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Shipbuilding — Mooring winches

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FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3730 was drawn up by Technical Committee ISO/TC 8, *Shipbuilding*, and circulated to the Member Bodies in April 1975.

It has been approved by the Member Bodies of the following countries :

Australia	Germany	Poland
Austria	Ireland	Romania
Belgium	Israel	South Africa, Rep. of
Brazil	Italy	Spain
Bulgaria	Japan	Sweden
Czechoslovakia	Korea, Rep. of	Turkey
Finland	Netherlands	United Kingdom
France	Norway	Yugoslavia

No Member Body expressed disapproval of the document.

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Shipbuilding — Mooring winches

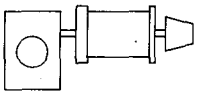
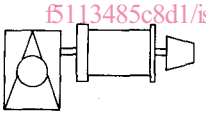
1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the characteristics of automatic and non-automatic mooring winches, having electric, hydraulic or steam drive, which fulfil the functions of manoeuvring, holding and storing mooring ropes on a single drum.

Such winches may also be used for warping purposes.

The functions of mooring winches covered by this International Standard are illustrated in table 1.

TABLE 1 — Functions

Operation	1 Non-automatic mooring winch	2 Automatic mooring winch
		
Mooring	X On drum	X On drum
Rope storing	X On drum	X On drum
Tension maintaining through brake	X On drum	X On drum
Warping	Optional. On warping-end or on drum	Optional. On warping-end or on drum
Tension maintaining through automatic device		X On drum

2 REFERENCE

ISO 2408, *Steel wire ropes for general purposes — Characteristics.*

3 DEFINITIONS

3.1 Nominal size

The nominal size of a mooring winch corresponds to the drum load at its nominal speed as given in the performance table (table 2).

3.2 Loads

3.2.1 drum load; rated load; hauling load; hoisting load : The maximum rope tension (in kilonewtons), measured at the drum exit when the winch is hoisting or hauling in at the nominal speed with the rope wound on the drum in a single layer (see 3.3.1).

3.2.2 holding load; brake holding load : The maximum tension (in kilonewtons) that can be maintained by a braking/locking system in the first layer.

3.2.3 stalling load : The maximum rope tension (in kilonewtons), measured at the drum exit when the drum ceases to rotate in the direction of haul, the prime mover being set for maximum torque and the rope being wound on the drum in a single layer.

FOR AUTOMATIC MOORING WINCHES ONLY

3.2.4 recovery load : The maximum rope tension (in kilonewtons), measured at the drum exit when the drum commences to rotate in the direction of haul, the prime mover being set for maximum torque under automatic control and the rope being wound on the drum in a single layer.

3.2.5 rendering load : The maximum rope tension (in kilonewtons), measured at the drum exit when the drum just commences to rotate in the opposite direction to the applied driving torque, the prime mover being set for maximum torque in automatic control, with the rope wound on the drum in a single layer.

3.3 Speeds

3.3.1 nominal speeds; design speed; rated speed : The maximum speed (in metres per second) that can be maintained by the winch when it is applying the drum load (see 3.2.1).

3.3.2 light-line speed; no-load speed; slack-rope speed : The maximum rope speed (in metres per second) that the winch can maintain with the rope wound on the drum in a single layer, and with negligible tension on the rope.

3.3.3 creep speed : The minimum uniform speed (in metres per second), measured on the first layer, that the winch can maintain under drum load.

3.4 Right-hand and left-hand mooring winches

A winch is termed a right-hand winch in relation to an observer situated on the side of the motor, power supply or controller (in the case of a symmetrical winch), when the reduction gear or the drive for the drum is on the right-hand side of the drum (see figure 1).

A winch is termed a left-hand winch in relation to an observer situated on the side of the motor, power supply or controller (in the case of a symmetrical winch), when the reduction gear or the drive for the drum is on the left-hand side of the drum.

