INTERNATIONAL STANDARD

ISO 4568

Fourth edition
2021-08

Ships and marine technology — Sea-going vessels — Windlasses and anchor capstans

Navires et technologie maritime — Navires de haute mer — Guindeaux et guindeaux-cabestans

Reference number
ISO 4568:2021(E)

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Published in Switzerland

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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.

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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This fourth edition cancels and replaces the third edition (ISO 4568:2006), which has been technically revised.

The main changes compared to the previous edition are:

— the definitions of working load (3.1), nominal size (3.2) and overload pull (3.3) have been revised;

— the definition of nominal recovery speed (former 3.5 in the previous edition) has been deleted;

— new definitions for windlass (3.5), double cable-lifter windlass with connection shaft (3.10) and control braking system (3.11) have been added;

— requirements have been added on: the mooring winch, in 4.4 and 5.4; the design of the cable lifter, in 4.6.2.2; and the electric motor, in 4.11.2 and 4.11.3;

— the strength requirements have been updated in 4.5;

— test methods have been added in 6.3 to 6.9.

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 — Sea-going vessels — Windlasses and anchor capstans

1 Scope

This document specifies requirements for the design, construction, safety, performance and acceptance testing of windlasses and anchor capstans.

This document is applicable to windlasses and anchor capstans of sea-going vessels, which have an electric, hydraulic, pneumatic or external drive, of the following types:

— symmetrical double cable-lifter windlasses (type 1);

— single cable-lifter windlasses (type 2);

— single cable-lifter windlass units (types 3 and 4);

— anchor capstans (type 5);

— double cable-lifter windlasses with connecting shaft (type 6).

For combined windlasses/mooring winches, ISO 3730 is applicable in addition to this document.

NOTE Attention is drawn to the requirements of relevant Classification Societies or the government of the state whose flag the ship is entitled to fly.

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 1704, *Ships and marine technology — Stud-link anchor chains*

ISO 3730, *Shipbuilding and marine structures — Mooring winches*

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

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

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.

ISO and IEC maintain terminology 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
working load
F_w
<windlass or anchor capstan> continuous working load that the prime mover of the windlass or anchor capstan is able to apply for 30 min, derived from the chain cable diameter and the chain cable grade

3.2
nominal size
<windlass or anchor capstan> size expressed in terms of chain cable diameter, in millimetres, grade of chain cable, holding load and maximum anchorage depth

Note 1 to entry: When the maximum anchorage depth is below 82,5 m, it is not expressed.

EXAMPLE 100/3/45- 100 m is the size designation of a windlass for a 100 mm diameter chain cable of IACS [1] Grade 3, with a holding load of 45 % of the breaking load of the chain cable, and a maximum anchorage depth of 100 m.

3.3
overload pull
short-time overload capacity necessary for the windlass or anchor capstan to break ground, provided by the windlass or anchor capstan prime mover

3.4
holding load
maximum static load on the chain cable that the cable-lifter brake can withstand

3.5
windlass
machine in which the cable-lifter is mounted on a horizontal shaft

3.6
symmetrical double cable-lifter windlass (type 1)
fully powered windlass with two symmetrical cable-lifters

Note 1 to entry: For the purposes of designation, it corresponds to Type 1, see Clause 7 and Figure 1.

3.7
single cable-lifter windlass (type 2)
single fully powered windlass with one cable-lifter

Note 1 to entry: For the purposes of designation, it corresponds to Type 2, see Clause 7 and Figure 2.

3.8
single cable-lifter windlass unit (types 3 and 4)
windlass unit in which one cable-lifter is provided with an external power source

Note 1 to entry: For the purposes of designation, it corresponds to Types 3 and 4, see Clause 7 and Figures 3 and 4.

3.9
anchor capstan (type 5)
machine in which the cable-lifter is mounted on a vertical shaft

Note 1 to entry: See Figure 5 and ISO 3828 for a complete definition.

1) International Association of Classification Societies.

