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Ships and marine technology — High holding power balance anchors

PROOF/ÉPREUVE

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Ships and marine technology — High holding power balance anchors

1 Scope

This document specifies the design and production requirements, test methods, marking and inspection certificate for high holding power balance anchors (hereinafter referred to as anchors).

It is applicable to the design, selection, production and acceptance of high holding power balance anchors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3828, *Shipbuilding and marine structures — Deck machinery — Vocabulary and symbols*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3828 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
high holding power balance anchor
HHBP anchor
anchor with a rotatory fluke that can be restored back to upright position by gravity once the anchor is hoisted from the sea bed, and with a holding power of at least twice that of an ordinary stockless anchor of the same mass

4 Design

4.1 Structure

An anchor is generally composed of a shank, a fluke, a head pin, a lateral pin, a shackle and an anchor shackle. The typical structure is shown in Annex A.

4.2 Basic specifications and dimensions

Anchors shall be designed as per the quantity required by outfitting. They shall be classified into different specifications based on the anchor theoretical mass. The corresponding basic dimensions are shown in Table A.1.

4.3 Material

4.3.1 The chemical composition of the anchor components shall be as specified in Table 1.

Table 1 — Chemical composition of anchor components

Values in percent (%)

Component	Chemical element content[a)]									
	C	Si	Mn[c)]	S	P	Residual element[b)]				
						Ni	Cr	Cu	Mo	total
shackle body, shank	0,29	0,35	1,10 to 1,60	0,035	0,035	-	-	-	-	-
shank, fluke	0,23	0,60	0,50 to 1,60	0,04	0,04	0,40	0,30	0,30	0,15	0,80
head pin, lateral pin, shackle pin	0,23	0,45	0,30 to 1,50	0,035	0,035	0,25	0,25	0,25	0,15	0,80

a) All figures are maximum values, in %, except the ranges.

b) Unless required by the purchaser, the residual elements do not need to be analyzed.

c) 0,04 % Mn may be added to the upper limit for each 0,01 % carbon reduction .

4.3.2 The mechanical properties of anchor components shall be as specified in Table 2.

Table 2 — Mechanical properties of anchor components

Component	Mechanical property[a)]				
	Tensile strength N/mm^2	Yield strength N/mm^2	Extension percentage %	Percentage of breaking area reduction %	Impact energy J
shackle body shank	490	295	22	-	27
shank, fluke, shank	450	230	22	35	25
head pin, lateral pin, shackle pin	410	245	25	35	27

a) All figures are minimum values.

4.3.3 The surface and the inside of cast and forged components of anchors should be free from cracks, airholes, cratering, cold shuts, scabs and any other defects that may affect the strength.

4.3.4 A Charpy V-notch impact test below 0 °C should be carried out regarding ice zone navigation requirements. The impact absorbing energy should not be less than 27 J.

4.3.5 The welding material used during the fabrication of the anchor should be compatible with the parent material.

5 Production

5.1 Visual appearance

Anchor rotary parts should be ground to Ra 25 µm and be able to flexibly rotate around the centre of gravity. The surface roughness of non-processed parts should be not more than Ra 100 µm.

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5.2 Dimensional tolerance and geometrical tolerance

5.2.1 The permissible dimensional tolerance on each component of the anchor should be ±4 %, and its maximum value shall not exceed ±20 mm.

5.2.2 The permissible tolerance between the swing angles of the anchor flukes should be ±1° respectively.

5.2.3 The straightness deviation of the anchor shank should not be more than 3 mm for a length within 1 m.

5.2.4 The anchor assembling tolerances should meet the following provisions.

a) Any side clearance between the shackle and the shank should be as specified in Table 3.

Table 3 — Clearance between shackle and shank

Nominal mass of the anchor t	Clearance value mm
≤ 3	≤ 3
>3 to ≤5	≤ 4
>5 to ≤7	≤ 6
>7	≤ 12

b) When the diameter of the shackle pin is less than or equal to 57 mm, the diameter difference between the shackle pin and the shackle pin hole shall not be more than 0,5 mm. When the diameter of the shackle pin is more than 57 mm, the diameter difference between the shackle pin and the shackle pin hole should not be more than 1,0 mm.

c) The clearance difference between the pin, the shackle pin and the anchor shank hole should not be more than 1,0 mm.

d) The length of the head pin shall be able to prevent the longitudinal movement of the anchor. Its clearance shall be no more than 1 % of the pin slot length.

e) The lateral inclination of the anchor shank shall not exceed 3°. See Figure 1.

