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D-03

MOORING WINCHES

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Foreword

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at <http://www.ccs.org.cn>. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn

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Main changes:

1. Normative references (2), (3) added.
2. Definitions 3.2(7)~(11) added.
3. Design and technical requirements 7.16~7.19 added

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MOORING WINCHES

1 Application

1.1 This Guideline applies to winches of sea-going and inland waterways ships that are driven electrically or hydraulically or by steam or external forces.

1.2 Winches used as windlasses are to be referred to Guideline 2 Windlasses of this PART in addition to this Guideline.

2 Normative references

2.1 The approval and inspection in this Guideline are to be based on the following documents:

- (1) ISO 3730 Shipbuilding – Mooring winches.
- (2) MSC.1/Circ.1619 GUIDELINES ON THE DESIGN OF MOORING ARRANGEMENTS AND THE SELECTION OF APPROPRIATE MOORING EQUIPMENT AND FITTINGS FOR SAFE MOORING
- (3) MSC.1/Circ.1175/Rev.1 GUIDANCE ON SHIPBOARD TOWING AND MOORING EQUIPMENT

3 Definitions

3.1 For definitions of terms such as products inspection, approval, type test, sample and unit/batch inspection, see 1.2 of Guideline 3, PART ONE of CCS Rules for Classification of Sea-going Steel Ships.

3.2 For the purpose of this Guideline:

- (1) Drum load is the maximum rope tension 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.
- (2) Holding load is the maximum static tension that can be maintained by a braking/locking system in the first layer.
- (3) Stalling load is the maximum rope tension measured at the drum exit when the drum ceases to rotate in the haul direction, with the prime mover being set for the maximum torque and

- the rope being wound on the drum in a single layer.
- (4) Recovery load (applicable to automatic mooring winches only) is the maximum rope tension measured at the drum exit when the drum commences to rotate in the haul direction, with the prime mover being set for the maximum torque under automatic control and the rope being wound on the drum in a single layer.
- (5) Rendering load (applicable to automatic mooring winches only) is the maximum rope tension measured at the drum exit when the drum just commences to rotate in the direction opposite to the applied driving torque, with the prime mover being set for the maximum torque in automatic control and the rope being wound on the drum in a single layer.
- (6) Nominal speed is the maximum speed that can be maintained by the winch when it is applying the drum load.
- (7) Line Design Break Force (LDBF) means the minimum force that a new, dry, spliced, mooring line will break at. This is for all synthetic cordage materials.
- (8) Ship Design Minimum Breaking Load (MBLSD) means the minimum breaking load of new, dry, mooring lines for which shipboard fittings and supporting hull structures are designed in order to meet mooring restraint requirements.
- (9) Mooring equipment and fittings means items such as mooring winches, capstans, bollards, bitts, fairleads, rollers, chocks, etc. and also includes mooring lines.
- (10) Mooring lines means ropes, wires and combinations used for mooring operations other than messenger lines but including tails.
- (11) Working Load Limit (WLL) means the maximum load that a mooring line should be subjected to in operational service, calculated from the relevant environmental mooring restraint requirement.

4 Plans and documents

4.1 The following plans and technical documents are to be submitted to CCS for approval:

- (1) Main performance specifications (covering the entire series for which approval is sought: Drum load, holding load, stalling load, recovery load, rendering load, nominal speed, design rope type and diameter, prime mover type and specification);

- (2) General assembly;
- (3) Drawing of welded structure;
- (4) Drawing of main parts (main shaft, coupling, brake, gear wheel, pinion, frame, seating, drum, reduction box, etc.);
- (5) List of physical and chemical properties of main parts;
- (6) Calculations (capacity calculation for main stressed parts and prime mover: at least 100% of drum load capacity);
- (7) Type test programme.

4.2 The following plans and documents are to be submitted to CCS for information:

- (1) Applicable technical standards;
- (2) Type test report of the product manufactured for the first time, if any;
- (3) Technical specifications of assembly and installation;
- (4) Welding procedures and evaluation record of welding procedures;
- (5) Product instructions.

5 Materials and components

5.1 Materials and components are to comply with relevant requirements of CCS Rules

5.2 The manufacture is to establish perfect means to control subcontractors for ensuring the quality of purchased materials. The material certificates are to be submitted to CCS Surveyor for confirmation.

6 Evaluation of welding procedure

6.1 An evaluation test is to be carried out for the welding procedure of structural components of mooring winches in accordance with the relevant requirements of CCS Rules for Materials and Welding, 2006.

