# INTERNATIONAL STANDARD

ISO
3730

Second edition
1988-12-15
Corrected and reprinted
1989-10-01

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

## Shipbuilding — Mooring winches

*Construction navale — Treuils d'amarrage*



Reference number
ISO 3730 : 1988 (E)

## 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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3730 was prepared by Technical Committee ISO/TC 8, *Shipbuilding and marine structures*.

This second edition cancels and replaces the first edition (ISO 3730 : 1976) and its Addendum 1 : 1981, of which it constitutes a minor revision.





Printed in Switzerland

# Shipbuilding — Mooring winches

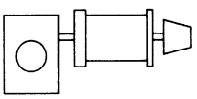
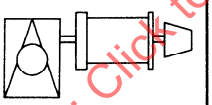
## 1 Scope

This International Standard specifies the characteristics of automatic and non-automatic mooring winches, with 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 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2408 : 1985, *Steel wire ropes for general purposes — Characteristics.*

ISO 2944 : 1974, *Fluid power systems and components — Nominal pressures.*

ISO 3828 : 1984, *Shipbuilding and marine structures — Deck machinery — Vocabulary.*

ISO 4413 : 1979, *Hydraulic fluid power — General rules for the application of equipment to transmission and control systems.*

ISO 6482 : 1980, *Shipbuilding — Deck machinery — Warping end profiles.*

ISO 7825 : 1985, *Shipbuilding — Deck machinery — General requirements.*

IEC 92, *Electrical installations in ships.*

IEC 529 : 1976, *Classification of degrees of protection provided by enclosures.*

## 3 Definitions

For the purposes of this International Standard, the definitions given in ISO 3828 and the following definitions apply.

**3.1 nominal size (of a mooring winch)**: Drum load at its nominal speed as given in the performance table (table 2).

### 3.2 Loads

**3.2.1 drum load** (deprecated: *rated load; hauling load; hoisting load*): 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 (brake) holding load**: Maximum tension, in kilonewtons, that can be maintained by a braking/locking system in the first layer.

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

**3.2.4 recovery load:** Maximum rope tension, in kilonewtons, measured at the drum exit when the drum commences to rotate in the haul direction, the prime mover being set for maximum torque under automatic control and the rope being wound on the drum in a single layer. [1)]

**3.2.5 rendering load:** 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. [1)]

### 3.3 Speeds

**3.3.1 nominal speed** (deprecated: *design speed; rated speed*): Maximum speed, in metres per second, that can be maintained by the winch when it is applying the drum load (3.2.1).

**3.3.2 light-line speed** (deprecated: *no-load speed; slack-rope speed*): 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:** Minimum uniform speed, in metres per second, measured on the first layer, that the winch can maintain under drum load.

### 3.4 Mooring winch side

**3.4.1 right-hand winch:** Winch where the reduction gear or the drum drive is on the right-hand side of the drum (see figure 1), in relation to an observer situated on the side of the motor, power supply or controller (in the case of a symmetrical winch).

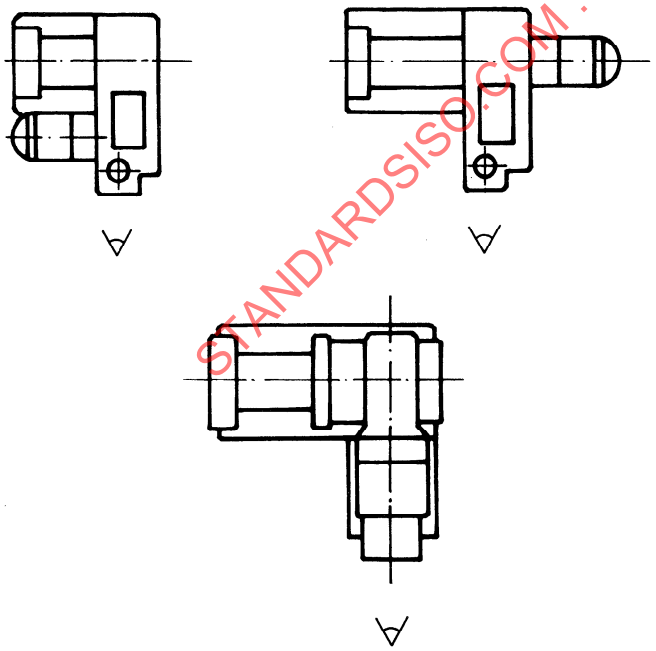


**Figure 1 — Examples of right-hand winches**

**3.4.2 left-hand winch:** Winch where the reduction gear or 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 (in the case of a symmetrical winch).

## 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.

It is recommended that synthetic ropes under tension should not be wound on a drum in more than one layer or short life will result.

NOTE — Attention is drawn to the existence of national safety regulations in certain countries 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 Basic calculation

#### 4.3.1 Winch drum load

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

#### 4.3.2 Maximum torque of prime mover corresponding to 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.

#### 4.3.3 Winch holding load

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.

### 4.4 Direction of motion of 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.

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.

1) Definitions 3.2.4 and 3.2.5 apply to automatic mooring winches only.

## 4.5 Brakes

**4.5.1** 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 drum rotation from its maximum speed without suffering damage. For other types of drive, a suitable braking system 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.

