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Ships and marine technology — Deep-sea hydraulic winch equipment

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 document 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*.

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 — Deep-sea hydraulic winch equipment

1 Scope

This document specifies requirements for the design, manufacture, operation, safety, performance, acceptance tests and designation system of deep-sea hydraulic winch equipment (hereafter referred to as “winch equipment”).

The deep-sea hydraulic winch equipment are intended to be used for large load deep-sea operations in depths of 3 000 m to 11 000 m.

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 780, *Packaging — Distribution packaging — Graphical symbols for handling and storage of packages*

ISO 3154, *Stranded wire ropes for mine hoisting — Technical delivery requirements*

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

ISO 4406, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

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

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

IEC 60529:2013, *Degrees of protection provide by enclosure (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:

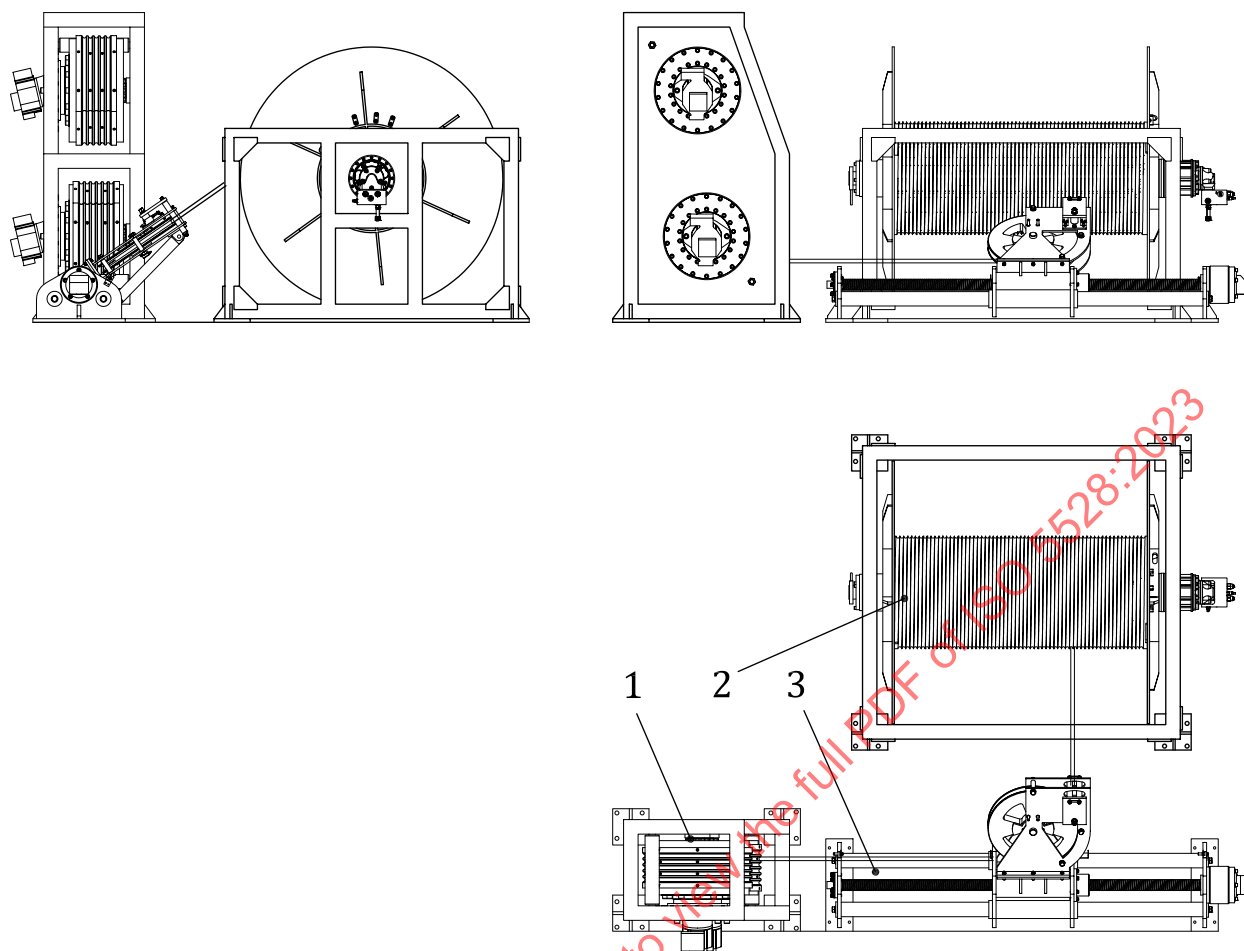
- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

deep-sea hydraulic winch equipment

combined winch equipment adopting hydraulic drive, double drums, traction winch, cable storage winch and right-angle cable spooling device

Note 1 to entry: See [Figure 1](#) for the structure.