3.10
double cable-lifter windlass with connecting shaft (type 6)
fully powered windlass in which two drive motors with two cable-lifters are connected by a shaft joint

Note 1 to entry: The cable-lifter can be driven by either drive motor.

Note 2 to entry: See Figure 6.

3.11
control braking system
device capable of automatically and stably braking a windlass or anchor capstan when the later are stopped, downtime, power off or any other non-operating state

3.12 Right- and left-hand windlasses

3.12.1
right-hand windlass
windlass where the drive for the cable-lifter or cable-lifter unit is on the right-hand side of the cable-lifter, in relation to an observer situated on the side of the motor, power supply or controller

3.12.2
left-hand windlass
windlass where the drive for the cable-lifter or cable-lifter unit is on the left-hand side of the cable-lifter, in relation to an observer situated on the side of the motor, power supply or controller

3.13
breaking load of the chain cable
minimum breaking load of the chain cable specified by IACS for the diameter and grade of chain cable concerned

3.14
anchorage depth
depth measured as the water height of the sea level at the point of anchoring

4 Design and construction

4.1 Chain cable

The chain cable shall meet the requirements of ISO 1704 for the three grades of chain cable (see 5.3).

4.2 Cable-lifter

4.2.1 The cable-lifter shall have at least five snugs.

4.2.2 The cable-lifter shall be declutchable from the drive. Power-operated clutches shall also be declutchable by hand.

4.3 Warping ends

4.3.1 The windlass may be designed with or without warping ends. The anchor capstan shall be designed with a warping end.

4.3.2 Warping ends may be fitted on the intermediate shaft or on the cable-lifter shaft; for the profile of warping ends, see ISO 6482.

4.4 Mooring winch

4.4.1 Windlasses may be designed to be with or without winches. Mooring winches shall be designed according to ISO 3730.

4.4.2 Mooring winches can be installed in the intermediate shaft or chain cable shaft.

4.5 Strength requirements

4.5.1 When calculating stress of driving units and other pressed parts according to the rated torque of the prime mover, the stress on such parts shall not exceed 40 % of the yield limit of the materials.

4.5.2 The windlass with brakes engaged and cable-lifter disengaged from drive units shall withstand the holding load given in 5.3 without brake slip; the stress on pressed parts shall not exceed 95 % of the yield limit of the materials.

4.5.3 When the electric motor is stalled or the safety valve is opened, the stress on pressed parts shall not exceed 95 % of the yield limit of the materials.

4.5.4 When the middle part of the warping end or mooring winch (if any) withstands the minimum breaking force of the fitted cables in the horizontal direction, the stress on windlass pressed parts shall not exceed 95 % of the yield limit of the materials.

4.5.5 When the cable-lifter brake withstands the holding load, the stress on relevant pressed parts shall not exceed 80 % of the yield limit of the materials.

4.5.6 When calculating the stress, attention shall be paid to:

a) stress concentration in keyways and other stress raisers;

b) dynamic effects due to sudden starting or stopping of the prime mover or chain cable;

c) the fact that calculations are made according to classical theory for stress calculation, if the calculations based on finite element simulation are not applicable to the above strength requirements.

4.6 Braking system

4.6.1 Control braking system

4.6.1.1 Electric windlasses shall be provided with a fail-safe braking mechanism such that the brakes are automatically engaged when the operating device is in the stop or braking position, or when there is no power to the electric motors. The brake shall be capable of holding a load on the chain cable of 1,5 times the working load of the windlass.

4.6.1.2 For other types of drives, a suitable fail-safe system of braking shall be agreed upon between the purchaser and manufacturer. Such a system shall be capable of holding a load on the chain cable of at least 1,3 times the working load of the windlass.

4.6.2 Cable-lifter brake

4.6.2.1 Each cable-lifter shall be fitted with a hand brake, which may be remotely controlled and which is capable of applying a braking torque sufficient to maintain a load equal to the holding load given in 5.3.

