stress relief after welding depending upon weld thickness. Stress relief is to be carried out as indicated in the approved welding procedure. Stress relief temperatures are not to exceed the tempering temperature of the base material.

506. **Freedom from defects**: All parts are to have a clean surface consistent with the method of manufacture and be free from cracks, notches, inclusions and other defects that would impair the performance of the product.

507. **Repairs**: Any necessary repairs to forged and cast anchors are to be agreed by the Surveyor and carried out in accordance with the repair criteria indicated in Part III, Title 61, Section 2, Chapter D and Chapter C and Part III, Title 61, Section 2, Chapter C. Repairs to fabricated anchors are to be agreed by the Surveyor and carried out in accordance

with qualified weld procedures, by qualified welders, following the parameters of the welding procedures used in construction.

508. **Anchor assembly** :Assembly and fitting are to be done in accordance with the design details. Securing of the anchor pin, shackle pin or swivel nut by welding is to be done in accordance with an approved procedure.

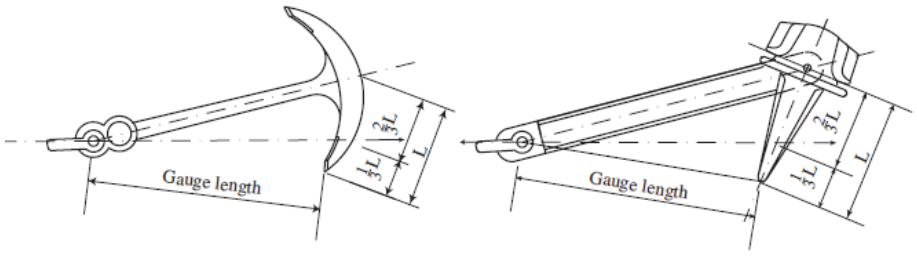
600. Proof testing of anchors [A1.4.3]

601. **Testing of ordinary anchors**

a. The proof load as per Table T.B2.601.1 is to be applied on the arm or on the palm at a spot which, measured from the extremity of the bill, is one-third of the distance between it and the centre of the crown. In the case of stockless anchors, both arms are to be tested at the same time, first on one side In case of the stockless anchors, both arms are to be tested at the same time, first on one side of the shank, then reversed and tested on the other.

b. Anchors of all sizes should be proof tested with the test loads stipulated in the Table T.B2.601.1.

FIGURE F.B2.601.1



Stocked Anchor Stockless Anchor

c. Before application of proof test load the anchors are to be examined to be sure that castings are reasonably free of surface imperfections of harmful nature. After proof load testing the anchors are to be examined for cracks and other defects. On completion of the proof load tests the anchors made in more than one piece are to be examined for free rotation of their heads over the complete angle. In every test the difference between the gauge lengths (as shown in figures) where one-tenth of the required load was applied first and where the load has been reduced to one-tenth of the required load from the full load may be permitted not to exceed one percent (1%).

602. **Testing of HHP anchors**

a. The HHP anchor is to be proof tested with load required by Table T.B2.601.1 for an anchor mass equal to 1.33 times the Actual mass of the HHP anchor. The proof loading procedure and examination procedure for HHP anchors are to comply with those for ordinary anchors, B2.601.c above

b. Anchors of all sizes should be proof tested with the test loads stipulated in the Table T.B2.601.1.

c. Before application of proof test load the anchors are to be examined to be sure that castings are reasonably free of surface imperfections of harmful nature.

d. After proof load testing the anchors are to be examined for cracks and other defects. On completion of the proof load tests the anchors made in more than one piece are to be examined for free rotation of their heads over the complete angle.

e. In every test the difference between the gauge lengths (as shown in figures) where one-tenth of the required load was applied first and where the load has been reduced to one-tenth of the required load from the full load may be permitted not to exceed one percent (1%).

603. **Testing of SHHP anchors:**

a. **Anchor proof test:** The SHHP anchor is to be proof tested with the load required by Table T.B2.601.1 for an anchor mass equal to 2 times the actual mass of the SHHP anchor. The proof loading procedure and examination procedure for SHHP anchors are to comply with those for ordinary anchors, Part III, title 61, Section 3, Chapter B2, item 601.d)

b. **Anchor inspection and additional tests**: After the proof load test, all SHHP anchors are to be surface inspected by the dye penetrant method or by the magnetic particle method. All surfaces of cast steel anchors are to be surface inspected. The surface inspections are to follow IACS UR 69 Guidelines for NDE of Hull and Machinery Steel Castings. All cast

steel anchors are to be examined by ultrasound testing (UT) in way of areas where feeder heads and risers have been removed and where weld repairs have been carried out. The ultrasound testing (UT) inspections are to follow IACS UR 69 Guidelines for NDE of Hull and Machinery Steel Castings. Welded steel anchors are to be inspected at the welds. At sections of high load or at suspect areas, the RBNA may impose volumetric nondestructive examination; e.g ultrasonic inspection, or radiographic inspection.

c. At the discretion of the RBNA Head Office, additional tests of the anchor may be required. These tests include the hammering test and the drop test, and are usually applied to cast steel anchors.

604. **Tests of approval and/or acceptance of type of high holding power anchors (HHP):** For approval and/or acceptance as a HHP anchor satisfactory tests are to be made on various types of bottom, and the anchor is to have a holding power at least twice than of an ordinary stockless anchor of the same weight. Full scale tests are to be carried out at sea on various types of bottom and to be applied to anchors the weights of which are, as far as possible, representative of the full range of sizes proposed; for a definite group of the range the two anchors selected for testing (ordinary stockless anchors and HHP anchors) should be of approximately the same weight, and should be tested in association with the size of chain cable appropriate to this weight.

a. The HHP anchor is to be proof tested with load required by Table T.B2.601.1 for an anchor mass equal to 1.33 times the actual mass of the HHP anchor. The proof loading procedure and examination procedure for HHP anchors are to comply with those for ordinary anchors, Part III, title 61, Section 3, Chapter B2, item 601.d)

b. The length of cable with each anchor should be such that the pull on the shank remains practically horizontal, for this purpose a scope of 10 is considered normal but a scope of not less than 6 may be accepted. Scope is defined as the ratio of length of cable to depth of water.

c. Three tests shall be taken for each anchor and nature of bed. The pull shall be measured by dynamometer. The stability of the anchor and ease of breaking out should be noted where possible. Tests are normally to be carried out from a tug but alternatively shore based tests may be accepted.

d. Measurements of pull based on RPM/bollard pull curve of tug may be accepted instead of dynamometer readings.

e. Tests in comparison with a previously approved HHP anchor may be accepted as a basis for approval.

f. For approval and/or acceptance of high holding power anchors of the whole range of weight, tests should be carried out on at least two - sizes of anchors and the weight of the maximum size to be approved could be accepted up to 10 times the weight of large size tested.

605. Tests of approval and/or acceptance of type for super high holding power anchors (SHHP)

a. The full scale tests required by Part II, Title 11, Section 3, Chapter D1, item 403.e) are to be carried out at sea on three types of bottom; normally, soft mud or silt, sand or gravel and hard clay or similar compounded material.

b. The tests are to be applied to anchors of mass which are as far as possible representative of the full range of sizes proposed.

c. For a definite group within the range, the two anchors selected for testing (ordinary stockless and SHHP anchors) should be approximately the same mass and should be tested in association with the size of chain required for the anchor mass and anchor type.

d. Where an ordinary stockless anchor is not available, a previously approved HHP anchor may be used in its place. The length of the cable with each anchor should be such that the pull on the shank remains practically horizontal. For this purpose a scope of 10 is considered normal.

e. hree tests shall be taken for each anchor and each type of bottom. The pull shall be measured by dynamometer. The stability of the anchor and ease of breaking out should be noted where possible. Tests are to be carried out from a tug but alternatively shore based tests may be accepted. Measurements of pull, based on the RPM/bollard pull curve of the tug may be accepted as an alternative to dynanometer.

f. Tests in comparison with a previously approved SHHP anchor may be also accepted as a basis for approval.

g. If approval is sought for a range of anchor sizes, then at least three anchor sizes are to be tested, indicative of the bottom, middle and top of the mass range.

h. The holding power test load is not to exceed the proof load of the anchor.

TABLE T.B2.601.1 - PROOF LOAD TESTS FOR ANCHORS – IACS UR A.1
Note: The proof load test for mass of anchor 30 < M < 45 are from RBNA 2008 Rules.

MASS OF ANCHOR Kg	PROOF TEST LOAD kN	MASS OF ANCHOR Kg	PROOF TEST LOAD kN	MASS OF ANCHOR Kg	PROOF TEST LOAD kKN	MASS OF ANCHOR Kg	PROOF TEST LOAD kN
30	15	1250	239	5400	691	16500	1330
35	17	1300	247	5500	699	17000	1360
40	19	1350	255	5600	706	17500	1390
45	21	1400	262	5700	713	18000	1410
50	23	1450	270	5800	721	18500	1440
55	25	1500	278	5900	728	19000	1470
60	27	1600	292	6000	735	19500	1490
65	29	1700	307	6100	740	20000	1520
70	31	1800	321	6200	747	21000	1570
75	32	1900	335	6300	754	22000	1620
80	34	2000	349	6400	760	23000	1670
90	36	2100	362	6500	767	24000	1720
100	39	2200	376	6600	773	25000	1770
120	44	2300	388	6700	779	26000	1800
140	49	2400	401	6800	786	27000	1850
160	53	2500	414	6900	794	28000	1900
180	57	2600	427	7000	804	29000	1940
200	61	2700	438	7200	818	30000	1990
225	67	2800	450	7400	832	31000	2030
250	70	2900	462	7600	845	32000	2070
275	75	3000	474	7800	861	34000	2160
300	80	3100	485	8000	877	36000	2250
325	84	3200	495	8200	892	38000	2330
350	89	3300	506	8400	908	40000	2410
375	93	3400	517	8600	922	42000	2490
400	98	3500	528	8800	936	44000	2570
425	103	3600	537	9000	949	46000	2650
450	107	3700	547	9200	961	48000	2730
475	112	3800	557	9400	975		
500	116	3900	567	9600	987		
550	125	4000	577	9800	998		
600	133	4100	586	10000	1010		
650	140	4200	595	10500	1040		
700	149	4300	604	11000	1070		
750	158	4400	613	11500	1090		
800	166	4500	622	12000	1110		
850	175	4600	631	12500	1130		
900	182	4700	638	13000	1160		
950	191	4800	645	13500	1180		
1000	199	4900	653	14000	1210		
1050	208	5000	661	14500	1230		
1100	216	5100	669	15000	1260		
1150	224	5200	677	15500	1270		
1200	231	5300	685	16000	1300		

700. Testing and certification [UR W29 4]

701. **Proof load tests** are to be carried out by an approved testing facility. Proof load testing for Ordinary, HHP and SHHP anchors is to be carried out in accordance with the pertinent requirements of B2.600 above .