Key

- 1 traction winch
- 2 cable storage winch
- 3 cable spooling device

Figure 1 — Split structure diagram of the winch equipment

3.2

traction winch

winch towed by double drums with straight grooves

3.3

storage winch

winch which can store cables with constant tension

3.4

cable spooling device

device with automatic right-angle cable spooling

3.5

working load

maximum load of *traction winch* (3.2) in continuous operation

3.6

nominal speed

maximum speed of *traction winch* (3.2) when it is continuously operating under *working load* (3.5)

4 Design and operation

4.1 Composition

Winch equipment includes traction winch, cable spooling device, cable storage winch, hydraulic pump station and control system.

4.2 Types

4.2.1 Winch equipment are divided into the following types according to different cables applied:

- a) winch equipment with steel cables;
- b) winch equipment with coaxial cables;
- c) winch equipment with photoelectric composite cables;
- d) winch equipment with fiber cables.

4.2.2 Winch equipment are divided into the following types according to structures:

- a) split winch equipment;
- b) combination winch equipment.

4.3 General design requirements

4.3.1 Winch equipment shall be designed in accordance with ISO 7825 and ISO 4413.

4.3.2 Winch equipment can be designed to be arranged on an open/weather deck or cabin according to the needs of the actual ship.

4.3.3 The electrical equipment installed on the open/weather deck shall have a minimum IP rating of IP 56, in accordance with IEC 60529. The electrical equipment installed in cabin shall have a minimum IP rating of IP 44.

4.3.4 The motor of winch equipment shall adopt continuous duty.

4.3.5 The steel cables shall conform to ISO 3154 when used for winch equipment.

4.3.6 If steel cables are used for winch equipment, the diameter of the traction wheel, storage cable winch drum and guide pulley shall not be less than 16 times the diameter of the selected steel cable. If coaxial cable or photovoltaic composite cable or fiber cable are used, the diameter of traction wheel, storage winch drum and guide pulley and all related structures shall be designed according to the curvature radius and material requirements provided by the cable manufacturer.

4.3.7 Winch equipment shall be designed as right-angle cable arrangement driven by hydraulic motors.

4.3.8 Winch equipment shall be designed for load, length and speed measurement and display functions.

4.3.9 The towing wheel friction grooves of the traction winch shall be designed as straight grooves, staggered symmetrically arranged and replaceable.

4.3.10 Corresponding guide pulleys shall be installed in accordance with the requirements of the use position of the traction winch and the cable storage winch.

4.3.11 The hydraulic system shall be a closed system, which is energy-saving and convenient for control and operation.

4.3.12 Traction winch, cable spooling device and storage winch shall be operated both independently and simultaneously. Winch equipment shall be operated both manually and automatically.

4.3.13 Solid particulate contamination level of hydraulic system fluids shall not be higher than -/18/15, as specified in ISO 4406.

4.4 Strength requirements

4.4.1 The allowable calculated stresses of any drive part under the drum 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.

4.4.2 With the maximum torque of prime mover or the set pressure of the safety valve, the allowable stress 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.

4.4.3 The allowable calculated stresses of any affected part under 80 % of the breaking strength of the rope 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.

4.5 Traction winch

4.5.1 The traction winch shall be equipped with independent braking devices.

4.5.2 The traction winch is composed of two towing wheels, each of which has a friction groove that can be embedded into a cable with an appropriate external diameter.

4.5.3 Each towing wheel should have an independent driving device, which adopts a variable hydraulic motor and compact and efficient reducer.

4.5.4 The cantilever arm end of the towing wheel shall be fastened with a pull plate.

4.5.5 Protection devices should be equipped at the entrance and exit of the traction wheel in order to prevent the cable from slipping out.

4.6 Cable spooling device

4.6.1 The cable spooling device shall adopt the right-angle cable spooling method.

4.6.2 The cable spooling device shall be independently driven and operated, and shall be automatic and independent cable spooling.

4.6.3 The swing angle of the cable pulley shall adapt to the changing layers of the cable storage drum.

4.7 Cable storage winch

- 4.7.1 The cable storage winch shall have an independent operating drive device.
- 4.7.2 The cable storage winch shall have independent braking devices.
- 4.7.3 The coaxial cable and photoelectric composite cable shall be equipped with slip ring.
- 4.7.4 The cable storage winch drum shall be provided with broken line type groove.

