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Ships and marine technology — Navigation and shallow-water engineering vessels — Anchor winches

Navires et technologie marine — Vaisseaux d'ingénierie de navigation en eau peu profonde — Treuils d'ancres

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

Ships and marine technology — Navigation and shallow-water engineering vessels — Anchor winches

1 Scope

This International Standard specifies requirements for the design, construction, operation, safety, performance, and inspection rules of anchor winches.

It is applicable to anchor winches, with hydraulic or electric drive, installed at the stern of seagoing transport ships. It can be used as a reference for shallow-water engineering vessels and inland ships.

It is only applicable to anchor winches with wire ropes used for anchor handling.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2408:2004, *Steel wire ropes for general purposes — Minimum requirements*

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

ISO 4413, *Hydraulic fluid power — General rules for the application of equipment to transmission and control systems*

ISO 6482, *Shipbuilding — Deck machinery — Warping end profiles*

ISO 7825, *Shipbuilding — Deck machinery — General requirements*

IEC 60092 (all parts), *Electrical installations in ships*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

3 Terms and definitions

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

3.1 Technical terms

3.1.1
nominal size of anchor winches
represented by 1/10 of the weight (kg) of the ordinary stockless anchor applicable to anchor winches

3.1.2
working load of anchor winches
F_W
maximum pull measured at the drum exit as the winch anchors at the nominal recovery speed with a rope wound on the drum in a single layer

3.1.3
nominal recovery speed
recovery speed measured when the pull of the anchor winch is the working load with a rope wound on the drum in a single layer

3.1.4
light line speed
recovery speed measured when the winch is bearing the pull not less than 25 % of the working load with a rope wound on the drum in a single layer

3.1.5
overload pull
maximum anchoring pull that the drum of the winch can bear for a short period of time

Note 1 to entry: Such pull is measured with a rope wound on the drum in a single layer.

3.2 Types of winches

3.2.1
left-hand anchor winch
winch where the reduction gear or drive of the drum is on the left-hand side of the drum, in relation to an observer situated on the side of the motor, power supply, or controller

Note 1 to entry: See Figure 1.

3.2.2
right-hand anchor winch
winch where the reduction gear or drive of the drum is on the right-hand side of the drum, in relation to an observer situated on the side of the motor, power supply, or controller

Note 1 to entry: See Figure 2.

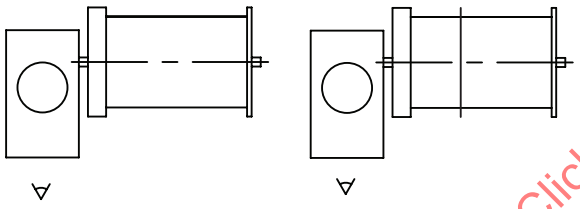

Figure 1 — Left-hand anchor winch

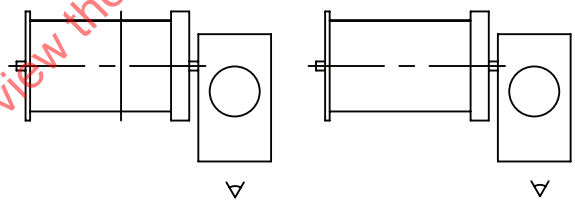

Figure 2 — Right-hand anchor winch

4 Design and operation

4.1 General requirements

Anchor winches shall meet the general requirements for deck equipment in ISO 7825.

NOTE Attention is drawn to the existence of safety regulations in certain countries and organizations affecting anchor winch controls.

4.2 Strength requirements

The strength of the component parts of the winch shall be capable of withstanding all loads of the respective nominal sizes of anchor winches as specified in Table 1 and Table 2.

4.3 Material stresses

4.3.1 The allowable calculated stresses of any drive part under the working load, based on simple elastic theory, shall not be greater than 0,4 times the upper yield strength (R_{eH}) or the 0,2 % proof strength, non-proportional extension ($R_{P0,2}$) of the material.

4.3.2 With the maximum torque of the prime mover or set pressure of the safety valve, the allowable stresses of any affected part shall not be greater than 0,9 times the upper yield strength (R_{eH}) or the 0,2 % proof strength, non-proportional extension ($R_{P0,2}$) of the material.