702. **Product tests**: the RBNA can request that either programme A or programme B be applied.

TABLE T.B2.702.1 APPLICABLE PROGRAMMES FOR EACH PRODUCT FORM

Product Tets	Product form		
	Cast Components	Forged Components	Fabricated / Welded Components
Programme A	Applicable	Not applicable	Not applicable
Programme B	Applicable (1)	Applicable	Applicable

Notes : (1) CVN (Charpy V-notch) impact tests are to be carried out to demonstrate at least 27 joules average at 0ºC.

703. Product test requirements for programme A and B:

a. **Drop test**: Each anchor fluke and shank is individually raised to a height of 4m and dropped on to a steel slab without fracturing. The steel slab is to be suitable to resist the impact of the dropped component.

b. **Hammering test**: After the drop test, hammering tests are carried out on each anchor fluke and shank, which is slung clear of the ground, using a non-metallic sling, and hammered to check the soundness of the component. A hammer of at least 3kg mass is to be used.

c. **Visual inspection**: After proof loading visual inspection of all accessible surfaces is to be carried out.

TABLE T.B2.702.2 PROGRAMME A PROGRAMME B

Progamme A	Programme B
Drop test	-
Hammering test	-
Visual inspection	Visual inspection
General NDE	General NDE
-	Extended NDE

704. **General non-destructive examination**: After proof loading general NDE is to be carried out as indicated in the following Tables T.B2.704.1 and T.B2 7043.2.

TABLE T.B2.704.1 GENERAL NDE FOR ORDINARY AND HHP ANCHORS

Location	Method of NDE
Feeders of castings	PT or MT
Risers of castings	PT or MT
Weld repairs	PT or MT
Forged components	Not required
Fabrication welds	PT or MT

TABLE T.B2.704.2 GENERAL NDE FOR SHHP ANCHORS

Location	Method of NDE
Feeders of castings	PT or MT and UT
Risers of castings	PT or MT and UT
Weld repairs	PT or MT
Forged components	Not rquired
Fabrication welds	PT or MT

PT = particle testing

MT = magnetic testing

UT = ultrasound testing

705. Part II Title 61 Section 2 Chapter C (IACS Recommendation No. 69 “Guidelines for non-destructive examination of marine steel castings”) is regarded as an example of an acceptable standard for surface and volumetric examination.

706. **Extended non-destructive examination**: After proof loading general NDE is to be carried out as indicated in the following Table T.B2.705.1.

TABLE T.B2.706.1 EXTENDED NDE FOR ORDINARY, HHP AND SHHP ANCHORS

Location	Method of NDE
Feeders of castings	PT or MT and UT
Risers of castings	PT or MT and UT
All surfaces of castings	PT or MT
Random areas of castings	UT
Weld repairs	PT or MT
Forged components	Not required
Fabrication welds	PT or MT

707. **Repair criteria:** If defects are detected by NDE, repairs are to be carried out in accordance with B2.507. For fracture and unsoundness detected in a drop test or hammering test, repairs are not permitted and the component is to be rejected.

708. **Mass and dimensional inspection**: Unless otherwise agreed, the verification of mass and dimensions is the

responsibility of the manufacturer. The Surveyor is only required to monitor this inspection. The mass of the anchor is to exclude the mass of the swivel, unless this is an integral component.

709. **Retests**: Mechanical retest are permitted in accordance with the requirements of Part II, Title 61, Section 2, Chapter A.

710. **Marking:** Anchors which meet the requirements are to be stamped on the shank and the fluke. The markings on the shank are to be approximately level with the fluke tips. On the fluke, these markings are to be approximately at a distance of two thirds from the tip of the bill to the center line of the crown on the right hand fluke looking from the crown towards the shank. The markings are to include:

a. Mass of anchor

b. Identification, e.g. test No. or certificate No.

c. RBNA's stamp

d. Manufacturer's mark

e. Additionally the unique cast identification is to be cast on the shank and the fluke.

711. **Certification:** Anchors which meet the requirements are to be certified by the RBNA at least with the following items:

a. Manufacturer's name

b. Type

c. Mass

d. Fluke and Shank identification numbers

e. Grade of materials

f. Proof test loads

g. Heat treatment

h. Marking applied to anchor

712. P**ainting**: All types of anchor are not to be painted until all tests and inspections have been completed.

B3. ANCHOR CHAINS [IACS UR A1.5]

100. Chain cables

101. **Grades of chain cables**: bower anchors are to be associated with stud link chain cables for one of the grades listed in Table T.B3.101.1

TABLE T.B3.101.1 GRADES OF CHAIN CABLES

Grade	Material	Range of UTS (N/mm^2)
RB- 1	Mild steel	300 to 490 (31 ÷ 50 kg/mm^2
RB- 2	Special quality steel	490 to 690 (50 ÷ 70 kg/mm^2)
RB- 3	Extra special quality steel	> 690 (>70 kg/mm^2)

Note: the designation "Grade 1" may be replaced, at discretion of RBNA, by "Grade 1a" where UTS is greater than 300 but not exceeding 400 N/mm2 or by "Grade 1b" where UTS is greater than 400 but not exceeding 490 N/mm2

102. **Proof and breaking loads of stud link chain cables**

a. The design and/or standard breaking loads BL and proof load PL (expressed in kN) of stud link chain cables are given in Table T.B3.102.1 being d the chain diameter (mm).

TABLE T.B3.102.1 PROOF AND BREAKING LOAD OF STUD LINK CHAIN CABLES

Grade	Breaking load	Proof load
RB-1	BL1 = 9,80665 x 10-3 [d2 (44 - 0,08 d)	PL1 = 0,7 L1
RB-2	BL2 = 1,4 BL1	PL2 = BL1
RB-3	BL3 = 2 BL1	PL3 = 1,4 L1

b. The test load values, rounded off from the loads in Table T.B3.102.1 above to be used for testing and acceptance of chain cables, are given in Table T.B3.102.2.

TABELA T.B3.102.2. TEST LOAD VALUES FOR STUD LINK CHAINS

* Values as per IACS Rec10 Table 4

Chain diameter mm	Grade 1		Grade 2		Grade 3	
	Proof load kN	Breaking load kN	Proof load kN	Breaking load kN	Proof load kN	Breaking load kN
11	36*	51*	51*	72*	72*	102*
12,5	46*	66*	66*	92*	92*	132*
14	56*	82*	82*	116*	116*	165*
16	76*	107*	107*	150*	150*	216*
17,5	89*	127*	127*	179*	179*	256*
19	105*	150*	150*	211*	211*	301*
20,5	123	175	175	244	244	349
22	140	200	200	280	280	401
24	167	237	237	332	332	476
26	194	278	278	389	389	556
28	225	321	321	449	449	642
30	257	368	368	514	514	735
32	291	417	417	583	583	833
36	328	468	468	655	655	937
34	366	523	523	732	732	1050
38	406	581	581	812	812	1160
40	448	640	640	896	896	1280
42	492	703	703	981	981	1400
44	583	769	769	1080	1080	1540
46	585	837	837	1170	1170	1680
48	635	908	908	1270	1270	1810
50	686	981	981	1370	1370	1960
52	739	1060	1060	1480	1480	2110
54	794	1140	1140	1590	1590	2270
56	851	1220	1220	1710	1710	2430
58	909	1290	1290	1810	1810	2600
60	969	1380	1380	1940	1940	2770
62	1030	1470	1470	2060	2060	2940
64	1100	1560	1560	2190	2190	3130
66	1160	1660	1660	2310	2310	3300
68	1230	1750	1750	2450	2450	3500
70	1290	1840	1840	2580	2580	3690
73	1390	1990	1990	2790	2790	3990
76	1500	2150	2150	3010	3010	4300
78	1580	2260	2260	3160	3160	4500
81	1690	2410	2410	3380	3380	4820
84	1800	2580	2580	3610	3610	5160
87	1920	2750	2750	3850	3850	5500
90	2050	2920	2920	4090	4090	5840
92	2130	3040	3040	4260	4260	6080
95	2260	3230	3230	4510	4510	6440
97	2340	3340	3340	4680	4680	6690
100	2470	3530	3530	4940	4940	7060
102	2560	3660	3660	5120	5120	7320
105	2700	3850	3850	5390	5390	7700

Chain diameter mm	Grade 1		Grade 2		Grade 3	
	Proof load kN	Breaking load kN	Proof load kN	Breaking load kN	Proof load kN	Breaking load kN
107	2790	3980	3980	5570	5570	7960
111	2970	4250	4250	5940	5940	8480
114	3110	4440	4440	6230	6230	8890
117	3260	4650	4650	6510	6510	9300
120	2400	4850	4850	6810	6810	9720
122	3500	5000	5000	7000	7000	9990
124	3600	5140	5140	7200	7200	10280
127	3750	5350	5350	7490	7490	10710
130	3900	5570	5570	7800	7800	11140
132	4000	5720	5720	8000	8000	11420
137	4260	6080	6080	8510	8510	12160
142	4520	6450	6450	9030	9030	12910
147	4790	6840	6840	9560	9560	13660
152	5050	7220	7220	10100	10100	14430
157	5320	7600	7600	10640	10640	15200
162	5590	7990	7990	11170	11170	15970

B4. ANCHOR CHAIN CABLES AND ACCESSORIES FOR EMERGENCY TOWING ARRANGEMENTS IACS UR-W-18

100. Application [W18.1]

101. The present subchapter B4 applies to the materials, design, manufacture and testing of stud link anchor chain cables and accessories used for ships under class notation "E", or when a special survey for the classification of such equipment is requested. Where, in exceptional cases, studless short link chain cables are used with the consent of the individual RBNA, they must comply with recognized national or international standards. The requirements for chafing chain for Emergency Towing Arrangements (ETA) are given in the Subchapter B5 below.

102. **Chain cable grades:** depending on the nominal tensile strength of the chain cable steel used for manufacture, stud link chain cables are to be subdivided into Grades RBNA 1, 2 and 3.