4.6.2.2 When designing cable-lifter brakes, attention shall be paid to the following.

a) The brake torque direction of the cable-lifter brake shall be adapted to the direction of anchoring.

b) The cable-lifter brake shall be capable of controlling the calculated load produced by the weight of the chain cables and windlass at a specified anchorage depth (the anchor and chain cables are freely suspended); apply the brake for each casting of a shot of chain cable, to stop the chain cable with slip of not more than 7 m, and the force on hand wheels shall not exceed 160 N.

c) When the cable-lifter brake withstands the holding load, the force on handles or hand wheels shall not exceed 750 N. It shall be operable for two persons.

4.7 Emergency stop

4.7.1 Each remotely controlled windlass shall be fitted with a quick-acting, local, emergency stop mechanism that, when operated, removes power from the windlass and applies the control braking system.

4.7.2 The emergency stop shall be located in a clearly marked and accessible position close to the windlass.

4.8 Protection

4.8.1 Prime movers and gearing shall be protected against excessive torque and shock.

4.8.2 Cable-lifter and gearing shall be protected against excessive torque developed by the prime mover.

4.9 Speed control

The speed of rotation of the cable-lifter shall be adjustable between “no load” speed and stop. It shall be possible to make the adjustment while the windlass is working.

4.10 Direction of motion of operating devices

4.10.1 The operation of the windlass shall be in accordance with ISO 7825.

4.10.2 The direction of operation of all control handles or hand wheels shall be clearly and permanently marked. It shall be such that the anchor is weighed or the brake is applied by movement of a handle towards the operator or alternatively a clockwise movement at a hand-wheel, and vice versa.

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

4.11 Drive equipment

4.11.1 Electrical drives and control equipment shall conform to the requirements of IEC 60092. Open deck mounted enclosures shall conform to IEC 60529, and/or to the appropriate degree of protection for the service and environment in which the equipment is installed.

4.11.2 Electric motors shall conform to the requirements of classification societies. Electric motors with rated power of 100 kW and above shall be certified by classification societies. Electrical drive and control equipment shall conform to IEC 60092. Open deck mounted enclosures shall conform to IP56

of IEC 60529 or to the appropriate degree of protection for the service and environment in which the equipment is installed.

4.11.3 The protection of electric motor cables and size of cables shall conform to the requirements of classification societies. Cables installed on open decks shall be provided with effective mechanical protection.

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

4.12 Remote control devices

Each remotely controlled machine part shall be operated locally by hand.

5 Requirements

5.1 The windlasses shall be capable of continuous operation for a period of 30 min while exerting the working load specified in 5.3. They shall also be capable of exerting, for a period of at least 2 min at reduced speed, the overload pull specified in 5.3.

5.2 The chain cable nominal speed shall be not less than 0,15 m/s. Assume a standard anchor, a warping end efficiency of 70 % and a buoyancy factor of 87 %.

5.3 The following values shall be used in determining performance data for windlasses. The values are based on the use of one cable-lifter at a time.

a) Working load, F_{w1}, in newtons, for an anchorage depth down to 82,5 m:

— Grade 1 chain cable: $F_{w1} = 37{,}5d^2$,

— Grade 2 chain cable: $F_{w1} = 42{,}5d^2$,

— Grade 3 chain cable: $F_{w1} = 47{,}5d^2$,

where

d is the chain cable diameter, in millimetres.

Overload pull = $1{,}5F_{w1}$.

b) Working load, F_{w2}, in newtons, for an anchorage depth deeper than 82,5 m:

$$F_{w2} = F_{w1} + (D - 82{,}5) \times 0{,}27d^2,$$

where

d is the chain cable diameter, in millimetres,

D is the anchorage depth, in metres.

Overload pull = $1{,}5F_{w2}$.

c) Holding load:

— with chain cable stopper: 0,45 times the breaking load of the cable;

— without chain cable stopper: 0,8 times the breaking load of the cable.