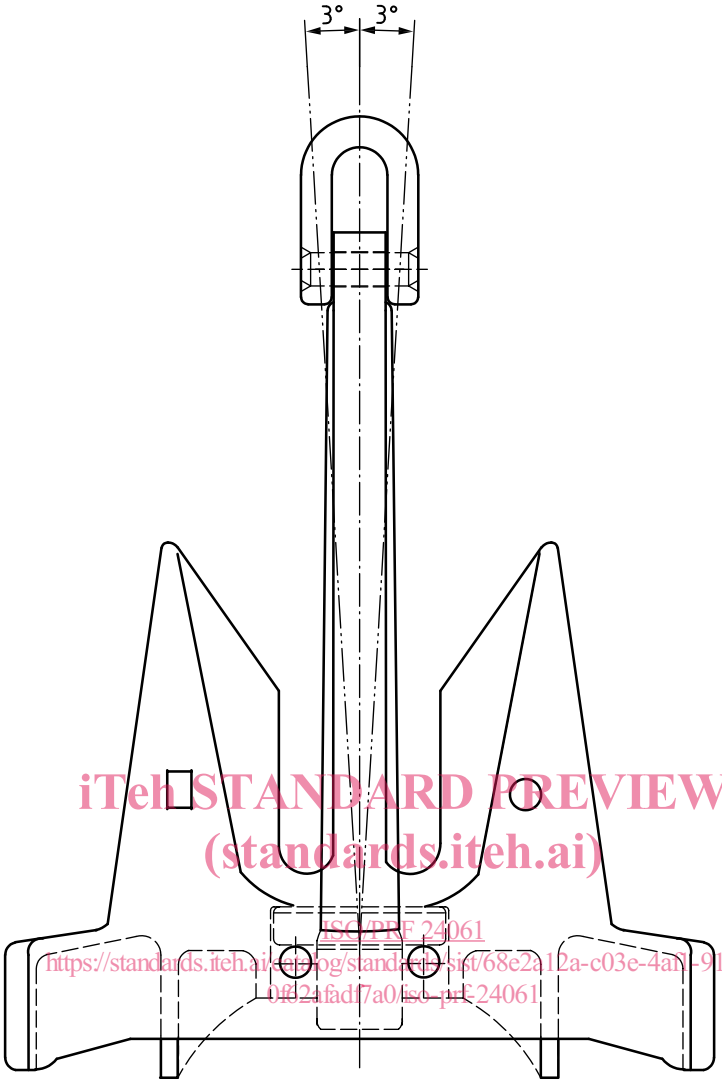


Figure 1 — Lateral inclination of the anchor

5.3 Welding and welding repair

Allowable defects should be repaired only after being evaluated through a qualified technical process. Stress relieving should be implemented.

5.4 Heat treatment

The anchor shank, fluke and shackle should be treated with a normalizing and tempering process, with a tempering temperature of not less than 600 °C.

5.5 Non-destructive test

The surface of cast and forged parts after machining shall be subject to a non-destructive test (NDT). The test for anchor cast components should be conducted in accordance with IACS REC. 69; the test for anchor forged parts should be conducted in accordance with IACS REC. 68.

5.6 Painting

Anchors should be painted with 2 coats, of asphalt and black paint; other paints can be used if mutually agreed.

5.7 Mass

The permissible deviation of the weighted mass relative to the nominal mass should be within 7 % to -3 %.

5.8 Balance

The fluke should be able to be restored back to its upright position automatically when the anchor is fully hanged. The alignment of the two fluke bills should not exceed any lateral plane of the anchor shank.