103. Approval of chain manufacturers

a. Anchor chain cables and accessories are to be manufactured only by works approved by the RBNA. For this purpose approval tests are to be carried out, the scope of which is to be agreed with the RBNA.

b. Applications for approval are to be made to the RBNA, stating the method of manufacture used, the grades of materials, the nominal dimensions and - where applicable - the material specification. A procedure test carried out on a high-strength chain cable may cover approval of lesser grades, provided that the material type, method of manufacture and the nature of the heat treatment are the same.

200. Materials

201. **Scope:** The present item B4.200 applies to rolled steels, forgings and castings used for the manufacture of anchor chain cables and accessories.

202 Requirements for material manufacturers

a. All materials used for the manufacture of anchor chain cables and accessories are to be supplied by manufacturers approved by the RBNA. RBNA approval is not required for Grade 1 steel bars.

b. Materials suppliers or chain cable manufacturers are to submit specifications for Grade 3 steel bars. These specifications should contain all necessary details, such as manufacturing procedure, deoxydation practice, specified chemical composition, heat treatment, and mechanical properties.

300 Rolled steel bars [W18.2]

301. Supply condition: Unless otherwise stipulated, the steel bars will be supplied in as rolled condition.

302. Chemical composition: The chemical composition of the steel bars is to be generally within the limits given in Table T.B4.302.1

TABLE T.B4.302.1 CHEMICALCOMPOSITION OF ROLLED STEEL BARS

Grade	Chemical composition in maximujm percent, unless specified					
	C	Si	Mn	P	S	Al total (1) minimum
1	0,20	0,15-0,35	Min 0,40	0,040	0,040	NR
2 (2)	0,24	0,15-0,55	1,60	0,035	0,035	0,020
3 (3)	In accordance with an approved specification					
Note 1 – Alumninum may be replaced partly by other grain fefining elements Note 2 – If RBNA agrees, additional alloying elements may be added Note 3 – To be killed and fine grain NR = Not required						

303. **Mechanical tests**

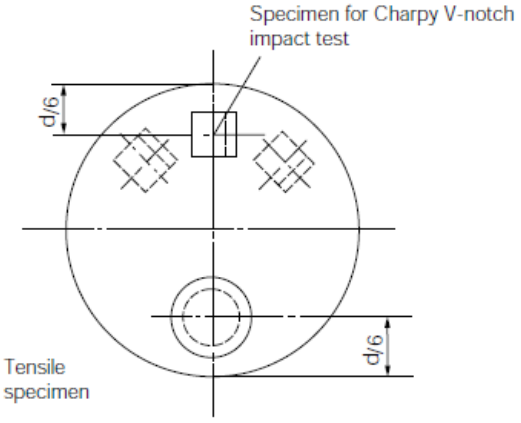
a. Mechanical tests representing the steel bars are normally to be carried out by the steel mill, and the results are to meet the requirements in Table T.B4.303.1. The test coupons are to be in a heat treatment condition equivalent to that of the finished chain cable and accessories.

b. Tensile and Charpy V-notch impact test specimens shall be taken from the test sample in the longitudinal direction at a distance of 1/6 diameter from the surface or as close as possible to this position, as shown in Figure F.B4.303.1.

TABLE T.B4.303.1 MECHANICAL PROPERTIES OF ROLLED STEEL BARS

Grade	R_{eH} N/mm^2 min	R_m N/mm^2	A_5 % min	Z % min	Charpy V-notch test	
					Test temperature in C	Absorbed energy in Joules, min
1	NR	370-490	25	NR	NR	NR
2	295	490-690	22	NR	0 (2)	27 (1)
3	410	Min. 690	17	40	0 -20	60 35
Note 1 – The impact of grade 2 materials may be waived, if the chain cable is to be supplied in a heat treated condition as per TABLE T.B4.803.1 Note 2 – Testing is normally to be carried out at 0°C NR = not required						

FIGURE F.B4.303.1 - SAMPLING LOCATIONS



c. For the tensile test, one specimen shall be taken from each test unit and tested, all in accordance with Part III Title 61 Section 2 Chapter.

d. One set of longitudinal Charpy V-notch test specimens shall be taken from each test unit and tested at the temperature prescribed in Table T.B4.303.1, all in accordance with Part III Title 61 Section 2 Chapter A. The specimen transverse axis is to be radial to the steel bar. The average value obtained from one set of three impacts specimens is to comply with the requirements given in Table Table T.B4.303.1. One individual value only may be below the specified average value provided it is not less than 70% of that value.

e. Re-test requirements for tensile tests are to be in accordance with Part III Title 61 Section 2 Chapter A with specimens taken from the same sample. Failure to meet the specified requirements of either of both additional tests will result in rejection of the test unit represented unless it can be clearly attributable to improper simulated heat treatment; see item B4.303.h below.

f. Re-test requirements for Charpy impact tests are to be in accordance with Part III Title 61 Section 2 Chapter A (UR W2). Specimens are to be selected from the same sample. Failure to meet the requirements will result in rejection of the test unit represented unless it can be clearly attributable to improper simulated heat treatment;

g. If failure to pass the tensile test or the Charpy V-notch impact test is definitely attributable to improper heat treatment of the test sample, a new test sample may be taken from the same piece and reheat treated. The complete test (both tensile and impact test) is to be repeated; and the original results obtained may be disregarded.

304. **Dimensional tolerances:** The diameter and roundness shall be within the tolerances specified in Table T.B3.304.1 unless otherwise agreed.

Table T.B4.304.1 Dimensional tolerance of rolled steel bars

Nominal diameter mm	Tolerance on diameter mm	Tolerance on Roundness (dmax - dmin) mm
less than 25	-0 + 1.0	0,6
25 – 35	-0 + 1.2	0.8
36-50	-0 + 1.6	1.1
51-80	-0 + 2.0	1.5
81-100	-0 + 2.6	1.95
101-120	-0 + 3.0	2.25
121-160	-0 + 4.0	3,0

305. **Freedom from defects:** The materials have to be free from internal and surface defects that might impair proper workability and use. Surface defects may be repaired by grinding, provided the admissible tolerance is not exceeded.

306. **Identification of material:** Manufacturers are to effectively operate an identification system ensuring traceability of the material to the original cast.

307. **Marking:** The minimum markings required for the steel bars are the manufacturers' brand mark, the steel grade and an abbreviated symbol of the heat. Steel bars having diameters of up to and including 40 mm and combined into bundles, may be marked on permanently affixed labels.

308. **Material certification:** Bar material for RBNA Grade 2 or Grade 3 is to be certified by the RBNA. For each consignment manufacturers shall forward to the RBNA a certificate containing at least the following data:

a. manufacturer's name and/or purchaser's order No.

b. number and dimensions of bars and weight of consignment

c. steel specification and chain grade

d. heat number

e. manufacturing procedure

f. chemical composition

g. details of heat treatment of the test sample (where applicable)

h. results of mechanical tests (where applicable)

i. number of test specimens (where applicable)

400. Forged steels for chain cables and accessories [UR W18 2.4]

401. **General requirements**

a. Forged steels used for the manufacture of chain cables and accessories are to be in compliance with Part III Title 61 Section 2 Chapter D UR W7, Hull and machinery steel forgings, unless otherwise specified in the following paragraphs.

b. The chemical composition is to comply with the specification approved by the RBNA. The steel manufacturer must determine and certify the chemical composition of every heat of material.

402. **Heat treatment:** The stock material may be supplied in the as rolled condition. Finished forgings are to be properly heat
treated, i.e. normalized, normalized and tempered or quenched and tempered, whichever is specified for the relevant steel grade in Table T.B4.403.1

TABLE T.B4.403.1 CONDITION OF SUPPLY OF CHAIN CABLES AND ACCESSORIES

Grade	Chain Cables	Accessories
1	As welded or normalized	NA
2	As welded or normalized (1)	Normalized
3	Normalized Normalized and tempered or Quenched and tempered	Normalized Normalized and tempered or Quenched and tempered
Note 1 – Grade 2 chain cables made by forging or casting are to be supplied in the normalized condition. NA = Not Applicable		

500. Cast steels for chain cables and accessories

501. **General requirements:** Cast steels used for the manufacture of chain cables and accessories are to be in compliance with Part III Title 61 Section 2 Chapter C unless otherwise specified in the following paragraphs B4.502 and B4.503.

502. **Chemical composition:** The chemical composition is to comply with the specification approved by the RBNA. The foundry is to determine and certify the chemical composition of every heat.

503. **Heat treatment:** All castings must be properly heat treated, i.e., normalized, normalized and tempered or quenched and tempered, whichever is specified for the relevant cast steel grade in Table T.B4.403.1

600. Materials for studs

601. The studs are to be made of steel corresponding to that of the chain cable or from rolled, cast or forged mild steels. The use of other materials, e.g. grey or nodular cast iron is not permitted.

700. Design and manufacture of chain cables and accessories
[W18.3]

701. **Design:** Chain cables must be designed according to a standard recognized by the RBNA, such as ISO 1704. A length of chain cable must comprise an odd number of links. Where designs do not comply with this and where accessories are of welded construction, drawings giving full details of the design, the manufacturing process and the heat treatment are to be submitted to the RBNA for approval.