4.8 Control system

- 4.8.1 The control system shall be able to control the synchronous operation of traction, storage cable and cable spooling, and shall maintain the cable tension and cable spooling in an orderly manner.
- 4.8.2 The control system shall be designed for both operation and debugging.
- 4.8.3 The hydraulic pump station motor cannot be started unless the operating handle is not in the middle position.
- 4.8.4 Emergency stop buttons shall be arranged at all operating locations with the highest priority, the emergency stop function shall be safe and reliable.

5 Performance parameters and requirements

5.1 Preferred numbers of working load

The preferred numbers of working load are taken according to the R10 rounded values: 50 kN, 63 kN, 80 kN, 100 kN, 125 kN, 160 kN, 200 kN and 250 kN, respectively.

NOTE The use of other working loads is not precluded, if agreed between the purchaser and the manufacturer.

5.2 Nominal speed

Nominal speeds of winch equipment are shown in [Table 1](#).

Table 1 — Nominal speeds of winch equipment

Operating condition	Nominal speed
	m/min
Rated load condition	40
	60
Light load condition	120

NOTE The use of other nominal speeds is not precluded, if agreed between the purchaser and the manufacturer.

5.3 Pressure

The hydraulic piping system of the winch equipment shall be capable of withstanding 1,5 times the system working pressure without leakage and deformation.

5.4 Sealing

The hydraulic system of the winch equipment shall be capable of withstanding 1,25 times the system working pressure without any leakage.

5.5 No-load

In the no-load state of the winch equipment, the high-speed and low-speed operation shall be free from jamming, abnormal noise and vibration.

5.6 Load

Under 25 %, 50 % and 100 % of working load and nominal speed respectively, the traction winch shall be able to run synchronously with the cable spooling device and the cable storage winch without sticking, abnormal noise and vibration.

5.7 Overload

Under 125 % working load, the traction winch shall run synchronously with the cable spooling device and the cable storage winch without sticking, abnormal noise and vibration, and the mechanical structure shall have no permanent deformation.

5.8 Braking

The static braking capacity of the traction winch shall not be less than 1,5 times the working load.

6 Acceptance tests

6.1 General

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

Type test may not be carried out, if the prototype test certificate is available and agreed by the manufacturer and purchaser.

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

6.2 Type test

6.2.1 Pressure test

After the hydraulic system piping passed the initial assembly and flushing, the pressure test with 1,5 times the working pressure shall be carried out for one piece. The pressure shall be kept for 5 min.

6.2.2 Sealing test

The sealing performance test shall be carried out for the hydraulic system, with the test pressure 1,25 times the working pressure. If the test pressure is greater than 7 MPa of the working pressure, the test shall be carried out by increasing 7 MPa. The pressure shall be kept for 10 min without leakage.

6.2.3 No-load test

The traction winch, the cable spooling device and the cable storage winch shall run synchronously under no-load for 10 min in each direction.

6.2.4 Load test

6.2.4.1 Under 25 % and 50 % of the working load and nominal speed, respectively, the traction winch shall run synchronously with the cable spooling device and the cable storage winch, and take up and down twice. The cumulative time should reach 10 min. Record the actual load, cable speed, system pressure, current, voltage, and check the operation of cable spooling device.

6.2.4.2 Under 100 % of the working load and nominal speed, the traction winch shall run synchronously with the cable spooling device and the cable storage winch, and take up and down more than 2 times. The cumulative time shall not be less than 60 min. Record the actual load, cable speed, system pressure, current, voltage, and check the operation of cable spooling device.

6.2.5 Overload test

Under 125 % of the working load, the traction winch shall run synchronously with the cable spooling device and the cable storage winch, and take up and down twice. The cumulative time should reach 10 min. Record the actual load, cable speed, system pressure, current, voltage, and check the operation of the cable spooling device.

6.2.6 Braking test

Static brake the traction winch, load to 1,5 times working load, hold for 2 min without slip.

6.3 Delivery test

6.3.1 No-load test

The traction winch, the cable spooling device and the cable storage winch shall run synchronously under no-load for 10 min in each direction.

6.3.2 Load test

Under 100 % of the working load and nominal speed, the traction winch shall run synchronously with the cable spooling device and the cable storage winch, and take up and down more than 2 times. The cumulative time shall not be less than 30 min. Record the actual load, cable speed, system pressure, current, voltage, and check the operation of the cable spooling device.

6.3.3 Overload test

Under 125 % of the working load, the traction winch shall run synchronously with the cable spooling device and the cable storage winch, and take up and down twice. The cumulative time should reach 10 min. Record actual load, cable speed, system pressure, current, voltage, and check the operation of the cable spooling device.

6.3.4 Braking test

Static brake the traction winch, load to 1,5 times working load, hold for 2 min without slip.

7 Designation system

7.1 Designation of product type

[Figure 2](#) shows the designation of the deep-sea hydraulic winch equipment.