4.3.3 The allowable calculated stresses of any affected part under the holding load shall not be greater than 0,9 times the upper yield strength (R_{eH}) or the 0,2% proof strength, non-proportional extension ($R_{P0,2}$) of the material.

4.4 Steel wire ropes

4.4.1 Construction of steel wire ropes

Steel wire ropes shall have the construction of applicable use. For design purposes, the drum shall be based on 6 × 36WS-IWRC or 6 × 41WS-IWRC steel rope manufactured from 1 960 N/mm^2 or 1 770 N/mm^2 tensile grade wire in accordance with of ISO 2408, C.9. The above requirement does not preclude the use of other types of rope in service.

4.4.2 Minimum breaking strength of steel wire ropes

The minimum breaking strength of steel wire ropes is 9~10 times the calculated value of the overload pull in 5.2.

4.5 Drum design

4.5.1 Drum diameter

The drum diameter shall be not less than 16 times the diameter of the design rope.

4.5.2 Drum capacity

The normal capacity is 110 m, and the high capacity is 200 m.

NOTE It does not preclude the use of drums with other drum capacity in service.

4.5.3 Drum length

The drum length shall meet the following requirements.

a) The drum length of normal-capacity drums shall be such that the total length of the design rope can be accommodated in not more than five layers. The overload pull can at most be applied to the fourth layer.

b) The length of the running part of the drum shall be enough for winding of at least 10 turns on each layer.

4.5.4 Drum flange height

a) When all the rope is reeled on a drum, the flange shall project at least 1,5 times the rope diameter above the outermost layer.

b) When calculating the drum size, layers of rope shall be superimposed directly upon each other without a half rope diameter offset between adjacent layers.

4.5.5 Drum clutch

The clutch shall be mounted between the drum and drive equipment. It shall be provided with a reliable locking device; if it is power driven, the manually operated device shall be provided as well.

4.6 Warping-ends

The anchor winch may be designed to be provided with or without warping-ends; the profile of warping-ends shall conform to the requirement of ISO 6482.

4.7 Brakes

4.7.1 Automatic braking system

4.7.1.1 Electric anchor winches shall be provided with an automatic braking system which operates when bringing the operating device to the stop or braking position. The brake shall be capable of holding a load on the hawser of 1,5 times the working load and of stopping the drum rotation from its maximum speed without suffering damage.

4.7.1.2 For anchor winches of other drive types, a proper automatic braking system shall be used if agreed between the purchaser and manufacturer. The braking system shall be capable of holding a load on the hawser of at least 1,3 times the working load.

4.7.2 Drum brakes

Each drum shall be provided with a manual brake; if this brake is power operated, it shall also be capable of manual operation. The braking torque shall be enough for maintaining the holding load specified in 5.6.

4.8 Safety and protection

4.8.1 When being subjected to the impact or over-torque, the prime mover and drive shall be provided with the following safety protection:

a) overpressure protection for hydraulic drives;

b) torque-limiting device between the motor and drive;

c) overload protection for motors.

4.8.2 The minimum ingress protection of electrical equipment on the weather deck is IP56 of IEC 60529, or the ingress protection applicable to the installation and operation environment of the equipment.

4.8.3 The safety and protection devices of anchor winches shall also conform to the requirements of ISO 7825.

4.9 Speed control

a) The speed of the winch shall be adjustable between stop and maximum within each gear step. It shall be possible to adjust the speed while the winch is working.

b) The drum brake shall be capable of controlling the rendering speed during the non-powered anchoring.

4.10 Operating devices

4.10.1 The operating device of anchor winches shall conform to the requirements of ISO 7825.

4.10.2 For anchor winches remotely operated, emergency stop mechanisms shall be installed beside the winch, to cut off the power of the winch and automatically brake if the power sources fail.

4.10.3 Every remotely operable control component shall be able to be operated manually beside the winch.

4.10.4 Emergency stop mechanisms shall be arranged in the accessible place for the operator, and the specific installation position may be determined in the agreement.

4.10.5 Whatever the form of motive power, the operating devices shall, when under manual control, be arranged to return to the braking or stop position automatically, unless otherwise agreed between the purchaser and manufacturer.