702. **Dimensions and dimensional tolerances:**

a. The shape and proportions of links and accessories must conform to a recognized standard, such as ISO 1704 or the designs specially approved.

b. The following tolerances are applicable to links:

c.1. Diameter measured at the crown (Two measurements are to be taken at the same location: one in the plane of the link{see dp in Figure F.B4.702.1}, and one perpendicular to the plane of the link):

i. up to 40mm nominal diameter : – 1mm

ii. over 40 up to 84mm nominal diameter: – 2mm

iii. over 84 up to 122mm nominal diameter : – 3mm

iv. over 122mm nominal diameter : – 4mm

v. The plus tolerance may be up to 5% of the nominal diameter. The cross sectional area of the crown must have no negative tolerance.

c.2. Diameter measured at locations other than the crown:

i. The diameter is to have no negative tolerance. The plus tolerance may be up to 5% of the nominal diameter. The approved manufacturer's specification is applicable to the plus tolerance of the diameter at the flush-butt weld.

c.3. The maximum allowable tolerance on assembly measured over a length of 5 links may equal +2.5%, but may not be negative (measured with the chain under tension after proof load test).

c.4. All other dimensions are subject to a manufacturing tolerance of ±2.5%, provided always that all of the final link parts of the chain cable fit together properly.

c.5. Studs must be located in the links centrally and at right angles to the sides of the link, although the studs at each end of any length may also be located off-centre to facilitate the insertion of the joining shackle. The following tolerances are regarded as being inherent in the method of manufacture and will not be objected to provided that the stud fits snugly and its ends lie practically flush against the inside of the link.

i. Maximum off-centre distance "X" : 10% of the nominal diameter d

ii. Maximum deviation "\" from the 90° - position : 4°

iii. The tolerances are to be measured in accordance with Figure F.B4.702.1

FIGURE F.B4.702.1 - MANUFACTORING TOLERANCES

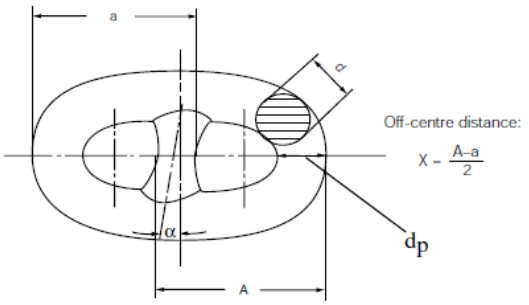


Figure 2 Manufacturing tolerances

c. The following tolerances are applicable to accessories:

c.1. nominal diameter : + 5%, -0%

c.2. other dimentions : + 2.5%

703. **Manufacturing process**

a. Stud link chain cables should preferably be manufactured by flash butt welding using Grade 1, 2 or 3 bar material. Manufacture of the links by drop forging or castings is permitted. On request, pressure butt welding may also be approved for studless, Grade 1 and 2 chain cables, provided that the nominal diameter of the chain cable does not exceed 26mm.

b. Accessories such as shackles, swivels and swivel shackles are to be forged or cast in steel of at least Grade 2. The welded construction of these parts may also be approved.

704. **Welding of studs :**The welding of studs is to be in accordance with an approved procedure subject to the following conditions:

a. The studs must be of weldable steel; cf. B4.600.

b. The studs are to be welded at one end only, i.e., opposite to the weldment of the link. The stud ends must fit the inside of the link without appreciable gap.

c. The welds, preferably in the horizontal position, shall be executed by qualified welders using suitable welding consumables.

d. All welds must be carried out before the final heat treatment of the chain cable.

e. The welds must be free from defects liable to impair the proper use of the chain. Under-cuts, end craters and similar defects shall, where necessary, be ground off.

Note: The RBNA reserves the right to call for a procedure test for the welding of chain studs.

705. **Heat treatment**

a. According to the grade of steel, chain cables and accessories are to be supplied in one of the conditions specified in Table T.B4.403.1. The heat treatment shall in every case be performed before the proof load test, the breaking load test, and all mechanical testing.

b. The mechanical properties of finished chain cables and accessories are to be in accordance with Table T.B4.705.1.

TABLE T.B4.705.1 MECHANICAL PROPERTIES OF FINISHED CHAIN CABLES AND ACCESSORIES

Grade	R_{eH} N/mm² min	R_m N/mm²	A_5 % min	Z % min	Charpy V-notch test		
					Test temperature in C	Absorbed energy in Joules, min	
						Base metal	Weldment
1	NR	NR	NR	NR	NR	NR	
2	295	490-690	22	NR	0	27	
3	410	Min. 690	17	40	0 (1) -20	500 27	
Note 1 – The impact of grade 2 materials may be waived, if the chain cable is to be supplied in a heat treated condition as per Table T.B4.803.1 Note 2 – Testing is normally to be carried out at 0°C NR = not required							

706. **Marking**

a. Chain cables which meet the requirements are to be stamped at both ends of each length at least with the following marks; cf. Figure F.B4.706.1.

a.1. Chain cable grade

a.2. - Certificate number

a.3. - RBNA's stamp

FIGURE F.B4.706.1 MARKING OF CHAIN CABLES

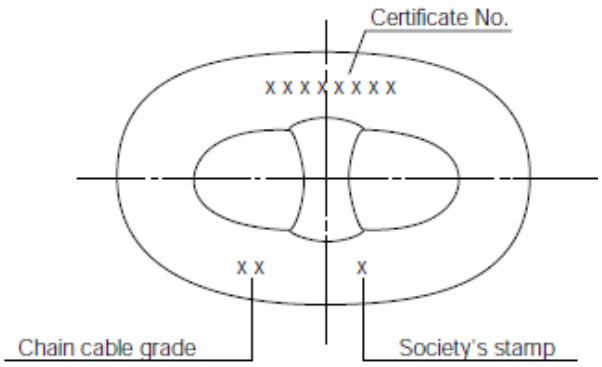


Figure 3 Marking of chain cables

708. **Freedom from defects**

a. All individual parts must have a clean surface consistent with the method of manufacture and be free from cracks, notches, inclusions and other defects imparing the performance of the product. The flashes produced by upsetting or drop forging must be properly removed.

b. Minor surface defects may be ground off so as to leave a gentle transition to the surrounding surface. Remote from the crown local grinding up to 5% of the nominal link diameter may be permitted.

800. Testing and certification of finished chain cables [W18.4]

801. **Proof and breaking load tests**

a. Finished chain cables are to be subjected to the proof load test and the breaking load test in the presence of the Surveyor, and shall not fracture or exhibit cracking. Special attention is to be given to the visual inspection of the flash-butt weld, if present. For this purpose, the chain cables must be free from paint and anti-corrosion media.

b. Each chain cable length (27.5 m) is to be subjected to a loading test at the proof load appropriate to the particular chain cable as given by Table T.B4 801.1 and using an approved testing machine.

TABLE T.B4.801.1 FORMULAE FOR PROOF LOAD AND BREAKING LOAD TESTS

Test	Grade 1	Grade 2	Grade 3
Proof load (kN)	$0.00686d^2(44-0.08d)$	$0.00981d^2(44-0.08d)$	$0.01373d^2(44-0.08d)$
Breaking load (kN)	$0.00981d^2(44-0.08d)$	$0.01373d^2(44-0.08d)$	$0.01961d^2(44-0.08d)$

***Note*: d = nominal diameter, in mm.**

c. For the breaking load test, one sample comprising at least of three links is to be taken from every four lengths or fraction of chain cables and tested at the breaking loads given by Table 5. The breaking load is to be maintained for a minimum of 30 seconds. The links concerned shall be made in a single manufacturing cycle together with the chain cable and must be welded and heat treated together with it. Only after this may they be separated from the chain cable in the presence of the Surveyor.

d. If the tensile loading capacity of the testing machine is insufficient to apply the breaking load for chain cables of large diameter, another equivalent testing method shall be agreed with the RBNA.

802. **Retests**

a. Should a breaking load test fail, a further test specimen may be taken from the same length of chain cable and tested. The test shall be considered successful if the requirements are then satisfied. If the retest fails, the length of chain cable concerned shall be rejected. If the manufacturer so wishes, the remaining three lengths belonging to the unit test quality may then be individually subjected to test at the breaking load. If one such test fails to meet the requirements, the entire unit test quantity is rejected.

b. Should a proof load test fail, the defective link(s) is (are) to be replaced, a local heat treatment to be carried out on the new link(s) and the proof load test is to be repeated. In addition, an investigation is to be made to identify the cause of the failure.

803. **Mechanical tests on grade 2 and 3 chain cable**

a. For Grade 2 and 3 chain cables, mechanical test specimens required in Table T.B4.803.1 are to be taken from every four lengths in accordance with B4.803.b. For forged or cast chain cables where the batch size is less than four lengths, the sampling frequency will be by heat and heat treatment charge. Mechanical tests are to be carried out in the presence of the Surveyor. For the location of the test specimens see B4.300 and Figure F.B4.303.1. Testing is to follow B3.303.d and B4.303.e. Retesting is to follow B4.303.f and B4.303.g.

b. An additional link (or where the links are small, several links) for mechanical test specimen removal is (are) to be provided in a length of chain cable not containing the specimen for the breaking test. The specimen link must be manufactured and heat treated together with the length of chain cable.

TABLE T.B4.803.1 NUMBER OF MECHANICAL TEST SPECIMENS FOR FINISHED CHAIN CABLES AND ACCESSORIES

Grade	Manufacturing Method	Condition of supply (1)	Number of test specimens		
			Tensile test for base metal	Charpy V-notch impact test	
				Base metal	Weldment
1	Flush-butt welded	AW N	NR	NR	NR
2	Flush-butt welded	AW	1 NR	3 (2)	NA
	Forged or cast	N	NR	NR	NR
3	Flush-butt welded	N NT QT	1	3	3
	Forged or cast	N NT QT	1	3	NA

Note 1 – AW = as welded,
N = normalized
NT = normalized and tempered
QT = quenched and tempered
Note 2 – For chain cables, Charpy V-notch impact test is not required

NR = Not Required
NA = Not Applicable

804. **Marking**

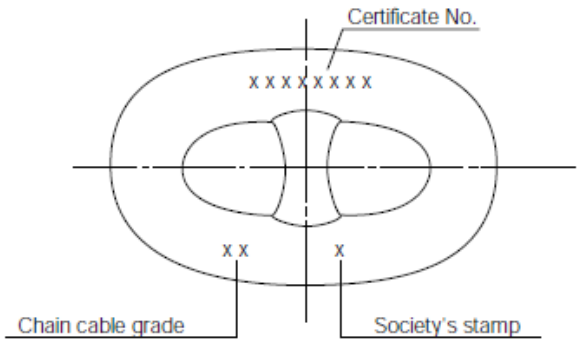
a. Chain cables which meet the requirements are to be stamped at both ends of each length at least with the following marks; cf. Figure F.B4.804.1.

a.1. Chain cable grade

a.2. Certificate number

a.3. RBNA's stamp

FIGURE F.B4.804.1 MARKING OF CHAIN CABLES



805. **Certification**

a. Chain cables which meet the requirements are to be certified by the RBNA at least with the following items:

a.1. - Manufacturer's name

a.2. – Grade

a.3. - Chemical composition (including total aluminum content)

a.4. - Nominal diameter/weight

a.5. - Proof/break loads

a.6. - Heat treatment

a.7. - Marks applied to chain

a.8. – Length

a.9. - Mechanical properties, where applicable

900. Testing and certification of accessories [W18.5]

901. **Proof load test**

a. All accessories are to be subjected to the proof load test at the proof load specified for the corresponding chain given by Table T.B4.801.1, and in accordance with the provisions of B4.801, as appropriate.

