BS ISO 3730:2012

BSI Standards Publication

Shipbuilding and marine structures — Mooring winches

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National foreword

This British Standard is the UK implementation of ISO 3730:2012. It supersedes BS 7471:1991, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SME/32/-/4, Ships and marine technology - Outfitting and deck machinery.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Shipbuilding and marine structures — Mooring winches

Construction navale et structures maritimes — Treuils d'amarrage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3730 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

This third edition cancels and replaces the second edition (ISO 3730:1988), which has been technically revised.

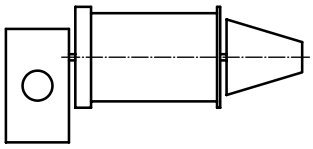
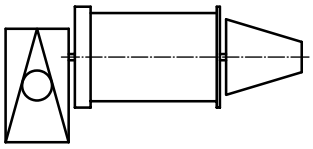
Shipbuilding and marine structures — Mooring winches

1 Scope

This International Standard specifies requirements for the design, operation, performance and acceptance tests of automatic and non-automatic mooring winches, with hydraulic, electric or steam drive, which fulfil the functions of manoeuvring, holding and storing mooring ropes on a single drum.

Such winches can also be used for warping purposes. See Table 1.

Table 1 — Functions

Operation	Non-automatic mooring winch	Automatic mooring winch
		
Mooring	On drum	
Rope storing	On drum	
Tension-maintaining through brake	On drum	
Warping	Optional on warping-end or on drum	
Tension-maintaining through automatic device		On drum

2 Normative references

The following referenced documents are indispensable for the application 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 2408, *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
right-hand winch
winch where the drum drive 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 See Figure 1.

3.2
left-hand winch
winch where the drum drive 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 See Figure 1.

3.3
central winch
winch where the drum drive is between the two drums

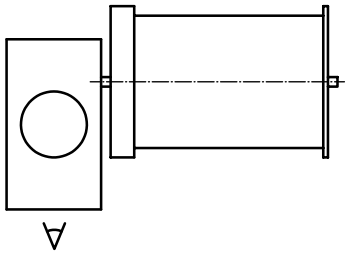
NOTE See Figure 1.

3.4
single drum winch
winch where one drum is driven by drive equipment

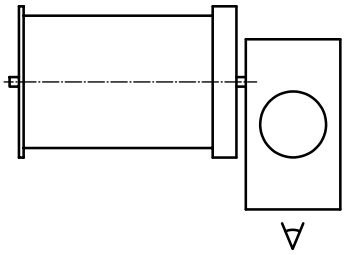
NOTE See Figure 1.

3.5
multiple drum winch
winch where two or more drums are driven by drive equipment

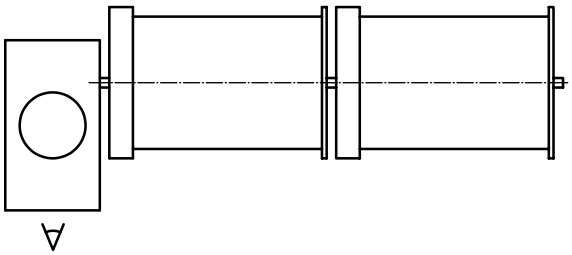
NOTE See Figure 1.



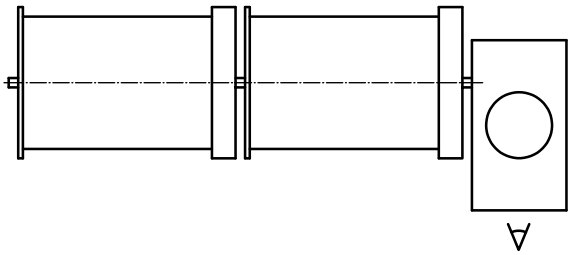
Left-hand single drum winch



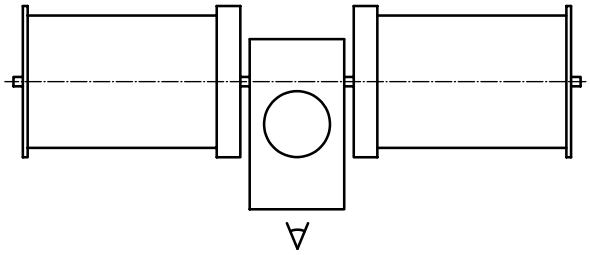
Right-hand single drum winch



Left-hand multiple drum winch



Right-hand multiple drum winch



Central multiple drum winch

Figure 1 — Winch type diagram

4 Design and operation

4.1 General requirements

Mooring winches shall meet the general requirements for deck equipment in ISO 7825 and the specific requirements given in 4.2 to 4.8.