7 Design and technical requirements

- 7.1 The mooring winch is to be able to operate, hold and store the rope on a single drum.
- 7.2 The mooring winch is to be driven by an independent prime mover and reversible.
- 7.3 The mooring winch is to be able to operate for 30 min continuously at the nominal speed with drum load.
- 7.4 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.
- 7.5 The holding load is not to be less than 80% of the design breaking load of rope.
- 7.6 The recovery load is not to be less than 50% of the drum load.
- 7.7 The rendering load is not to be more than 50% of the design breaking load of rope.
- 7.8 The mooring winch must be provided with an automatic braking system which operates when the hand-operated lever or wheel is brought to the stop or braking position or when there is no power on the winch. The brake is to be capable of stopping the drum rotating from the nominal speed without failure when the winch is applying the drum load. The automatic braking system is to be capable of holding a static load 1.25 times the drum load. For the automatic braking device of electrical mooring winches, there is not to be any slip or damage. For hydraulic mooring winches, certain slip movement not exceeding 1 m in one minute is allowed.
- 7.9 The direction of motion of the operating devices is to be such that the rope is hauled in by clockwise movement at a hand lever or alternatively movement of the hand lever towards the operator and that the rope is rendered by contrary movement of the hand lever.
- The direction of all control handles is to be clearly and permanently marked. Whatever the form of motive power, the operating device is, when under manual control, to be arranged to return to the braking or stop position automatically.
- 7.10 The drum is to be fitted with a clutch to enable it to be disengaged from the driving device and locked tightly.
- 7.11 The diameter of the drum is to comply with the following requirements:

- (1) If steel wire rope is adopted, the diameter of the drum is not to be less than 16 times the

design rope diameter.

- (2) If polyester or polyamide rope is adopted, the diameter of the drum is not to be less than 6 times the design rope diameter.
- (3) If polypropylene rope is adopted, the diameter of the drum is not to be less than 4 times the design rope diameter.

7.12 When all the rope is reeled on the drum, the flange is to project at least 1.5 times the rope diameter above the outermost layer.

7.13 Strength requirements

- (1) For calculation of the stress of transmission gear and other parts under force with 100% rated torque of the prime mover, the stress obtained in respect to parts under force is not to exceed 40% of the yield limit of the material.
- (2) With the maximum torque of the prime mover corresponding to the worst condition, the stress obtained in respect to parts under force is not to exceed 90% of the yield limit of the material.
- (3) With the braking load being applied, the stress obtained in respect to parts under force is not to exceed 90% of the yield limit of the material.

7.14 The mooring winch of tanker is designed to have periodical brake test.

7.15 The mooring winch brake of tanker is to be the brake type with brake power to be controlled and measured.

The following is the requirement of MSC.1/Circ.1619 which is suitable for the mooring arrangement(mooring winch) designed for ships of 3,000 gross tonnage and above constructed on or after 1 January 2024,

7.16 The selection of winches should take into account:

- (1) The availability of winches with alternative drum arrangements, including split drum arrangements, which can reduce the need for manual handling of mooring lines during mooring operations;
- (2) The positioning of winch controls, including the availability of remote controls for winches

to improve the line of sight and reduce operator exposure to snap-back;

- (3) The availability of constant tension winches and their appropriateness for the normal operation of the ship; and
- (4) Limiting noise levels to ensure proper communication during mooring operations.

7.17 The selection of mooring lines should take into account:

- (1) The guidance on mooring restraint as per appendix A of MSC.1/Circ.1175/Rev.1;
- (2) The diameter D of surfaces of mooring fittings that are in contact with the mooring line in relation to the mooring line diameter d (D/d ratio) to reduce or mitigate bend loss of strength;
- (3) The compatibility of the MBLSD of mooring lines and the brake capacity of the mooring winches installed on board;
- (4) The Line Design Break Force (LDBF) to be 100% to 105% of the MBLSD;
- (5) The characteristics and limitations of mooring lines including material properties and environmental operating conditions anticipated during normal operation of the ship;
- (6) The anticipated behaviour of the mooring line in the event of failure;
- (7) The influence on stored energy and the potential for snap-back of high stiffness mooring lines caused by the use of tails; and
- (8) As far as possible, but at least for lines in the same service (e.g. headlines, breast lines or springs), mooring lines of the same diameter and type (i.e. material) should be used.

7.18 To avoid overload on mooring winches, fittings and mooring lines, consideration should be given to select mooring winches with brake capacity of less than the ship design minimum breaking load of the mooring line or with adjustable brake capacity.

7.19 The WLL of mooring lines should be used as user operating limiting values, not to be exceeded. The WLL is expressed as a percentage of MBL_{SD} and should be used as a limiting value in operational mooring analyses. Steel wires have a WLL of 55% of MBL_{SD} and all other cordage (synthetic) have a WLL of 50% of the MBL_{SD}

8 Type test

8.1 Selection of typical samples

When applying for approval, a representative set is to be selected from each series of winches according to the type to be approved, reflecting the design/production ability of the manufacturer. Usually the winches with the maximum holding load are to be selected.