902. **Breaking load test**

a. From each manufacturing batch (same accessory type, grade, size and heat treatment charge, but not necessarily representative of each heat of steel or

individual purchase order) of 25 units or less of detachable links, shackles, swivels, swivel shackles, enlarged links, and end links, and from each manufacturing batch of 50 units or less of kenter shackles, one unit is to be subjected to the breaking load test at the break load specified for the corresponding chain given by Table T.B4.801.1 and in accordance with the provisions of B4.801, as appropriate. Parts tested in this way may not be put to further use. Enlarged links and end links need not be tested provided that they are manufactured and heat treated together with the chain cable.

b. The RBNA may waive the breaking load test if:

b.1. the breaking load has been demonstrated on the occasion of the approval testing of parts of the same design, and

b.2. the mechanical properties of each manufacturing batch are proved,

b.3. the parts are subjected to suitable non-destructive testing.

c. Notwithstanding the above, the accessories, which have been successfully tested at the prescribed breaking load appropriate to the chain, may be used in service at the discretion of the RBNA where the accessories are manufactured with the following:

c.1. the material having higher strength characteristics than those specified for the part in question (e.g. Grade 3 material for accessories for Grade 2 chain)

c.2. alternatively, the same grade material as the chain but with increased dimensions subject to the successful procedure tests that such accessories are so designed that the breaking strength is not less than 1.4 times the prescribed breaking load of the chain for which they are intended.

903. **Mechanical properties and tests**

a. Unless otherwise specified, the forging or casting must at least comply with the mechanical properties given in Table T.B4.705.1, when properly heat treated. For test sampling, forgings or castings of similar dimensions originating from the same heat treatment charge and the same heat of steel are to be combined into one test unit. Mechanical tests are to be carried out in the presence of the Surveyor depending on the type and grade of material used. From each test unit, one tensile test specimen and three Charpy V-notch impact test specimens are to be taken in accordance with Table T.B4.803.1 and tested in accordance with Part III, Title 61, Section 3, Chapter A (UR W2). For the location of the test specimens see B4.300 and Figure F.B4.303.1. Testing is to follow B4.303.d and B4.303.e. Retesting is to follow B4.303.f and B4.303.g. Enlarged links and end links need not be tested provided that they are manufactured and heat treated together with the chain cable.

904. **Marking:** Accessories which meet the requirements are to be stamped as follows:

a. Chain cable grade

b. Certificate number

c. RBNA's stamp

905. **Certification:** Chain accessories which meet the requirements are to be certified by the RBNA at least with the following items:

a. Manufacturer’s name

b. Grade

c. Heat Number

d. Chemical composition (including total aluminum content)

e. Nominal diameter/weight

f. Proof/break loads

g. Heat treatment

h. Marks applied to accessory

i. Mechanical properties, where applicable

B5. CHAFFING CHAIN FOR EMERGENCY TOWING ARRANGEMENTS

100. Scope

101, The present Subchapter B5 applies to the chafing chain for chafing gear of two types of Emergency Towing Arrangement (ETA) with specified safe working load (SWL) of 1000kN (ETA1000) and 2000kN (ETA2000). Chafing chains other than those specified can be used subject to special agreement with the RBNA.

200. Approval of manufacturing

201. The chafing chain is to be manufactured by works approved by RBNA according to B4.103.

300. Materials

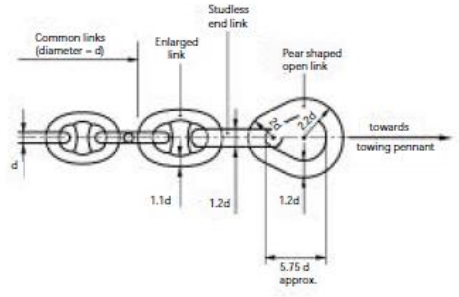
301. The materials used for the manufacture of the chafing chain are to satisfy the requirements of b4.300.

400. Design, manufacture, testing and certification of chafing chain

401. The chafing chain is to be designed, manufactured, tested and certified in accordance with the requirements of B4.700, B4.800 and B4.900.

402. 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 Figure F.B5.401.1.

FIGURE F.B5.401.1: TYPICAL OUTBOARD CHAFING CHAIN END



403. The common link is to be of stud link type grade 2 or 3.

404. 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 in Table T.B5.404.1.

TABLE T.B5.404.1 NOMINAL DIAMETER OF COMMON LINK FOR CHAFING CHAINS

Type of ETA	Nominal diameter of common link, d minimum	
	Grade 2	Grade 3
ETA 1000	62 mm	52 mm
ETA 2000	90 mm	76 mm

B6. STEEL WIRE ROPES

100. Application

101. The steel wire ropes used should meet the requirements of this section, which are in accordance with the standard NBR-6890.

102. The steel wire ropes will be obtained by the processes indicated in the item 200.

103 The steel wire ropes used should preferably meet the requirements of Table T. B 6.103.1.

104. Conventionally the steel wire ropes can be manufactured in some categories of tensile strength, namely:

TABLE T. B 6.104.1-CHART SHOWING THEVARIATIONS OF SRENGTHS OF WIRES AS A FUNCION OF THEIR RESPECTIVE DIAMETERS CIMAF

Acronym	Correspondence in N/mm^2
PS	1370 – 1770
IPS	1570 – 1960
EIPS	1770 - 2160
EEIPS	1960 - 2160

TABLE T.B6.103.1 – STEEL WIRE ROPES

CLASSIFICATION OF STEEL	QUALITY	STRUCTURE OF SWR		COMPOSIION OF THE LEGS	BREAKING LOAD (mín.)
		n° OF LEGS	n° OF WIRES		N / mm^2
6 × 19 + AF	Medium steel of plow MPS	6	19	1 + 6 / 12 1 fiber core	1420 - 1570 N/mm2
6 × 24 + 7AF	Medium steel of plow MPS	6	24	9 / 15 7 fiber cores	1570-1960 N/mm2
6 × 37 + AF	Steel of plow PS	6	37	1 + 6 / 12 / 18 1 fiber core	1710 – 2160 N/mm2

200. Manufacture

201. In the manufacture of steel wire rope (galvanized and redrawn) quality A or B should be employed wires protected by an homogeneous layer of zinc applied by hot dip or electroplated.

202. The mass of the zinc coating should meet the requirements of the table T.B6.202.1.

TABLE T.B6.202.1 - MASS OF ZINC COATING

ϕ OF THE WIRE	QUALITY A	QUALITY B
g / m	g / m	g / m
d < 0,49	75	40
0,50 > d < 0,59	90	50
0,60 > d < 0,79	110	60
0,80 > d < 0,99	130	70
1,00 > d < 1,19	150	80
1,20 > d < 1,49	165	90
1,50 > d < 1,89	180	100
1,90 > d < 2,49	205	110
2,50 > d < 3,19	230	125
3,20 > d < 3,99	250	135

300. Requirements for steel wire rope tests

301. Winding test:

a. the sample should be taken, at least, of one wire of each leg of rope, and then wrapped in at least 10 tight helicoidally turns around a cylindrical mandrel of specified diameter in the table T.B6.301.1;

b. the test will be considered satisfactory if the zinc layer continue to adhere firmly to the wire after the winding;

c. when in the first test a wire does not meet the requirements, will be allowed an additional test on all remaining wires of rope sample;

d. the result of the additional test shall be considered satisfactory if at least 96% of the wires tested do not display superficial defects.

TABLE T.B6.301.1 – DIAMETER OF THE MANDREL

TYPE OF WIRE	ϕ of the wire < 1,50 mm	ϕ of the wire > 1,50 mm
QUALITY A	4 × ϕ of the wire	6 × ϕ of the wire
QUALITY B	2 × ϕ of the wire	3 × ϕ of the wire

302. Torsion test

a. the sample consists of all individual wires of one leg of new rope with nominal free length between clamps as the values of the table T. B6.302.1;

b. the test should be considered satisfactory, even in the event of breaking at any point of the sample, if the minimum number of twists in the individual wires meet the requirements of table T. B6.302.1;

c. when in the first test the sample does not meet the requirements, an additional test will be allowed in all remaining cable wires; and

d. the result of the additional test will be considered satisfactory if at least 96% of the wires support the minimum number of twists of the table T. B6.302.1.

TABLE T.B6.302.1 – LENGTH AND MINIMUM NUMBER OF TWISTS FOR WIRES

ϕ OF THE WIRE (mm)	RATED LENGTH BETWEEN CLAMPS	NUMBER OF TWISTS	
		QUALITY A	QUALITY B
d < 0,99	200 × ϕ do arame	26	48
1,00 > d < 1,29	100 × ϕ do arame	13	24
1,30 > d > 2,29	100 × ϕ do arame	13	23
2,30 > d < 2,99	100 × ϕ do arame	12	20
3,00 > d < 4,00	100 × ϕ do arame	10	18

303. Coating test:

a. the sample is to be taken at least one wire of each leg and then the mass of the zinc layer be assessed and certified by the manufacturer through removal by chemical process of galvanization and measurement of the loss of mass of the wires;

b. the zinc layer test shall be considered satisfactory if the mass of the zinc layer meets the requirements of the tables T. B6.202.1 and T. B6.303.1;

c. the test can also be performed by process of immersion in a solution of copper sulfate based crystallized, and after the required number of dips and washing in running water, the wires should not display adherent deposits of copper;

d. when in the first test a wire does not meet the requirements will be allowed an additional test in all the remaining wires of the cable sample;

e. the result of additional test will be considered satisfactory if at least 96% of the wires tested meet the requirements of the tables 4.1. F-14 and t. B6.303.1.

TABLE T.B6.303.1 – MINIMUM NUMBER OF DIPS

ϕ OF THE WIRE (mm)	TIME OF IMERSION (seg)	
	QUALITY A	QUALITY B
d < 0,59	30	---
0,60 > d < 0,99	60	30
1,00 > d < 1,49	90	60
1,50 > d < 1,89	120	60
1,90 > d < 2,49	120	90
2,50 > d < 3,19	150	90
3,20 > d < 3,99	180	120

304. Breaking load test:

a. the sample consists of the new steel wire rope itself with nominal length between the clamps equal to 30 times its diameter but no shorter than 600 mm, drawn from each batch of the same manufacturing and characteristics or of each reel in cases of different batches;

b. the test shall be considered satisfactory if the test sample until the break down meet the requirements of table T. B6.304.2;

c. when the pulling capacity of the testing machine is insufficient to test the sample of the steel wire rope itself, it is accepted the test on one of its legs. In this case, the result of breaking load obtained, multiplied by the quantity of legs and by deducting 10% should meet the requirements of table T. B6.304.2;

d. the breaking load test may also be carried out in individual samples of wires with nominal free length between clamps as values of the table T. B6.302.1. In this case, the result of breaking load obtained, multiplied by the number of wires and multiplied by the factors indicated in table T. B6.304.1 should meet the requirements of table T. B 54.304.2;

e. when in the first test, in either case, the sample does not meet the requirements, an additional test will be allowed;

f. the result of additional testing will be considered satisfactory if the test sample until the breaking down meet the requirements of table T. B6.304.2, allowing a tolerance of up to 2.5% below the value listed in the table.