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

4.2 Material stresses

The winch manufacturer shall be responsible for determining the strength requirements of the component parts of the winch to withstand all loads of the respective nominal sizes of mooring winches, as specified in Table 2.

4.3 Strength requirements

4.3.1 Winch drum load

The allowable calculated stresses of any affected part of the winch, 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 Maximum torque of prime mover

The allowable stresses in the affected parts 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 Winch holding load

The allowable calculated stresses of the affected parts 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.

4.3.4 Other requirements

Related requirements of OCIMF should also be satisfied for mooring winches used in tankers.

4.4 Operating devices

The direction of motion of the operating devices shall be such that the rope is hauled-in by clockwise movement at a hand-wheel or crank handle or alternatively movement of a hand-lever towards the operator, and vice versa.

If it has been agreed between the purchaser and manufacturer, the rope may be hauled in by anti-clockwise movement at a hand-wheel or crank handle.

The direction of motion of the operating devices shall be clearly and permanently marked.

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.

4.5 Brakes

4.5.1 Automatic braking system

Electric winches shall be provided with an automatic braking system which operates when bringing the operating device to the stop or braking position, and also when there is no power on the winch. The brake shall be capable of holding a load on the hawser of 1,5 times the drum load and of stopping the drum rotation from its maximum speed without suffering damage.

For winches of hydraulic or steamdrive, when bringing the operating device to the stop or braking position, and also when there is no power on the winch, the drum shall be capable of holding a load on the hawser of 1,25 times the drum load, and the movement of the rope shall be controlled within 1,0 m/min.

4.5.2 Drum brake

All drums shall be provided with a drum brake capable of maintaining the holding load specified in 5.2.

For mooring winches used in tankers, the structure and performance of drum brakes should satisfy the requirements of OCIMF.

For tankers, they should also satisfy the requirement of OCIMF that each ship should reserve a complete set of brake test devices.

4.6 Drum design

4.6.1 Design rope

4.6.1.1 Steel wire ropes

For design purposes, the drum shall be based on 6×36WS-IWRC or 6×41WS-IWRC steel rope manufactured from 1 770 N/mm^2 tensile grade wire in accordance with C.9 of ISO 2408.

The above requirement does not preclude the use of other types of steel wire rope in service.

4.6.1.2 Synthetic fibre ropes

General synthetic fibre ropes or high modulus synthetic fibre mooring lines may be used.

4.6.2 Drum diameter

4.6.2.1 Round strand wire ropes

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

4.6.2.2 Synthetic fibre mooring lines

The drum diameter shall be not less than 6 times the diameter of the synthetic fibre mooring line.

For high modulus synthetic fibres, the ratio of drum diameter and rope shall meet the requirements of the rope manufacturer.

4.6.3 Drum capacity

Drum capacity shall be of two capacities, “normal” and “high”. The minimum length of design rope to be stored on normal-capacity drums is given in column 12 of Table 2. High-capacity drums shall store twice the length of rope of normal-capacity drums.

4.6.4 Drum length

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. If it has been agreed between the manufacturer and purchaser, the layers should be applicable to other layers.

b) The drum length of high-capacity drums shall be such that the total length of the design rope can be accommodated in not more than eight layers.

c) The large loads should not be applied while more than four layers of rope are reeled on the drum, otherwise short life of rope will result; it is recommended that a split drum should be used, and the number of layers on the storage section may be increased.

d) The length of the working part of a split drum: for steel wire ropes and high modulus synthetic fibre ropes, the length of the working part of the drum shall be enough for winding of 10 turns; for general synthetic fibre ropes, it shall be enough for winding of 5-6 turns.

4.6.5 Drum flange height

a) For steel wire ropes, when all the rope is reeled on a normal-capacity drum, the flange shall project at least 1,5 times the rope diameter above the outermost layer. For synthetic fibre ropes, the flange shall project at least 1,0 time the rope diameter above the outermost layer.

b) The flange height of high-capacity drums shall be such that the design rope above the outermost layer may be fully stored without projecting beyond the flanges.

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

4.6.6 Drum clutch

The clutch shall be mounted between the drum and drive equipment.

4.7 Auxiliary equipment

4.7.1 Rope guide

An automatic rope guide may be fitted on the mooring winches if proposed by the purchaser.

4.7.2 Warping-ends

The profile of warping-ends shall be in accordance with ISO 6482 and their diameter shall conform to the requirement of column 11 of Table 2.

4.8 Drive equipment

4.8.1 Electrical drives and control equipment

Electrical drives and control equipment shall conform to the requirements of IEC 60092. Deck-mounted enclosures shall conform to IEC 60529 IP56, or the grade of protection in line with the environment for installation and use of equipment.