8.2 The type test items generally are to include the following:

- (1) no-load operating test of the whole set;
- (2) load test;
- (3) test of the automatic braking system;
- (4) test of holding load of brake;
- (5) recovery load (applicable to automatic mooring winches only) (i.e. automatic constant tension test);
- (6) rendering load (applicable to automatic mooring winches only) (i.e. automatic constant tension test);
- (7) operational test of brake;
- (8) dismantling.

8.3 Tests are to comply with the following requirements:

- (1) CCS Surveyor is to check the manufacturer's test laboratory/test bench used as approval test location and confirm compliance with the requirements of 8.3(2). Otherwise, all tests are to be carried out at certification and test organizations recognized by CCS.
- (2) Measuring instruments used in the tests are to have valid calibration certificates, and the accuracy of test instruments is not to be lower than that required by Table 8.3(2).

Accuracy of Test Instrument

Table 8.3(2)

Items to be measured	Allowable system error of test instrument (%)
Pressure	±1.5
Flow	±2.5
Temperature	±2.5
Stopwatch	±1

8.4 Test methods are to comply with the following requirements separately.

- (1) No-load operating test of the whole set: The clutch is to be turned on and the brake loosened to operate the mooring winch continuously for 15 min respectively in both directions at no-load speed.
- (2) Load test: With the drum load as applied load, the applied weight is to be raised and lowered continuously for 30 min at the nominal speed, within an effective height of about 8 m.
- (3) Test of the automatic braking system:
 - ① the test is to be carried out in the test conditions of load test. The automatic braking system is to stop the drum rotation without failure. When the operating device of an electric mooring winch is brought to the braking or stop position, the automatic braking system is to brake immediately;
 - ② when the applied weight (equal to drum load) is raised, the weight is to be increased to 1.25 times the weight of drum load, without slip or damage of the automatic braking system of the electric mooring winch. For hydraulic mooring winches, certain slip movement not exceeding 1 m in one minute is allowed.
- (4) Test of holding load of brake: The drum braking device is to be turned on to prevent reeling of it, and the static load test is to be carried out by applying the holding load on the steel wire led out from the drum. The drum shall not rotate within 2 min .
 - ① if the design brakes is mature and complies with the design calculation and strength requirements of 7.1.2 of this Guideline, the test may be dispensed with. For novel designs, however, the test is to be carried out;
 - ② there is to be no slip of the brake in the test and no permanent deformation of parts under force after the test.
- (5) Recovery load (applicable to automatic mooring winches only) (i.e. automatic constant tension test): The maximum applied weight which can be raised by the drum is to be

recorded when the drum commences to rotate in the haul direction, with the prime mover being set for the maximum torque under automatic control and the rope being wound on the drum in a single layer.

(6) Rendering load (applicable to automatic mooring winches only) (i.e. automatic constant tension test): The maximum applied weight which can be raised by the drum is to be recorded when the drum just commences to rotate in the direction opposite to the applied driving torque, with the prime mover being set for the maximum torque in automatic control and the rope being wound on the drum in a single layer.

(7) Operational test of brake: The brake is to be operated tightly, the clutch disengaged and a load 1.5 times the drum load applied on the drum, without slip of the brake.

(8) The winch is to be dismantled and examined after the above tests.

9 Unit/batch inspection

9.1 The inspection of winches for issuing CCS marine product certificate is to cover the following:

(1) The inspection of winches is to include examination of documents, inspections and function tests during manufacturing process.

(2) Inspections during manufacturing process are mainly to include material tests, non-destructive tests of main parts (if required), examination of quality of manufacturing and assembly of parts.

9.2 The inspection for issuing CCS marine product certificate to winches not approved by CCS is to be carried out according to 8 of this Guideline.

9.3 The inspection for issuing CCS marine product certificate to winches approved by CCS is to include the following items:

(1) no-load operating test of the whole set;

(2) load test;

(3) operational test of brake;

(4) function test of other devices, if applicable.

9.4 Where the design of a winch is changed after type test, with the holding load being the same or lower and construction being the same as the original type or main components being kept, related test items may be reduced in CCS inspection for issuing CCS marine product certificate.

9.5 If the manufacturer does not have adequate test facilities for winches with drum load of 150 kN or over, no-load test may be carried out and other test items are to be carried out on board.

9.6 If the test with an associated hydraulic pump station has not been carried out by the manufacturer for a hydraulic winch, a flow conversion description for the pump station is to be provided to demonstrate that the actual speed of the winch complies with the relevant requirements.

9.7 In any case, the records or reports submitted by the manufacturer regarding the inspection for issuing CCS marine product certificate are at least to include the following:

- (1) quality certificates and/or reports of reexamination of physical and chemical properties of main materials;
- (2) qualification certificates and related certificates of main purchased parts;
- (3) inspection, measurement and test means of the manufacturer, together with a list of test and inspection equipment used and copies of valid calibration certificates;
- (4) the test report is to include product or sample type, specification, serial number, test location and date, test environment, test items, test data, problems revealed in the test and examination and description of how the problems are handled, and test conclusions.