4.11 Drive equipment

4.11.1 Electrical drives and control equipment shall conform to the requirements of IEC 60092.

4.11.2 Hydraulic drives and control equipment shall conform to the requirements of ISO 4413.

4.11.3 The prime mover of winches shall meet the following conditions:

a) anchor winches shall be driven with an independent prime mover, and be able to control the hauling, veering, and speed of the rope;

b) having the capacity of running for 30 min continuously under working load at nominal recovery speed, and running for 2 min continuously under overload pull at reduced speed.

5 Detailed specification

5.1 Performance specifications of anchor winches

For performance specifications of anchor winches, see Tables 1 and 2. The overload pull and working load shall be the minimum values.

Rope diameter and minimum breaking strength in Tables 1 and 2 are recommended values; the use of other diameters or strength grades of steel wire rope is not precluded in service, if agreed between the purchaser and manufacturer.

Table 1 — Performance specifications of anchor winch with 1 770 N/mm² tensile grade wire

Nominal size	Overload pull kN	Working load kN	Design rope diameter mm	Design minimum breaking strength of rope kN	Holding load kN	
					With rope stopper	Without rope stopper
18	8,283	4,142	11	76,2	34,3	61,0
24	11,093	5,546	13	106	47,7	84,8
30	13,770	6,885	14	124	55,8	99,2
36	16,660	8,330	16	161	72,5	128,8
42	19,599	9,799	18	204	91,8	163,2
48	22,105	11,052	18	204	91,8	163,2
57	26,343	13,172	20	252	113,4	201,6
66	30,628	15,314	22	305	137,3	244,0
78	36,227	18,114	24	363	163,4	290,4
90	41,858	20,929	26	426	191,7	340,8
102	46,870	23,435	26	426	191,7	340,8
114	52,578	26,289	28	494	222,3	395,2
129	59,693	29,847	30	567	255,2	453,6

Table 1 *(continued)*

Nominal size	Overload pull kN	Working load kN	Design rope diameter mm	Design minimum breaking strength of rope kN	Holding load kN	
					With rope stopper	Without rope stopper
144	66,623	33,312	32	645	290,3	516,0
159	73,878	36,939	34	728	327,6	582,4
174	80,143	40,071	34	728	327,6	582,4
192	88,388	44,194	36	817	367,7	653,6
210	96,849	48,424	38	910	409,5	728,0
228	105,341	52,671	40	1 010	454,5	808,0
246	114,143	57,071	42	1 100	495,0	880,0
264	121,661	60,830	42	1 100	495,0	880,0
285	131,282	65,641	44	1 220	549,0	976,0
306	140,610	70,305	45	1 280	576,0	1 024,0
330	152,397	76,198	48	1 450	652,5	1 160,0
354	163,936	81,968	50	1 580	711,0	1 264,0
378	173,960	86,980	50	1 580	711,0	1 264,0
405	186,319	93,160	52	1 700	765,0	1 360,0
432	199,297	99,649	54	1 840	828,0	1 472,0
459	211,502	105,751	56	1 980	891,0	1 584,0
489	226,043	113,021	58	2 120	954,0	1 696,0
525	242,006	121,003	60	2 270	1 021,5	1 816,0

Table 2 — Performance specifications of anchor winch with 1 960 N/mm² tensile grade wire

Nominal size	Overload pull kN	Working load kN	Design rope diameter mm	Design minimum breaking strength of rope kN	Holding load kN	
					With rope stopper	Without rope stopper
18	8,283	4,142	11	84,4	38,0	67,5
24	10,935	5,467	12	100,0	45,0	80,0
30	13,770	6,885	14	137,0	61,7	109,6
36	16,660	8,330	16	179,0	80,6	143,2
42	19,166	9,583	16	179,0	80,6	143,2
48	22,105	11,052	18	226,0	101,7	180,8
57	26,096	13,048	19	252,0	113,4	201,6
66	30,102	15,051	20	279,0	125,6	223,2
78	35,640	17,820	22	338,0	152,1	270,4
90	41,239	20,620	24	402,0	180,9	321,6
102	46,870	23,435	26	472,0	212,4	377,6
114	51,882	25,941	26	472,0	212,4	377,6
129	58,843	29,421	28	547,0	246,2	437,6
144	65,958	32,979	30	628,0	282,6	502,4
159	72,888	36,444	32	715,0	321,8	572,0