4.8.2 Hydraulic drives and control equipment

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

4.8.3 Prime mover of winches

The prime mover of winches shall meet the following conditions:

a) Mooring winches shall be driven with an independent prime mover, and be able to control the hauling, veering and speed of the drum.

b) Having the capacity of running for 30 min continuously under drum load at nominal mooring speed.

c) Having an overload protector.

d) Stalling load shall be not more than 50 % of the breaking strength of the design rope.

5 Performance specifications

For performance specifications of mooring winches, see Table 2.

5.1 Drum load

The drum load shall be within 0,22 to 0,33 times the breaking strength of the design rope when operating at the corresponding nominal mooring speeds.

5.2 Holding load

The holding load shall be not less than 0,8 times the breaking strength of the design rope.

5.3 Recovery load

The recovery load shall be not less than 0,5 times the drum load.

5.4 Rendering load

The rendering load shall be not more than 0,5 times the breaking strength of the design rope.

5.5 Speeds

5.5.1 Nominal mooring speed

The minimum design speed for the respective nominal sizes of mooring winches shall be in accordance with that specified in Table 2.

5.5.2 Light-line speed

The minimum light-line speed for the respective nominal sizes of mooring winches shall be in accordance with that specified in Table 2.

For some types and sea routes, it may be more than 0,5 m/s; the agreement should be made between the user and manufacturer when the contract is signed.

5.5.3 Creep speed

Creep speed shall be less than 0,5 times the nominal mooring speed and not more than 0,15 m/s.

6 Acceptance tests

6.1 General

Type tests or individual tests shall be carried out after mooring winches are assembled at the manufacturer.

6.2 Type test

This test may be replaced by a prototype test certificate if agreed by the manufacturer and purchaser. Where tests are required in excess of the type test, these shall be agreed between the purchaser and manufacturer. The type test shall be carried out as follows.

6.2.1 Operation under no-load

Running for 30 min, 15 min continuously in each direction, at light-line speed.

6.2.2 Operation under load

Hauling and veering of the drum load of the winch for 30 min continuously at nominal mooring speed.

6.2.3 Automatic brake system test

This test shall satisfy the requirements of 4.5.1.

6.2.4 Automatic tension test for automatic mooring winches

Verify the recovery and rendering loads.

6.2.5 Holding load test

To be tested by applying the holding load to a rope let off the drum, whereupon the drum shall not rotate within 2 min.

Related requirements of OCIMF shall also be satisfied for mooring winches used in tankers.

While testing, the following shall be checked:

a) tightness against oil leakage;

b) presence of abnormal temperature of bearings;

c) measurement of actual speed;

d) presence of abnormal noise;

e) power consumption.

Where tests are required in excess of the type test, these shall be agreed between the purchaser and manufacturer.

6.3 Individual test

6.3.1 Operation under no-load

Running for 30 min, 15 min continuously in each direction, at light-line speed.

6.3.2 Automatic brake system test

This test shall satisfy the requirements of 4.5.1.

It may be carried out on-board ship if agreed between the purchaser and manufacturer.

6.3.3 Operation under load

Hauling and veering of the drum load of the winch for 30 min continuously.

This test may be omitted if agreed between the purchaser and manufacturer.

6.3.4 Inspection for the manipulation of drum brake and clutch

Check the operational flexibility of the control lever (handwheel) for drum brake and clutch.

6.3.5 Drum brake holding load test

To be tested by applying the holding load to a rope let off the drum, whereupon the drum shall not rotate.

Calculation methods, test data of special brake testers or type tests may be used instead if agreed between the purchaser and manufacturer.

Related requirements of OCIMF should also be satisfied for mooring winches used in tankers.

While testing, the following shall be checked:

a) tightness against oil leakage;