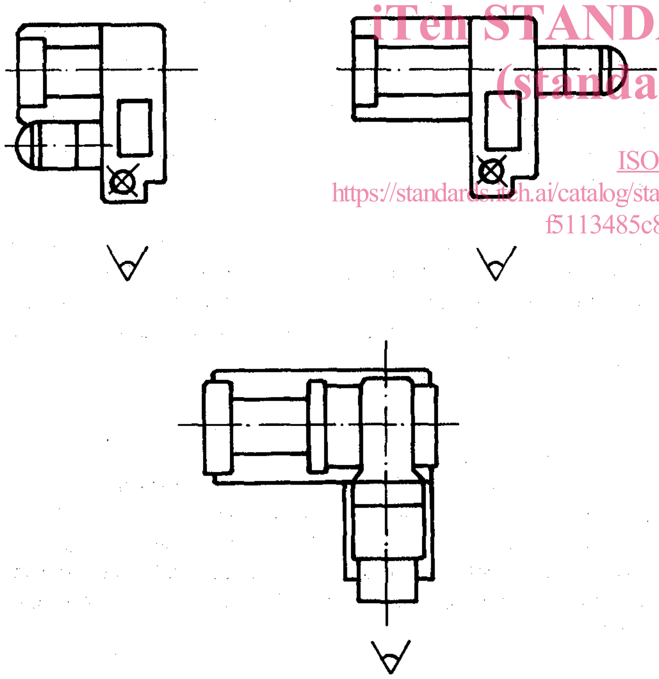


FIGURE 1 – **Examples of right-hand winches**

4 DESIGN AND OPERATION

4.1 Material stresses

The manufacturer of the winch 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, specified in table 2.

4.2 Basic calculation

4.2.1 *Drum load of the winch*

The allowable calculated stresses, based on simple elastic theory, of any part of the winch shall not be greater than 0,4 times the 0,2 % proof stress of the material.

4.2.2 *Maximum torque of prime mover corresponding to the most severe working conditions*

The allowable stresses in the affected parts shall not be greater than 0,9 times the 0,2 % proof stress of the material.

4.2.3 *Holding load of the winch*

The allowable calculated stresses of the affected parts (including the base plate) shall not be greater than 0,9 times the 0,2 % proof stress of the material.

4.3 Direction of motion of the operating devices

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

The direction of operation of all control handles shall be clearly and permanently marked.

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

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

4.4 Brakes

4.4.1 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 rotation of the drum at its maximum speed without suffering damage. For other types of drive, a suitable system of braking should be agreed upon between the purchaser and manufacturer. Such a system shall be capable of holding a load on the hawser of 1,5 times the drum load.

4.4.2 All winches shall be provided with a drum brake capable of maintaining the holding load of the winch.

4.5 Drum design

4.5.1 *Design rope*

For design purposes the drum shall be based on a Warrington-Seale steel-cored rope manufactured from 1 570 N/mm²

tensile grade wire in accordance with table 10 (column 6) of ISO 2408.

NOTE – The above requirement does not preclude the use of other types of rope in service.

The use of ropes having minimum tensile strengths of 1 420 N/mm^2, 1 570 N/mm^2 and 1 770 N/mm^2 has been approved by the International Association of Classification Societies (IACS).

4.5.2 *Drum diameter*

The drum diameter shall be not less than 16 times the diameter of the design rope, as specified in column 11 of table 2.

4.5.3 *Drum capacity*

Drums 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.

4.5.4 *Drum length*

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 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.

Where a split drum is used, the number of layers on the storage section may be increased.

NOTE – Attention of users of the winch must be drawn to the possibility of damage occuring to the rope if large loads are applied while more than four layers of rope are reeled on the drum.

4.5.5 *Drum flange height*

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 outer layer. The flange height of high-capacity drums shall be such that the design rope may be fully stored without projecting beyond the flanges when wound with the layers superimposed directly upon each other (i.e. without a half rope diameter offset between adjacent layers).

4.5.6 *Drum clutch*

The drum shall be declutchable from the drive unless otherwise agreed between the purchaser and the manufacturer.

4.6 Auxiliary equipment

4.6.1 *Rope guide*

An automatic rope guide may be fitted on the drum if agreed between purchaser and manufacturer.

