



Guideline No. T-09 (202502)

T-09

Marine Submerged Pump

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Foreword

The product inspection guideline of China Classification Society (hereinafter referred to as "CCS") specifies the applicable technical requirements and inspection and test requirements for classification products and authorized statutory products of ships to be approved/inspected by CCS.

The Guidelines allow users to adopt alternative test methods and requirements, provided they meet or exceed the standards set by the Guidelines.

The Guidelines are prepared and updated by CCS and published on <http://www.ccs.org.cn>. In case of any comments and suggestions, please contact CCS via service@ccs.org.cn.

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Marine Submerged Pump

1 Scope of Application

1.1 The Guideline is applicable to the drawing approval and survey of Submerged pump products that are completely immersed in the conveying medium and are driven by integrated motor or hydraulic motor for conveying liquefied natural gas, methanol and liquid ammonia;

1.2 In addition to considering the applicability of materials, relevant requirements in the Guidelines can be referred to for Submerged pumps conveying other media.

2 Normative References

2.1 The accreditation and survey bases adopted in this Chapter are as follows:

- (1) Chapter 2 of Part 3 and Chapters 1 and 3 of Part 4 of CCS Rules for Classification of Sea-Going Steel Ships
- (2) Chapters 5 and 6 of Part 3 of CCS Rules for Materials and Welding
- (3) Chapters 5 and 6 of Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
- (4) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)
- (5) Chapters 3, 5, 9, 11 and 12 of CCS Rules for Natural Gas Fuel Used in Ships
- (6) Chapters 3, 5, 9, 10 and 11 of CCS *Guidelines for Ships Using Methanol/Ethanol Fuel*
- (7) Chapters 3, 5, 9, 10 and 11 of CCS *Guidelines for Ships Using Ammonia Fuel*
- (8) CCS Product Survey Guideline *P-01 Pump*
- (9) CCS Product Survey Guideline *H-03 Hydraulic Motor*

2.2 The accreditation and survey bases referred to in this Chapter are as follows:

- (1) ISO 24490 Cryogenic vessels - Pumps for cryogenic service
- (2) API 610 Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries

- (3) IACS UR G3 Rev.8"Liquefied gas cargo and process piping".
- (4) MSC.1-Circ.1621 Interim Guidelines For The Safety Of Ships Using MethylEthyl Alcohol As Fuel.
- (5) ISO 13709 Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries

3 Terms and Definitions

3.1 For the definitions of terms such as product survey, accreditation, type test, sample and unit/batch survey, please refer to Article 3.1.2, Chapter 3, Part 1 of CCS Rules for Classification of Sea-Going Steel Ships.

3.2 Submerged pump: It refers to a pump in which both the pump and the motor (or drive motor) are immersed in liquid cargo and used for conveying liquid.

4 Drawings and Data

The following drawings and data shall be submitted for approval.

4.1 The following drawings and data shall be submitted to CCS for approval:

- (1) Table of main performance specifications of the product (including flow, pressure, speed, shaft power, cavitation resistance and applicable medium of the whole series of the product to be accredited. If it is supplied in complete sets of pump units, the model and parameters of supporting motors shall also be included);
- (2) General assembly drawing (profile, including pump and motor);
- (3) Structure and layout plan of bearings and shaft seals (if it has been shown in the general assembly drawing, it may not be submitted);
- (4) List of physical and chemical properties of important parts;
- (5) Drawings of important parts, including casing, pump body, impeller, main shaft, motor stator, motor rotor, hydraulic motor, flow deflector and diffuser.

4.2 The following drawings and data shall be submitted to CCS for information:

- (1) Product instructions;
- (2) Main process documents, such as heat treatment process of parts, welding process for welded pump body, and casting process of castings if necessary;

- (3) Samples of product nameplate, factory certificate, etc.;
- (4) Design calculation sheet according to corresponding standards.

4.3 Approved drawings/materials shall at least include the following contents:

- (1) Factory overview: factory name, address, production history, production capacity, technical and inspection personnel, main products, affiliation, product trademarks, etc.;
- (2) Details of the product to be approved;
- (3) List of main production equipment;
- (4) List of main testing equipment;
- (5) The brief production process of the product to be accredited. If welding structure is adopted, the welding process shall be evaluated and approved in accordance with the requirements of CCS Rules for Materials and Welding and the standards accepted by CCS;
- (6) Quality management documents or quality system certificates;
- (7) Enterprise registration certificate;
- (8) Qualification certificate and/or production license, if applicable;
- (9) Product quality certificate or sample of certificate;
- (10) Quality control plan, if applicable;
- (11) List of qualified suppliers, if applicable;

5 Raw Materials, Parts and Components

5.1 If the purchased pressure-bearing parts such as pump body, pump cover and safety valve body are castings or forgings, they shall have marine product certificates of the CCS, or be purchased from a factory recognized by the CCS and have the quality certificate of the manufacturer; if they are purchased from a factory not recognized by the CCS, the test or survey of physical and chemical properties of castings and forgings shall be witnessed by the surveyor of the CCS when the pump factory applies for the product survey of the CCS.