TABLE T.B6.304.1 - FACTORS

CLASSIFICATION OF THE ROPE	FATOR
6 × 19 + AF	0,86
6 × 24 + 7AF	0,87
6 × 37 + AF	0,83

TABLE T.B6.304.2 – MINIMUM BREAKING LOAD IN STEEL WIRE ROPES

NOMINAL DIAMETER mm	CLASSIFICATION OF THE ROPE					
	6 × 19 + AF MPS		6 × 24 + 7AF MPS		6 × 37 + AF PS	
	QUALITY A (KN)	QUALITY B (KN)	QUALITY A (KN)	QUALITY B (KN)	QUALITY A (KN)	QUALITY B (KN)
8,0	26	29	23	25	28	31
9,5	37	41	30	33	41	45
11,5	51	56	41	45	56	61
13,0	65	72	52	57	75	83
14,5	83	91	69	76	95	105
16,0	102	112	86	95	117	129
19,0	145	160	125	138	167	184
22,0	196	216	164	180	226	249
26,0	255	281	220	242	295	324
29,0	324	354	279	307	370	407
32,0	395	434	345	380	455	500
35,0	475	522	418	460	522	573
38,0	562	618	501	551	618	679
42,0	656	722	578	636	722	794
45,0	756	832	674	741	832	915
48,0	865	952	772	849	954	1049
51,0	980	1078	883	971	1078	1186

400. Dimensional assessment

401. The steel wire ropes will be dimensionally checked according to the following requirements:

a. checking of wires:

a.1. the quantity in each leg and the diameter of the individual wires are checked; and

a.2. the maximum allowable variation between the diameter of the wires of the same layer should meet the requirements of table T. B6.401.1.

b. checking of the pitch:

b.1. the cable pitch will be verified in reels at a distance of at least 3.0 m, and the measured length should correspond to five or more pitches; and

b.2. the checking will be considered to be satisfactory if the calculated result divided by the number of pitches does not exceed 7.25 times the cable diameter.

c. checking of the diameter:

c.1. the diameters will be checked in the reels in at least three different sections 1.5 m apart between each one; and

c.2. the actual diameter of the wire rope will be the result of the calculated average in the measurements made according to the maximum allowed tolerances in the table T.B6.401.1.

TABLE T.B6.401.1 – TOLERANCES FOR DIAMETERS OF STEEL WIRE ROPES

RATED DIAMETER OF THE ROPE (mm)	TOLERANCE	DIAMETERR OF THE WIRE (mm)	QUALITY A	QUALITY B
d < 19,0	+ 0,08	0,25 > d < 0,70	---	+ 0,038
19,0 > d < 29,0	+ 1,20	0,70 > d < 1,50	+ 0,089	+ 0,051
29,0 > d < 38,0	+ 1,60	1,50 > d < 2,35	+ 0,114	+ 0,063
38,0 > d < 57,0	+ 2,40	2,35 > d < 3,59	+ 0,190	+ 0,073

500. Marking

501. The steel wire ropes that have met satisfactorily the test requirements will be marked in the reels or spools with an undeletable marking or been labeled by the manufacturers with the following inscriptions:

a. RBNA stamp;

b. Number of the certificate of classification;

c. Construction of the rope;

d. Quality of the steel;

e. Minimum breaking load, in KN;

f. Length, in m;

g. Diameter, in mm; and

h. Manufacture Mark;

B7. FIBER ROPES

100. Application

101. The cables referred to in this section shall be made of natural fibers such as hemp, manila, and sisal and synthetic fibers such as nylon, polypropylene, polyethylene, polyamide and polyester and preferably will be used as mooring and towing cables.

200. Formation of the test sample

201. The test sample consists of the new fiber rope itself taken from each batch of the same material, construction, type, nominal diameter and drawn manufactured uninterruptedly in the same production sequence.

202. The test sample shall be 2.50 m in length, so that the nominal free length between the clamps of the machine shall be at least 1.50 m for natural fiber and 0.90 m for synthetic fiber.

203. In the case of orders in large quantities will be removed an additional sample for every 2000 m or fraction of cable of the same kind for a vessel.

300. Requirements for testing in fiber ropes

301. Breaking test:

a. the test consists of submitting samples to the breaking loads indicated on table T.B7.301.1;

b. the test shall be considered satisfactory, even occurring the breakage in the clamping or in the seam, if the result reaches at least 90% of the tabulated breaking load.

TABLE T.B7.301.1 – MINIMUM BREAKING LOAD IN THREE-STRAND FIBER ROPES

DIAMETER mm	SISAL KN	MANILA KN	HEMP KN	POLYETHYLENE KN	POLYPROPYLENE KN	NYLON KN
20	24	29	31	42	52	81
22	29	35	37	50	64	98
24	35	41	43	60	74	118
28	47	57	59	78	99	155
30	54	66	68	90	113	174
32	61	73	75	102	125	196
36	74	91	94	127	158	243
40	88	108	115	153	190	294
44	108	131	139	184	229	351
48	123	149	158	220	267	412
52	142	172	185	257	309	479
56	162	196	210	296	353	549
60	181	221	237	335	404	626
64	206	250	267	378	459	706
72	260	309	327	476	575	883
80	314	378	402	573	706	1079
88	363	451	480	689	834	1285
96	412	520	554	829	1000	1510

400. Marking

501. The fiber ropes that have been met satisfactorily the test requirements will be marked or labeled by the manufacturers with the following inscriptions:

a. RBNA stamp;

b. Number of the certificate of classification;

c. Material and type of the rope;

d. Length, in m;

e. Diameter, in mm; and

f. Manufacture Mark;

B8. WINDLASS AND CAPSTAN

100. Application

101. This sub-chapter applies to all windlasses and capstans to be installed aboard ships.

102. The design and construction of all equipment subject of this sub-chapter is to be in compliance with Part II, Title 11, Section 3, -Chapter D, item D2.600.

200. Inspections

201. The requirements for inspection at works are given in the RBNA Rules for the Construction and Classification of Steel Vessels, Part I Title 01, Section 2.

202. A test program is to be previously ascertained with the manufacturer according to the standard NBR 8551 or equivalent, including at least the following inspections and tests:

a. Checking of the material and driver unit certificates from the manufacturer;

b. Checking the dimensions according to the approved plans and specifications;

c. The windlass is to be tested for at least 30 minutes at the continuous duty pull Tcont, corresponding to the grade of chain cables given by (excerpt from Part II, Title 11, Section 3, Sub-chapter D2):

Tcont = 37.5 d2 N (3.82 d2 kgf) grade 1
42.5 d2 N (4.33 d2 kgf) grade 2
47.5 d2 N (4.84 d2 kgf) grade 3

where d = chain diameter (mm).

d. A temporary overload capacity test or "short term pull" is to be carried out at 1.5 the continuous duty pull for at least two minutes. The speed in this period can be lower than nominal.

e. The automatic break system of the driver unit, the emergency breaking system and the wildcat breaking system are to be checked out.

300. Certification at work

301. Upon satisfactory completion of the tests, a certificate is to be issued containing the following data:

a. Design Type approval (if not Type Approval, identification of the approved plans and specifications)

b. Description of inspections and tests

c. Manufacturers' name and address

d. Year of manufacture

e. Model / Type

f. Hoisting capacity

g. Anchor chain or anchor cable capacity (length x diameter)

h. Hoisting speed

i. Approximate weight

400. Acceptance Criteria

401. The acceptance criteria is full conformity with standard NBR 8551.

500. Markings

501. The markings corresponding to the data on the certificate are to be punched or tagged to the equipment.

CHAPTER C
MATERIALS FOR STEERING GEAR CONTROL SYSTEM

CHAPTER CONTENTS

C1. SCOPE

100. Application

101. This Chapter applies to the components of the steering gear control system operated by power or manually.

200. Steels for the steering gear control system

201. Follow requirements of the Section 2 of this Part III of the Rules.

300. Hydraulic components

301. Hydraulic components such as cylinders, hoses, pipes, etc. will be tested in the manufacturers in the presence of a RBNA surveyor.

CHAPTER D
LIFE SAVING APPLIANCES

CHAPTER CONTENTS

D1. SCOPE

100. Application

101. This Chapter applies to the components to the life saving appliances carried on board.

200. Trials and tests

201. The trial and tests are to be in accordance with the national regulations of NORMAM 05.

202. For ships with GT ≥ 500, or where indeicated by NORMAM 05, the trials and tests are to be in accordance with the IMO Life Saving Appliances Code (LSA Code).

D2. FIRE FIGHTING EQUIPMENT

100. Application

101. This Subchapter D5 applies to the components of the equipment for firefighting carried on board.

200. Trials and tests

a. **For ships with GT < 500**: These requirements apply to the testing and approval procedures for materials used in the construction or repair of ships accommodations according to the requirements of NORMAM 05 or where these Rules require.

b. **For ships with GT ≥ 500 GT**: These requirements apply to the testing and approval procedures for materials used in the construction or repair of ships accommodations according to the requirements of the International Convention for safety of Life at Sea (SOLAS), the Fire Test Procedures (FTP) Code, and/or national Regulations or where these Rules require.

Guidance

As specified in NORMAM 05, the International Regulations and Codes for the testing and approval of fire-fighting materials and equipment are also applicable to vessels having GT < 500.

End of guidance

300. Periodical survey and testing of CO2 and Halon containers
[IACS Rec 53]

301. Survey of containers intended for storage of fire-extinguishing medium is carried out during an annual and special survey of the ship and under special circumstances also during an occasional survey of the ship.

302. Containers after repair or discharge are to be subject to a hydrostatic test.

303. External examination is to be carried out at each container annually.

a. External examination is to be carried out at each container annually.

b. [IACS Rec 53 modified by NORMAM 01] Periodic hydrostatic testing of high pressure CO2 containers is to be performed at maximum intervals of five years. The tests will be according to ABNT standards or equivalent.

c. In case the cylinders have been inspected annually and provided that in this period there was no fall of pressure, no corrosion observed the cylinders are full, the hydrostatic tests may be extended for a further five years period for a maximum of 50% of the cylinders. The remaining cylinders are to be tested during the five following years.

d. In case one cylinder presents an unsatisfactory result, all cylinders of the fixed system are to be tested.