Table 2 *(continued)*

Nominal size	Overload pull kN	Working load kN	Design rope diameter mm	Design minimum breaking strength of rope kN	Holding load kN	
					With rope stopper	Without rope stopper
174	79,153	39,576	32	715,0	321,8	572,0
192	87,661	43,830	34	807,0	363,2	645,6
210	95,905	47,953	36	904,0	406,8	723,2
228	104,367	52,183	38	1 010,0	454,5	808,0
246	111,884	55,942	38	1 010,0	454,5	808,0
264	120,377	60,188	40	1 120,0	504,0	896,0
285	130,431	65,216	42	1 230,0	553,5	984,0
306	140,053	70,026	44	1 350,0	607,5	1 080,0
330	150,633	75,317	45	1 410,0	634,5	1 128,0
354	161,523	80,762	46	1 480,0	666,0	1 184,0
378	172,444	86,222	48	1 610,0	724,5	1 288,0
405	185,236	92,618	50	1 740,0	783,0	1 392,0
432	197,441	98,721	52	1 890,0	850,5	1 512,0
459	208,718	104,359	52	1 890,0	850,5	1 512,0
489	223,104	111,552	54	2 030,0	913,5	1 624,0
525	239,067	119,534	56	2 190,0	985,5	1 752,0
561	256,114	128,057	58	2 350,0	1 057,5	1 880,0
600	273,330	136,665	60	2 510,0	1 129,5	2 008,0

5.2 Overload pull

The overload pull F_{max} of anchor winches shall be calculated according to Formula (1):

$$F_{max} = \frac{K_1 \times (K_2 \times G_1 + G_2) \times K_3}{K_4} \times \frac{9,8}{1\,000}, kN \quad (1)$$

where

G_1 is the weight of an ordinary stockless anchor, kg;

G_2 is the weight of a 100 m-long wire rope, kg;

K_1 is the multi-layer winding factor of wire ropes, taken as 1,27;

K_2 is the holding force coefficient of ordinary stockless anchors, taken as 2,70;

K_3 is the buoyancy coefficient of seawater, taken as 0,87;

K_4 is the friction coefficient of fairleads, taken as 0,70.

5.3 Working load

The working load F_w of the winch shall be 1/2 the overload pull in 5.2.

5.4 Nominal recovery speed

The nominal recovery speed of the winch shall be not less than 0,15 m/s.

5.5 Light line speed

The light line speed of the winch shall be twice the nominal recovery speed.

NOTE The value can be agreed upon between the manufacturer and purchaser.

5.6 Holding load

— With a rope stopper: 45 % of the breaking strength of the rope.

— Without a rope stopper: 80 % of the breaking strength of the rope.

6 Acceptance tests

6.1 General

Type tests or individual tests shall be carried out after anchor winches are assembled at the manufacturer. Where tests are required in excess of the following requirements, these shall be agreed between the purchaser and manufacturer.

NOTE 1 Some tests can take place at the factory or on board, as agreed by the manufacturer and purchaser.

NOTE 2 Attention is drawn to the requirements of national authorities or classification societies.

6.2 Type test

This test may be replaced by a prototype test certificate if agreed by the manufacturer and purchaser. The type test shall be carried out as follows.

6.2.1 Operation under no-load

The winch shall run for 30 min, 15 min continuously in each direction under no-load at the speed not less than the nominal recovery speed; after testing for 30 min, it shall run under no-load for 10 min at the light line speed, 5 min in each direction at each step of speed.

6.2.2 Working load pull test

The winch shall make hoisting and rendering operations continuously for 30 min under the working load specified in 5.3 and at the nominal recovery speed specified in 5.4.

6.2.3 Light line speed test

The winch shall make hoisting and rendering operations continuously for 10 min under the load specified in 3.1.4.

6.2.4 Overload pull test

The winch shall operate under the overload pull specified in 5.2 for 2 min.

6.2.5 Automatic braking system test

This test shall be carried out once or twice according to the requirements of 4.7.1.