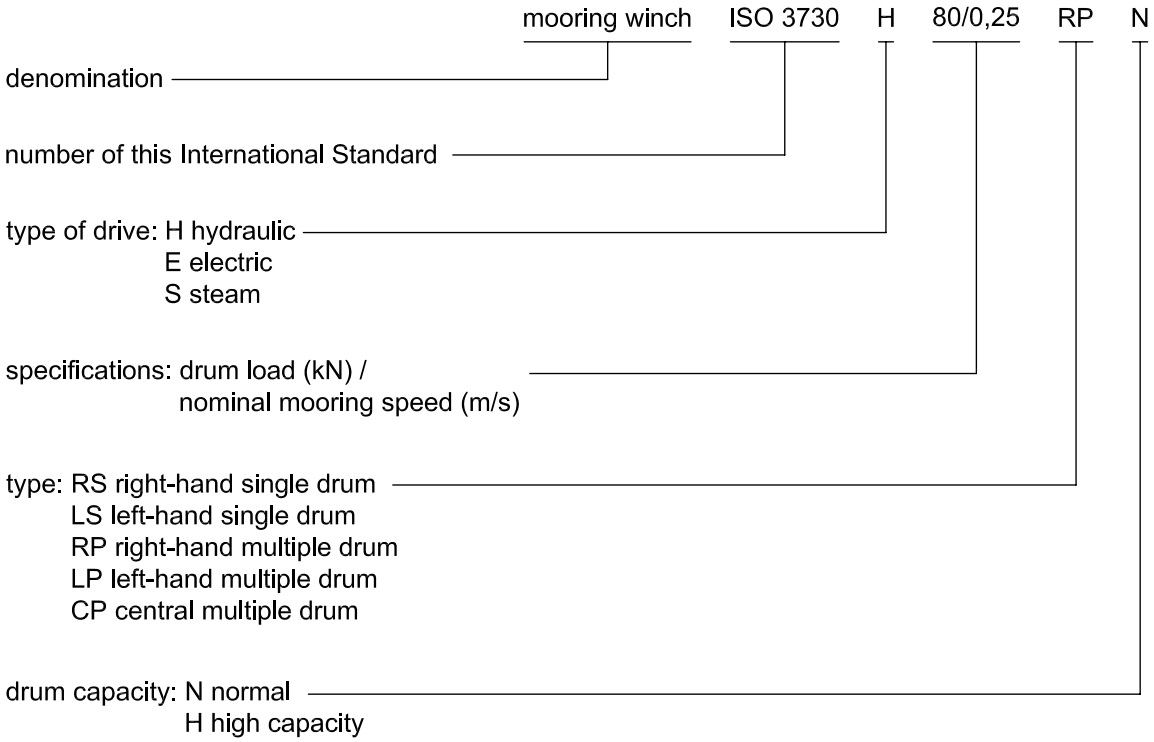
b) temperature of bearings;

c) presence of abnormal noise;

d) speed of drum rotation.

7 Designation system

7.1 Designation of product models



EXAMPLE Designation of a mooring winch according to ISO 3730, with hydraulic drive, normal drum capacity, right hand multiple drums model, drum load 80 (kN)/nominal mooring speed 0,25 (m/s):

Mooring winch ISO 3730-H-80/0.25-RP-N

7.2 Nameplate

Mooring winches shall be permanently mounted with the corrosion-resistant nameplate on their visible position with the following information:

a) product name;

b) drum load;

c) nominal mooring speed;

d) holding load;

e) manufacturing number;

f) manufacturing date;

g) manufacturer name.

7.3 Marking

Mooring winches complying with this International Standard shall be permanently marked with the following information:

Scope of the breaking strength of rope (MBL_{min} and MBL_{max}) (unit: kN).

Table 2 — Performance specifications

1	2	3 [a]	4 [a]	5 [a]	6 [b]	7 [b]	8	9 [c]	10 [c]	11 [d]	12	
Nominal size	**Drum load**	**Nominal mooring speed** min.	**Light line speed** min.	**Creep speed** max.	**Design rope diameter**	**Minimum breaking strength of rope**	**Holding load** min.	**Recovery load** min.	**Rendering load** max.	**Minimum diameter of drum and warping-ends**	**Drum capacity**	
											normal	**high**
	see 5.1	see 5.5.1	see 5.5.2	see 5.5.3	see 4.6.1	see 4.6.1	see 5.2	see 5.3	see 5.4	see 4.6.2/ 4.7.2	see 4.6.3	
	kN	m/s	m/s	m/s	mm	kN	kN	kN	kN	mm	m	m
5	50	0,25	0,5	0,125	18	204	163	25	100	288	180	360
6.3	63	0,25	0,5	0,125	20	252	200	31,5	126	320	180	360
8	80	0,25	0,5	0,125	22	305	240	40	150	352	200	400
10	100	0,25	0,5	0,125	24	363	290	50	180	384	200	400
12	125	0,2	0,5	0,1	26	426	341	62,5	210	416	200	400
16	160	0,2	0,5	0,1	32	645	516	80	320	512	250	500
20	200	0,16	0,5	0,08	36	817	654	100	408	576	250	500
25	250	0,16	0,5	0,08	40	1 010	808	125	500	640	250	500
32	315	0,13	0,5	0,065	44	1 220	976	157,5	610	704	250	500
40	400	0,13	0,5	0,065	48	1 450	1 160	200	720	768	250	500

[a] Only applicable to manually controlled winches.

[b] The selection of design rope diameter and minimum breaking strength is based on 6×36WS-IWRC or 6×41WS-IWRC in C.9 of ISO 2408; the selection of other types of ropes shall meet the requirements of 5.2.

[c] Only applicable to automatically controlled winches.

[d] The values in the table are applicable to steel wire ropes, and the minimum drum diameter of fibre mooring lines is 6 times the rope diameter. The diameter of warping-ends using fibre mooring lines is selected according to ISO 6482.

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