[IACS Rec 53 original]

e. Testing is required for not less than 10% of the containers.

f. For low pressure CO2bulk storage containers hydrostatic testing may be required at the survey-or's discretion, depending on the results from internal survey. In the case of insulated containers, the surface beneath insulation should be spot-checked for corrosion. Removal of insulation should be done as necessary in accordance with the manufacturer's procedure.

304. Low pressure CO2 bulk storage containers are subject to internal survey if the content has been released and the container is more than 5 years old.

305. Allowable total loss of CO2 shall not exceed 10% and for Halon 5% of installed quantity.

306. **External Examination**

a. Containers are subject to external examination together with all stationary fittings and devices.

b. External examination is to include:

b.1. condition of fittings, manometers, outer surfaces, fastenings and insulation,

b.2. serviceability of the automatic equipment of alarm and protection systems (if fitted),

b.3. condition of safety valves, safety membranes and other pressure safety devices.

c. If the external examination reveals damage, the origin of which cannot be determined, the surveyor may require an internal survey or hydrostatic test.

307. **Internal Survey**

a. During survey particular attention is to be given to the mounting seats of the valve heads of the pressure vessels, fittings, manhole covers and other areas where damage (corrosion, pitting, cracks etc.) is most likely to occur.

b. If visual inspection reveals corrosion attacks, thickness measurements should be done. If thickness reduction at any point is found to exceed 10%, repairs of the container or replacement is required.

308. **Hydrostatic Testing**

a. The test pressure is to be according to the Rules of RBNA.

CHAPTER F
MATERIALS FOR CLOSING ARRANGEMENTS AND PROTECTION OF THE HULL ACCESSES

CHAPTER CONTENTS

F1. SCOPE

100. Application

101. This Chapter shall apply to the components of the devices for hull openings protection and closing.

200. Rules and standards

201. The present Chapter F is based on the following rules and standards:

a. IACS LL62, ICLL Reg. 23

b. ISO 1751,

c. ISO 3903

d. ISO 21005:2004

F2. MATERIALS

100. Steel for closing devices

101. Follow the requirements of Section 2 of this Part III of the Rules.

200. Other materials

201. The use of glass reinforced fiber resins, wood etc. should be submitted to the RBNA specifications and accorded how their characteristics should be proven.

300. Gaskets and seals

301. The specifications should be submitted to the RBNA, referred to the locations where are used.

F3. SIDE SCUTTLES, WINDOWS AND SKYLIGHTS

100. General.
[IACS LL62, ICLL Reg. 23]

101. Side scuttles and windows together with their glasses, deadlights[1] and storm covers, if fitted, shall be of approved design and substantial construction in accordance with, or equivalent to, recognised national or international standards. Non-metallic frames are not acceptable.

Note: Deadlights are fitted to the inside of windows and side scuttles while 'storm covers' are fitted to the outside of windows, where accessible, and may be hinged or portable.

102. Side scuttles are defined as being round, or oval, openings with an area not exceeding 0.16 square metres. Round or oval openings having areas exceeding 0.16 square metres shall be treated as windows.

103. Windows are defined as being rectangular openings generally, having a radius at each corner relative to the window size in accordance with recognised national or international standards, and round, or oval, openings with an area exceeding 0.16 square metres.

104. Side scuttles to the following spaces shall be fitted with efficient hinged inside deadlights:

a. spaces below freeboard deck

b. spaces within the first tier of enclosed superstructures

c. first tier deckhouses on the freeboard deck protecting openings leading below or considered buoyant in stability calculations.

105. The deadlights shall be capable of being effectively closed and secured watertight if fitted below freeboard deck and weathertight if fitted above.

106. Side scuttles shall not be fitted in such a position that their sills are below a line drawn parallel to the freeboard deck at side and having its lowest point 2.5 percent of the breadth B, or 500 mm, whichever is the greatest distance, above the summer load line (or timber summer load line if assigned). See Figure F.F3.106.1 below.

107. Side scuttles shall be of the non-opening type in ships subject to damage stability regulations, if calculations indicate that they would become immersed by any intermediate stage of flooding or the final equilibrium water plane in any required damage case.

108. Windows shall not be fitted in the following locations:

a. below the freeboard deck

b. in the first tier end bulkheads or sides of enclosed superstructures

c. in first tier deckhouses that are considered buoyant in the stability calculations.

109. Side scuttles and windows at the side shell in the second tier, protecting direct access below or considered buoyant in the stability calculations, shall be provided with efficient hinged inside deadlights capable of being effectively closed and secured weathertight.

110. Side scuttles and windows set inboard from the side shell in the second tier, protecting direct access below to spaces listed in Item F3104 above, shall be provided with either efficient hinged inside deadlights or, where they are accessible, permanently attached external storm covers of approved design and of substantial construction and capable of being effectively closed and secured weathertight.

111. Cabin bulkheads and doors in the second tier separating side scuttles and windows from a direct access leading below may be accepted in place of deadlights or storm covers fitted to the side scuttles and windows.

112. Deckhouses situated on a raised quarter deck or on the deck of a superstructure of less than standard height or on the deck of a deckhouse of less than standard height, may be regarded as being in the second tier as far as the provision of deadlights is concerned, provided the height of the raised quarter deck, superstructure or deckhouse is equal to, or greater than, the standard quarter deck height.

113. Fixed or opening skylights shall have glass thickness appropriate to their size and position as required for side scuttles and windows. Skylight glasses in any position shall be protected from mechanical damage and where fitted in positions 1 or 2, shall be provided with permanently attached robust deadlights or storm covers.

200. Types, series and models of the scuttles and rectangular windows.
[ISO 1751, 3903]

201. Ship´s side scuttles may be of three types:

a. Type A: Heavy-type side scuttle;

b. Type B: Medium-type side scuttle;

c. Type C: Light-type side scuttle.

202. Ship´s ordinary rectangular windows may be of two types:

a. Type E: Heavy-type rectangular window;

b. Type F: Light-type rectangular window.

203. The scuttles and rectangular windows may be of the following models according to:

a. the types of glass holder: “hinged model” and “fixed model”.

b. the method of fastening: “bolted model” and “welded model”.

204. Series.

a. Side scuttle may be of the regular series (N) or of the fire-resistant series (P).

b. Windows may be of the regular series (N), fire-resistant series (P) or of the heated series (H).

205. Window scantlings defined in this subchapter are provided for the following build-up of the window:

a. monolithic window

b. laminated window

c. double windows unit with gap

206. Laminated windows are glass windows realized by placing a layer of resin (polyvinyl butyral as a general rule) between two sheets of glass.

207. Double windows are glass windows realized by two sheets of glass, separated by a spacebar hermetically sealed.

300. Design Load

301. The design load shall be calculated in accordance with Part II, Title 11, Section 2, Subchapter F7, Item 200.

302. There aren´t any scuttle or window be installed in the part of the ship where the load pressure of the project, calculated in accordance with Part II, Title 11, Section 2,.Subchapter F7, Item 200, supersedes the maximum allowable pressure according to diameter and type of scuttles and rectangular windows in Tables T.F3.302.1 and T.F3.302.2.

303. For ships with a length L_c equal to or greater than 100 m, loads in accordance with ISO 5779 (“*Shipbuilding -- Ordinary rectangular windows – Positioning*”) and 5780 (“*Shipbuilding -- Side scuttles – Positioning*”) standard have to be calculated additionally. The greater value has to be considered up to the third tier.

304. Deviations and special cases are subject to separate approval.

305. **[ISO:3903 Anex A]** Where one or both dimensions (width and height) of a rectangular window are different from those given in Table T.F3.302.1, maximum pressure (p), in kilopascals, shall be determined using the following equation:

$$p = \frac{40000 \cdot t^2}{\beta \cdot b^2}$$

Where:

t – is the nominal thickness of the glass pane, in mm;

β – is the factor obtained from the graph in figure F.F3.305.1;

b – is the minor dimension of the window, in mm;

400. Calculation of the glass thickness [ISO 21005:2004, Anex A]

401. In general, toughened glasses with frames of special type are to be used in compliance with, or equivalent to, recognised national or international standards.

402. The use of clear plate glasses is considered by the RBNA on a case by case basis

403. The minimum allowable glass thickness for **thermally toughened glasses i**s given in tables T.F3.302.1 and T.F3.302.2, depending on the sizes, type and class of the window.

404. Where one or both dimensions (width w1 or height h1) of a window are different from those given in Table T.F3.302.1, the required glass thickness of monolithic windows and side scuttles are to be determined using the following equation:

a. for rectangular windows:

$$t = \frac{b}{200}\sqrt{\alpha \times \beta \times p}$$

b. for circular windows:

$$t = \frac{d_1}{400}\sqrt{\alpha \times p}$$

Where:

d_1 - is nominal size, in mm (*the clear light dimensions of the windows or the side scuttles*).

t - is the thickness of the glass pane, in mm;

α = 1,2 (factor for glass edge cover);

β is the factor obtained from graph in Figure F.F3.305.1

b is the dimension of w1 or h1, whichever is less, in mm;

p is the pressure , in kPa;

405. The thickness of laminated window and the outside glass of double window exposed to loads is to be calculated as defined in F3.403 above considering the total thickness of the laminated window as a monolithic window.

406. Thickness of glasses forming screen bulkheads or internal boundaries of deckhouses. The thickness of glasses forming screen bulkheads on the side of enclosed promenade spaces and that for rectangular windows in the internal boundaries of deckhouses which are protected by such screen bulkheads are considered by the RBNA on a case by case basis.

407. The RBNA may require both limitations on the size of rectangular windows and the use of glasses of increased thickness in way of front bulkheads which are particularly exposed to heavy sea.

FIGURE F.F3.305.1. CURVE FOR DETERMINATION OF FACTOR β BASED ON WINDOW SIZE RATIO.