6 Test methods

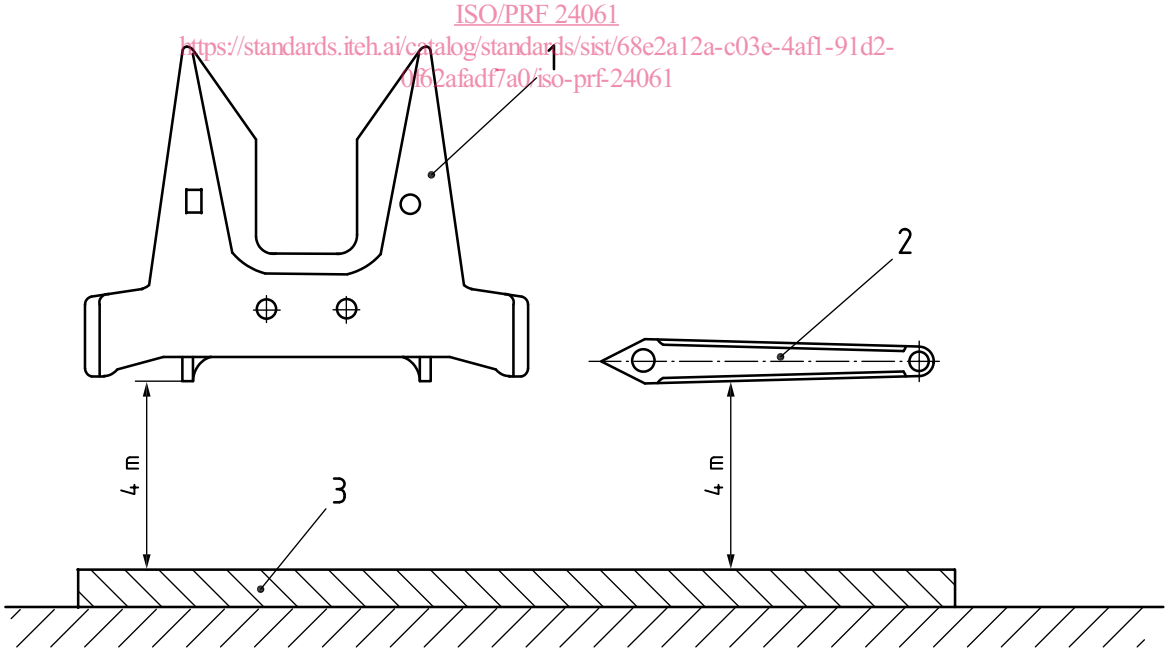
6.1 Drop test

Anchors should be subject to a drop inspection, where the anchor is dropped from a height of 4,0 m; the anchor should be free from crack defects. The detailed procedures are as follows.

a) Being hung horizontally and vertically (head-down) respectively (see Figure 2), the shank and anchor fluke are dropped from a height of 4,0 m onto a steel lining (with a thickness of not less than 50 mm) fixed onto a solid foundation.

b) After the drop inspection, the anchor flukes and shank should be lifted off the ground with a non-metal rope and subject to a hammering test with a hammer weighing 3 kg to 7 kg.

c) Check whether the sound is clear or not. If there is any abnormal sound, they should be re-inspected with a NDT, and re-tested after defects repair.



Key

1 fluke
2 shank
3 steel foundation

Figure 2 — Drop test

6.2 Proof test

The proof test load for high holding power anchors shall be the load specified for the nominal anchor, the mass of which is 1,33 times the actual total mass of the high holding power anchor. Conduct a proof load test using the proof loads specified in Table 4. When the nominal mass lies between two values in the table, the proof test load should be determined by an interpolation method.

The residual deformation after the test should not exceed 1 % of the gauge length, and the fluke should be able to rotate freely to 35° ± 1°. The roof test shall be conducted according to Annex B.