5.2 The main shaft of the Submerged pump shall be provided with marine product certificate issued by CCS or pass the survey conducted by CCS.

5.3 If the hydraulic motor is outsourced, it shall be provided with marine product certificate of CCS.

5.4 Sensors, hydraulic pipelines and accessories shall be of models approved by the CCS and have factory quality certificates.

6 Technical Requirements for Design

6.1 The Submerged pump shall be designed according to appropriate authoritative standards and meet the technical requirements of Section 6, Chapter 2, Part 3 of CCS Rules for Classification of Sea-Going Steel Ships and 6.13.1.b, Chapter 5, Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

6.2 The selection of raw materials for main parts and components of Submerged pump shall meet the relevant requirements in Chapter 6 of Part 3 of CCS *Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*, *Rules for Materials and Welding*, *Rules for Natural Gas Fuel Used in Ships*, *Guidelines for Ships Using Methanol/Ethanol Fuel* and *Guidelines for Ships Using Ammonia Fuel*; or other materials approved by CCS. Pump materials used for conveying corrosive media shall be resistant to corrosion.

6.3 The Submerged pump shall be provided with a flow deflector to reduce the fluid resistance at the liquid inlet, reduce the net positive suction head (NPSHr) required and prevent cavitation at the liquid inlet.

6.4 The Submerged pump motor driven by an integrated motor shall meet the requirements of Chapters 1 and 3 in Part 4 of *CCS Rules for Classification of Sea-Going Steel Ships*, except for temperature rise test and idling test. The hydraulic motor shall meet the relevant technical requirements of CCS Product Survey Guideline *H-03 Hydraulic Motor*. For the selection of main components for conveying low-temperature liquid cargo, the designer shall take into account the low-temperature performance of materials.

6.5 Measures shall be taken for the Submerged pump to balance the radial force and axial force caused by the operation of impeller, such as setting diffuser and thrust self-balancing mechanism.

6.6 The Submerged pump driven by an integrated motor shall be provided with monitoring, alarm and protection functions to monitor parameters such as vibration, current, flow rate and inlet pressure. The motor shall have overload protection function and emergency stop function.

6.7 The Submerged pump driven by an integrated motor and its power supply cable shall be provided with at least two independent ways to automatically cut off the power supply in case of low liquid level. Automatic shutdown of the motor can be achieved by detecting low pump outlet pressure, low motor current or low liquid level. The construction and installation of the pump, its connecting cables and other measures shall be such that it cannot be energized when not submerged or in an explosive gas atmosphere.

6.8 For pressure-bearing parts such as pump body and pump casing, if welding structure is adopted, the welding process shall be evaluated and approved according to the relevant requirements of CCS Rules for Materials and Welding.

7 Type Test

In addition to the requirements of Article 9 of CCS Product Survey Guideline *P-01 Pump*, the following requirements shall also be met:

7.1 The main raw materials and parts and components of the Submerged pump shall be tested for physical and chemical properties according to the Table of Physical and Chemical Properties of Raw Materials and Parts and Components approved by CCS, as well as low-temperature impact test;

7.2 Type test shall be carried out for each model and specification of Submerged pump assembly;

7.3 For Submerged pump assembly, the operation test shall be carried out with the

low-temperature medium for which the pump is designed or with other media lower than the design temperature;

When the test medium is different, performance point conversion calculation shall be provided.

7.4 The motor test requirements of the Submerged pump driven by an integrated motor shall be implemented with reference to CCS Survey Guideline *E-03 Motor*, and the following tests shall be carried out:

- (1) Overall dynamic balance (all rotating parts together);
- (2) Overload/overcurrent test (can be exempted if test report is provided);
- (3) Insulation resistance measurement;
- (4) Pressure test;
- (5) Enclosure protection grade for methanol pump motor;
- (6) Inclining test.

8 Unit/Batch Survey

In addition to meeting the requirements of Article 10 of CCS Survey Guideline *P-01 Pump*, pumps for conveying low-temperature medium shall also meet the following requirements:

8.1 The water pressure strength test and rated point performance test of each pump body at 1.5 times the design pressure shall be witnessed by the surveyor on site;

8.2 For Submerged pump assembly, the rated point performance test shall be carried out with the low-temperature medium for which the pump is designed or with other media lower than the design temperature;

8.3 If the manufacturer requires alternatives to the above tests, the pump may be certified as follows:

- (1) The pump has been subject to type approval test in accordance with the requirements of Article 5.13, Chapter 5, Part 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (CCS 5.13.1b (1)). and
- (2) The manufacturer has an accredited quality system, which is evaluated and certified by CCS and regularly audited. and
- (3) The quality control plan shall include the contents of hydraulic test and pump discharge test at 1.5 times design pressure for each pump body.

Test records shall be maintained by the manufacturer

8.4 The integrated motor of the Submerged pump shall be tested as follows:

- (1) Overall dynamic balance (all rotating parts together);
- (2) Insulation resistance measurement;
- (3) Pressure test.