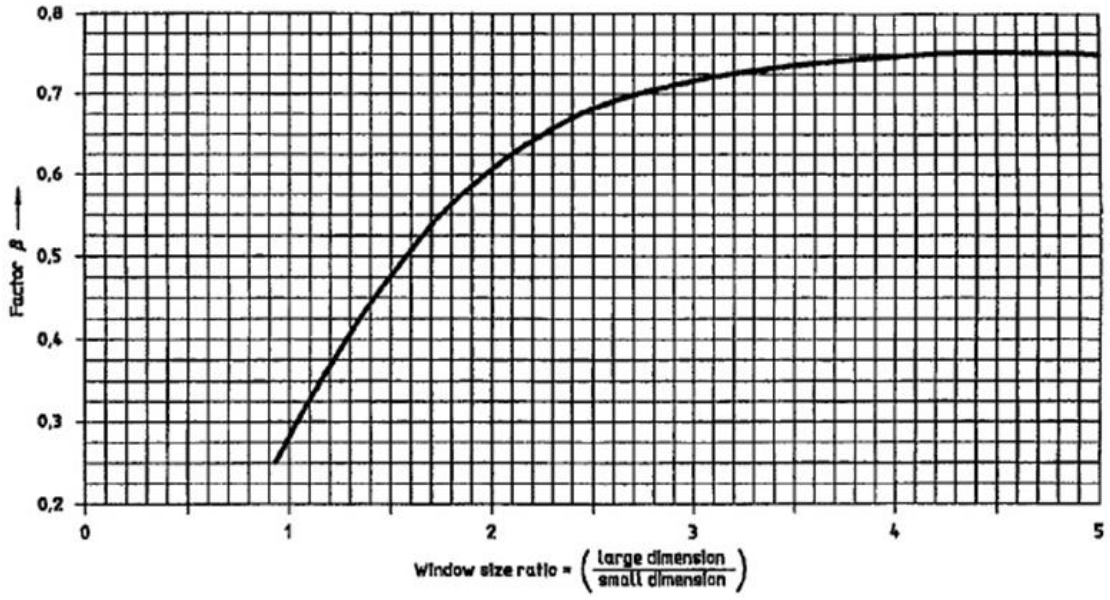


FIGURE F.F3.106.1. ARRANGEMENT OF SIDE SCUTTLES

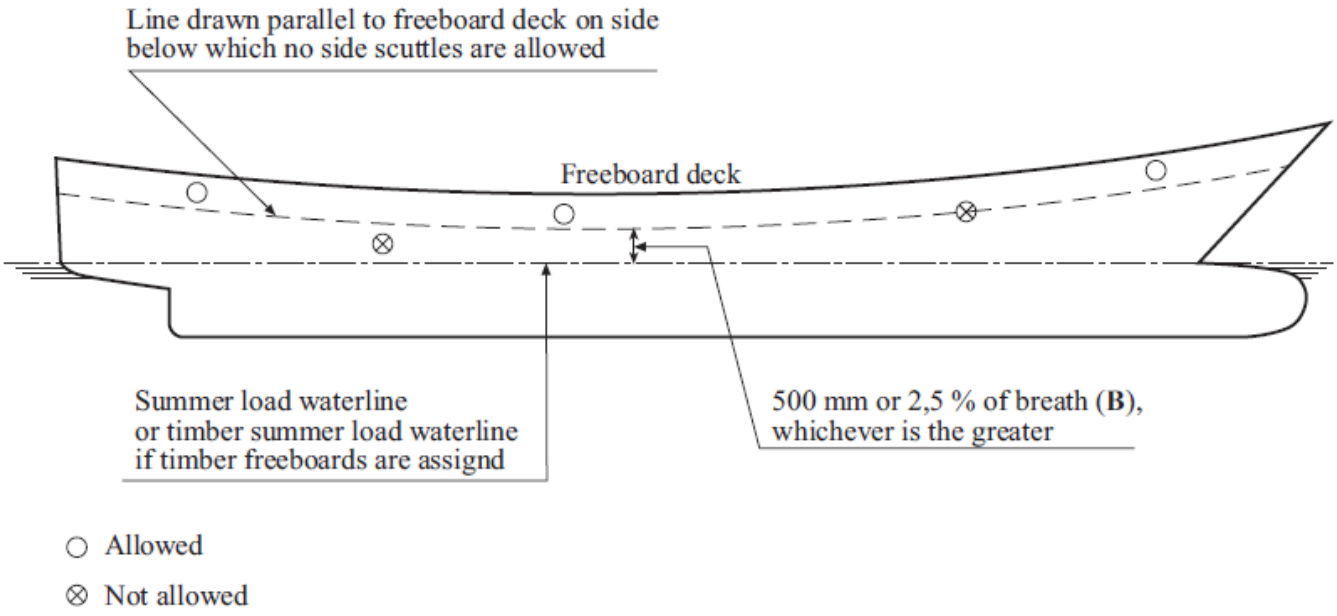


TABLE T.F3.302.1. GLASS THICKNESS AND MAXIMUM PRESSURE FOR TYPES "E" AND "F" RECTANGULAR WINDOW REGULAR SERIES (N), THERMALLY TOUGHENED GLASS PANES. [ISO 21005 e ISO 3903]

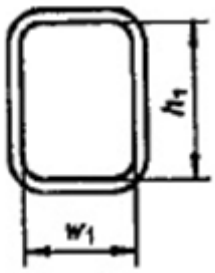
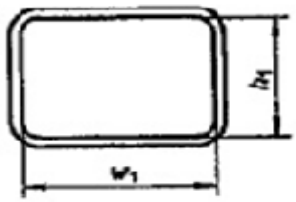
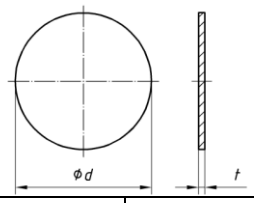
									
Nominal size width(*mm*)× height(*mm*)	300× 425	355× 500	400× 560	450× 630	500× 710	560× 800	900× 630	1000× 710	1100× 800
TYPE "E"									
Glass thickness	10	10	12	12	15	15	19	19	-
Max. allowable pressure (*kPa*)	99	71	80	63	80	64	81	64	-
Minimum number of fasteners	4	4	4	4	6	6	6	8	-
TYPE "F"									
Glass thickness	8	8	8	8	10	10	12	12	15
Max. allowable pressure (*kPa*)	63	45	36	28	36	28	32	25	31
Minimum number of fasteners	4	4	4	4	6	6	6	8	8

TABLE T.F3.302.2. GLASS THICKNESS AND MAXIMUM PRESSURE FOR TYPES "A", "B" AND "C" SIDE SCUTTLES REGULAR SERIES (N), THERMALLY TOUGHENED GLASS PANES. [ISO 21005 e ISO 1751]

						
Nominal diameter (*mm*)	200	250	300	350	400	450
TYPE "A"						
Glass thickness	10	12	15	15	19	-
Max. allowable pressure (*kPa*)	328	302	328	241	297	-
Minimum number of fasteners (glass holder)	2	3	3	3	3	-
TYPE "B"						
Glass thickness	8	8	10	12	12	15
Max. allowable pressure (*kPa*)	210	134	146	154	118	146
Minimum number of fasteners (glass holder)	2	3	3	3	3	4
TYPE "C"						
Glass thickness	6	6	8	8	10	10
Max. allowable pressure (*kPa*)	118	75	93	68	82	65
Minimum number of fasteners (glass holder)	2	2	3	3	3	3

500. Materials

501. The materials used for the main components of the side scuttles and windows, such as: main frame, glassholder, deadlight and glass retaining frames/rings, are to be in accordance with ISO 1751 (*"Shipbuilding – Ship's side scuttles")* and ISO 3903 *("Shipbuilding – Ships' ordinary rectangular windows"*).

502. **Glass panes.** Toughened safety glass panes according to ISO 1095 ("*Shipbuilding – Toughened safety glass panes for ship's side scuttles*") or glass panes of equivalent quality are to be used. For fire resistant glass panes, glass panes according to ISO 5797 ("*Ships and marine technology -- Windows and side scuttles for fire-resistant constructions*") or glass panes of equivalent quality are to be used.

503. **Limitations for ships**:

a. only thermally toughened safety glass or laminated glass will be accepted, i.e. polycarbonate or acrylic will not be accepted.

b. Windows shall be mechanically secured, i.e. fastening with only an adhesive is not accepted.

600. Testing

601. Side scuttles and windows made and tested according to ISO 1751 for side scuttles and ISO 3903 for windows, with glass according to ISO 21005 ("*Ships and marine technology – Thermally toughened safety-glass panes for windows and side scuttles")* and glass tested and marked according to ISO 614 *("Shipbuilding and Marine Structures: Toughened safety glass panes for rectangular windows and side scuttles: punch method of non-destructive strength testing"*) will normally be accepted. The same applies to national standards equivalent to the ISO-standards.

700. Type approval programme.

701. The Type Approval programme outlines the procedure and conditions for obtaining, maintaining and renewing a Type Approval. Part I, Title 2, Section1, Subchapter F3 describes the Type Approval procedures in general.

702. The Type Approval documentation is to be submitted by the manufacturer in accordance with Part I, Title 1, Section 2 at Initial Type Approval and updated, at renewal.

703. Additionally to Item 702 above, the following shall be specified, if applicable:

a. Product specification/data sheet/drawings, including:

a.1. chemical composition of glass or synthetic material, e.g. acrylic or polycarbonate

a.2. production of plate glass (float or polished) or synthetic material

a.3. toughened, thermally or chemically

a.4. annealed, heat strengthened, fully tempered

a.5. build up (monolithic, laminated, layered).

b. Interlayer and interlayer thickness are to be specified, where relevant.

b.1. side scuttle series (N or P), type (Type A, B or C) and model (opening/non-opening, with/without deadlight, opening direction of glassholder, type of fastening, bolted/welded)

b.2. window type (Type E or F) and model (opening/nonopening, opening direction of glassholder, type of fastening, bolted/welded)

b.3. dimensions and tolerances

b.4. frames (material quality and sizes) and gaskets

b.5. screws and threads

b.6. strength - i.e. impact and bending strength.

c. Areas of Application and Limitations of the product, including handling/storage instructions.

c.1. - Description of production processes 1)

c.2. - Description of quality control arrangement 1)

c.3. - Description of packing of product 1)

c.4. - Information regarding marking of the product. 1)

1) To be verified at Initial Survey prior to issuance of Type Approval Certificate.

CHAPTER G
MATERIALS FOR HULL OUTFITING

CHAPTER CONTENTS

G1. SCOPE

100. Application

101. This Chapter shall apply to components of the hull outfitting.

G2. MATERIALS USED

100. Appendages welded to the steel structure

101. The requirements of Section 2 of this Part III of the Rules are to be complied with.

200. Materials in other locations

201. The use of other materials should be submitted to the RBNA and an agreement reached as to how their characteristics are to be confirmed.

Rgmm14en-PIIIT61S3-abcdfg-00