Table 4 — Nominal mass and proof test load for anchor

Nominal mass of the anchor	Proof test load	Nominal mass of the anchor	Proof test load	Nominal mass of the anchor	Proof test load	Nominal mass of the anchor	Proof test load
kg	kN	kg	kN	kg	kN	kg	kN
50	23,2	1 200	231,0	4 800	645,0	1 100 0	1 070,0
55	25,2	1 250	239,0	4 900	653,0	1 150 0	1 090,0
60	27,1	1 300	247,0	5 000	661,0	1 200 0	1 110,0
65	28,9	1 350	255,0	5 100	669,0	1 250 0	1 130,0
70	30,7	1 400	262,0	5 200	677,0	1 300 0	1 160,0
75	32,4	1 450	270,0	5 300	685,0	1 350 0	1 180,0
80	33,9	1 500	278,0	5 400	691,0	1 400 0	1 210,0
90	36,3	1 600	292,0	5 500	699,0	1 450 0	1 230,0
100	39,1	1 700	307,0	5 600	706,0	1 500 0	1 260,0
120	44,3	1 800	321,0	5 700	712,0	1 550 0	1 270,0
140	49,0	1 900	335,0	5 800	721,0	1 600 0	1 300,0
160	53,3	2 000	349,0	5 900	728,0	1 650 0	1 330,0
180	57,4	2 100	362,0	6 000	735,0	1 700 0	1 360,0
200	61,3	2 200	376,0	6 100	740,0	1 750 0	1 390,0
225	65,8	2 300	388,0	6 200	747,0	1 800 0	1 410,0
250	70,4	2 400	401,0	6 300	754,0	1 850 0	1 440,0
275	74,9	2 500	414,0	6 400	760,0	1 900 0	1 470,0
300	79,5	2 600	427,0	6 500	767,0	1 950 0	1 490,0
325	84,1	2 700	438,0	6 600	773,0	2 000 0	1 520,0
350	88,8	2 800	450,0	6 700	779,0	2 100 0	1 570,0
375	93,4	2 900	462,0	6 800	786,0	2 200 0	1 620,0
400	97,9	3 000	474,0	6 900	794,0	2 300 0	1 670,0
425	103,0	3 100	484,0	7 000	804,0	2 400 0	1 720,0
450	107,0	3 200	495,0	7 200	818,0	2 500 0	1 770,0
475	112,0	3 300	506,0	7 400	832,0	2 600 0	1 800,0
500	116,0	3 400	517,0	7 600	845,0	2 700 0	1 850,0
550	125,0	3 500	528,0	7 800	861,0	2 800 0	1 900,0
600	132,0	3 600	537,0	8 000	877,0	2 900 0	1 940,0
650	140,0	3 700	547,0	8 200	892,0	3 000 0	1 990,0
700	149,0	3 800	557,0	8 400	908,0	3 100 0	2 030,0
750	158,0	3 900	567,0	8 600	922,0	3 200 0	2 070,0
800	166,0	4 000	577,0	8 800	936,0	3 400 0	2 160,0
850	175,0	4 100	586,0	9 000	949,0	3 600 0	2 250,0

Table 4 *(continued)*

Nominal mass of the anchor	Proof test load	Nominal mass of the anchor	Proof test load	Nominal mass of the anchor	Proof test load	Nominal mass of the anchor	Proof test load
kg	kN	kg	kN	kg	kN	kg	kN
900	182,0	4 200	595,0	9 200	961,0	3 800 0	2 330,0
950	191,0	4 300	604,0	9 400	975,0	4 000 0	2 410,0
1 000	199,0	4 400	613,0	9 600	987,0	4 200 0	2 490,0
1 050	208,0	4 500	622,0	9 800	998,0	4 400 0	2 570,0
1 100	216,0	4 600	631,0	1 000 0	1 010,0	4 600 0	2 650,0
1 150	224,0	4 700	638,0	1 050 0	1 040,0	4 800 0	2 730,0

Stress-bearing areas shall be checked after a pull force load test.

6.3 Holding power test

A holding power test shall be carried out on three kinds of experimental ground, i.e. muddy ground, sandy ground and rocky ground, as specified in Annex C.

7 Marking

Qualified anchors shall be marked or branded on the shank and flukes with the following:

a) Class Society approved mark and certificate serial number;

b) mass of the anchor;

c) HHBP mark for high holding power balance anchors.

8 Certificate

Qualified anchors should be provided with inspection certificates containing at least the following:

a) raw material quality certificate;

b) physical and chemical properties test report;

c) heat treatment record and NDT record;

d) drop tests report and proof testing report.