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

## 4.6 Drum design

### 4.6.1 Design rope

For design purposes the drum shall be based on a Warrington-Seale 6 × 36 steel-cored rope manufactured from 1 770 N/mm$^2$ tensile grade wire in accordance with Group 3 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).

### 4.6.2 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.

### 4.6.3 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.

### 4.6.4 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 occurring to the rope if large loads are applied while more than four layers of rope are reeled on the drum.

### 4.6.5 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 outermost 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).

### 4.6.6 Drum clutch

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

## 4.7 Auxiliary equipment

### 4.7.1 Rope guide

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

### 4.7.2 Warping-ends

A winch may may be specified with or without warping-ends; their profile shall be in accordance with ISO 6482 and their diameter shall be not less than the theoretical value given in column 11 of table 2.

When warping-ends are specified, the purchaser shall state whether the drum is to be declutchable or not. If only one warping-end is specified, its position (right or left) shall also be stated in the order.

### 4.7.3 Fibre-rope handling gear

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

For synthetic ropes or drums, the minimum winding ratios shall be:

- polyamide : 6
- polyester : 6
- polypropylene : 4

For synthetic ropes on warping-ends, see ISO 6482.

## 4.8 Drive equipment

**4.8.1** Electrical drives and control quipment shall conform to the requirements of IEC 92. Deck-mounted enclosures shall conform to IEC 529 IP 56.

**4.8.2** Hydraulic drives and control equipment shall conform to the requirements of ISO 4413. System nominal pressure shall be selected from ISO 2944, and the drive shall operate at a pressure 10 % below the selected nominal pressure, if agreed between the manufacturer and purchaser.

# 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 preset values of rendering and recovery loads to be obtained.

NOTE — For definitions of the loads and speeds in 5.1 to 5.5.3, refer to 3.2 and 3.3 respectively.

### 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 acceptance by 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:

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

b) 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 the purchaser and manufacturer.

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

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

e) While testing, the following shall be checked:

1) presence of abnormal temperature of bearings;

2) measurement of actual speed;

3) presence of abnormal noise;

4) power consumption.

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

#### 6.1.2 Individual tests

The following tests shall be carried out:

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

b) Correct operation of braking system.

c) While testing the following shall be checked:

1) tightness against oil leakage;

2) temperature of bearings;

3) presence of abnormal noise;

4) power consumption;

5) speed of drum rotation.

### 6.2 On-board aceptance tests and inspections

It is recommended that the inspections and tests given in 6.2.1 and 6.2.2 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.

## 7 Designation

Mooring winches conforming to this International Standard shall be designated by the following indications, in the order given:

a) denomination: mooring winch;

b) number of this International Standard: ISO 3730;

c) type of winch: E for electric, H for hydraulic, S for steam drive;

d) nominal size (see 3.1);

e) drum capacity: N (normal) or H (high) (see 4.6.3);

f) right- or left-hand winch (R or L) (see 3.4);

g) number and, where applicable, position of warping-ends: R or L (see 4.7.2);

h) type of drum connection (add X only if it is de-clutchable: see 4.6.6);

i) information on motive power: voltage and frequency of electric current, or hydraulic fluid pressure and flow rate, or steam pressure and flow rate.

EXAMPLE

Designation of a mooring winch according to ISO 3730, with electric drive of nominal size 20, normal drum capacity, left-hand model, with one warping-end on the right and with declutchable drum, voltage 440 V and frequency 60 Hz:

**Mooring winch ISO 3730-E-20-N-L-1R-X-440/60**

## 8 Marking

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

a) number of this International Standard: ISO 3730;

b) nominal size (see 3.1).

EXAMPLE

**ISO 3730-20**

**Table 2 — Performance specifications**

| 1 | 2 | 3[1] | 4[1] | 5[1] | 6 | 7 | 8 | 9[2] | 10[2] | 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 4.6.1 | see 4.6.1 | see 5.2 | see 5.3 | see 5.4 | see 4.6.2 et 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 | 204,2 | 150 | 25 | 90 | 288 | 180 | 360 |
| **8** | 80 | 0,25 | 0,5 | 0,125 | 22 | 305 | 220 | 40 | 135 | 352 | 200 | 400 |
| **12** | 125 | 0,2 | 0,5 | 0,1 | 26 | 426 | 310 | 60 | 189 | 416 | 200 | 400 |
| **16** | 160 | 0,2 | 0,5 | 0,1 | 32 | 645,2 | 470 | 80 | 286 | 512 | 250 | 500 |
| **20** | 200 | 0,16 | 0,5 | 0,08 | 36 | 816,6 | 590 | 100 | 362 | 576 | 250 | 500 |
| **25** | 250 | 0,16 | 0,5 | 0,08 | 40 | 1 008,2 | 730 | 125 | 447 | 640 | 250 | 500 |
| **32** | 315 | 0,13 | 0,5 | 0,065 | 44 | 1 219,2 | 880 | 155 | 540 | 704 | 250 | 500 |
| **40** | 400 | 0,13 | 0,5 | 0,065 | 48 | 1 451,8 | 1 050 | 200 | 645 | 768 | 250 | 500 |

1) Only applicable to manually controlled winches.

2) Only applicable to automatically controlled winches.

This page intentionally left blank