4.6.2 *Warping-ends*

A winch may be specified with or without warping-ends. A warping-end when fitted shall have a diameter not less than that specified in column 11 of table 2.

4.6.3 *Fibre-rope handling gear*

A winch may be specified with or without fibre-rope handling gear.

5 PERFORMANCE

The mooring winch shall be capable of exerting the hauling, holding, recovery and rendering loads according to its nominal size, as specified in table 2 and within the limitations specified in 5.1 to 5.4.

The device for automatic service may also enable smaller pre-set values of rendering and recovery loads to be obtained.

NOTE – For definitions of the following loads and speeds, refer to 3.2 and 3.3.

5.1 Drum load

The drum load shall be not greater than 0,33 times the breaking strength of the design rope when operating at the corresponding nominal 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 speed*

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

5.5.2 *Light-line speed*

The light-line speed, measured on the first layer on the drum, shall be not less than 0,5 m/s.

5.5.3 *Creep speed*

The creep speed shall be not more than 0,5 times the nominal speed and not more than 0,15 m/s.

6 ACCEPTANCE TESTS

6.1 Rules concerning testing at manufacturer's works for the acceptance of the manufacturer and purchaser

6.1.1 *Type testing*

One winch of each batch shall be tested. This test may be replaced by a prototype test certificate if agreed by the manufacturer and purchaser.

The test shall be carried out as follows :

1) Operation under load : Hauling and veering of the drum load of the winch for 30 min continuously.

2) Holding test : To be tested by applying the holding load to a rope led off the drum, when the drum shall not rotate. This may be carried out on board ship if agreed between purchaser and manufacturer.

3) Automatic brake system test : This test shall satisfy the requirements of 4.4. It may be carried out on board ship if agreed between purchaser and manufacturer.

4) Automatic controls : Verify the recovery and rendering loads.

5) While testing, the following should be checked :

a) presence of abnormal temperature of bearings;

b) measurement of actual speed;

c) presence of abnormal noise;

d) power consumption.

Where tests are required in excess of the type test, these should be agreed between the pruchaser and manufacturer at the time of the contract.

6.1.2 *Individual tests*

The following tests shall be carried out :

1) Operation under no load : Running for 30 min, 15 min continuously in each direction, at light-line speed.

2) Correct operation of brake system.

3) While testing, the following should be checked :

a) tightness against oil leakages;

b) temperature of bearings;

c) presence of abnormal noise;

d) power consumption;

e) speed of rotation of the drum.

6.2 On-board acceptance tests and inspections

It is recommended that the following inspections and tests be carried out on board the ship, to ensure that the winch is fully operable.

All tests shall be carried out under ship power.

6.2.1 *Running tests.*

The winch shall be run for 10 min at light-line speed, 5 min continuously in each direction.

6.2.2 *Bearings*

Bearing temperature rises shall be checked.

TABLE 2 – **Performance specifications**

1	2	3*	4*	5*	6	7	8	9**	10**	11	12	
Nominal size	**Drum load**	**Nominal 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.**	**Theoretical diameters 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 4.5.1	see 4.5.1	see 5.2	see 5.3	see 5.4	see 4.5.2 and 4.6.2	see 4.5.3	
	kN	m/s	m/s	m/s	mm	kN	kN	kN	kN	mm	m	m
5	50	0,25	0,5	0,125	18	181	150	25	90	288	180	360
8	80	0,25	0,5	0,125	22	271	220	40	135	352	200	400
12	125	0,20	0,5	0,100	26	378	310	60	189	416	200	400
16	160	0,20	0,5	0,100	32	573	470	80	286	512	250	500
20	200	0,16	0,5	0,080	36	725	590	100	362	576	250	500
25	250	0,16	0,5	0,080	40	895	730	125	447	640	250	500
32	315	0,13	0,5	0,065	44	1 080	880	155	540	704	250	500
40	400	0,13	0,5	0,065	48	1 290	1 050	200	645	768	250	500

* Only applicable to manually controlled winches.

** Only applicable to automatically controlled winches.