



## **China Classification Society**

# Guidelines for Accreditation of Onshore Joint Commissioning Agencies of Battery-Powered Marine Power System

Issue date:2025.01.01

© China Classification Society

## Table of Contents

1 Scope of application .....	错误！未定义书签。	5
2 Testing capacity of testing institute .....	错误！未定义书签。	5
2.1 Site .....	错误！未定义书签。	6
2.2 Personne .....		36
2.3 Equipment .....	错误！未定义书签。	6
2.3.1 Power supply .....	错误！未定义书签。	7
2.3.2 Electrical load .....		37
2.3.3 Simulated propeller load .....		38
2.4 Measuring instruments .....		39
2.5 Test items .....		39
3 Quality system of testing institute .....		46
4 Format and requirements of report .....		46

## **1 Scope of application**

1.1 The Guidelines are developed to cooperate with the implementation of requirements for onshore joint commissioning of the battery power system in the Specifications for Battery Power of Marine Applications. The Guidelines, as a supplement to the Guidelines for the Accreditation of Marine Product Testing and Inspection Institutes, constitute the accreditation basis for onshore joint commissioning testing institutes. The accreditation process shall be carried out in accordance with the general regulations, general requirements and accreditation process in the Guidelines for the Accreditation of Marine Product Testing and Inspection Institutes.

1.2 For accreditation of relevant marine power systems for which onshore joint commissioning is required according to the requirements of the Specifications for Battery Power of Marine Applications, the Guidelines shall be followed.

## **2 Testing capacity of testing institute**

The testing capacity of the testing institute shall be accredited from several aspects, including site, personnel, equipment and instruments, and test items. In consideration of the actual situations of the institutes applying for accreditation of onshore joint commissioning, the onshore joint commissioning institutes can be classified according to the following conditions:

Those having the ability of joint commissioning for system with a total power of 2000 kW and above in a single-axis propulsion can be rated as "Class I Testing Institutes of Onshore Joint Commissioning", and granted with the "Class I Onshore Joint Commissioning Organization" mark as required;

Those having the ability of joint commissioning for system with a total power of 1000-2000 kW (not included) in single-axis propulsion can be rated as "Class II Testing Institutes of Onshore Joint Commissioning", and granted with the "Class II Onshore Joint Commissioning Organization" mark as required;

Those having the ability of joint commissioning for system with a total power of 500-1000 kW (not included) in single-axis propulsion can be rated as "Class III

Testing Institutes of Onshore Joint Commissioning", and granted with the "Class III Onshore Joint Commissioning Organization" mark as required;

Those having the ability of joint commissioning for system with a total power below 500 kW (not included) in single-axis propulsion can be rated as "Class IV Testing Institutes of Onshore Joint Commissioning", and granted with the "Class IV Onshore Joint Commissioning Organization" mark as required.

## **2.1 Site**

The site of the testing institute applying for accreditation shall satisfy the requirements of the commissioning test of ship systems to be jointly commissioned onshore. This includes the following abilities:

2.1.1 The ability to lift, handle, and store the equipment under test;

2.1.2 Equipment space and test operation space for reasonable arrangement of marine power system for joint commissioning, and personnel evacuation passage in case of emergency;

2.1.3 Adequate lighting and ventilation;

2.1.4 Supply of water, electricity and compressed air required for the test.

## **2.2 Personnel**

The testing institute applying for accreditation shall have a certain number of professionals who are proficient in the operation procedures of the auxiliary equipment in 2.3 and the measuring instruments in 2.4 of the Guidelines, and proficient in the skills required for the onshore joint commissioning test items in 2.5 of the Guidelines, at least the following requirements shall be met:

Not less than 2 technicians with intermediate professional title of in marine engine specialty

Not less than 2 technicians with intermediate professional title in marine electric specialty

## **2.3 Equipment**

The equipment of the testing institute applying for accreditation shall satisfy

requirements of the commissioning test for the ship system to be jointly commissioned onshore, including but not limited to:

### **2.3.1 Power supply**

#### 2.3.1.1 DC power supply

- (1) Rated input voltage
- (2) Rated input current
- (3) Rated output voltage
- (4) Rated output current
- (5) Maximum output power
- (6) Rated breaking current of circuit breaker

The power supply parameters above shall be in consistence with the requirements of the corresponding level of Clause 2 Testing capacity of the Guidelines, the rated output voltage can be continuously and stably adjusted in the range of 0-1000V DC.

#### 2.3.1.2 AC power supply

- (1) Rated input voltage
- (2) Rated input current
- (3) Rated output voltage
- (4) Rated output current
- (5) Maximum output power
- (6) Rated breaking current of circuit breaker

The power supply parameters above shall be in consistence with the requirements of the corresponding level of Clause 2 Testing capacity of the Guidelines.

### **2.3.2 Electrical load**

#### 2.3.2.1 DC resistance load

- (1) Rated voltage
- (2) Rated current
- (3) Maximum absorption power

The power supply parameters above shall be in consistence with the requirements of the corresponding level of Clause 2 Testing capacity of the Guidelines.

#### 2.3.2.2 AC resistance load

- (1) Rated voltage
- (2) Rated current
- (3) Maximum absorption capacity

The power supply parameters above shall be in consistence with the requirements of the corresponding level of Clause 2 Testing capacity of the Guidelines.

#### 2.3.2.3 AC inductive load

- (1) Rated voltage
- (2) Maximum absorption capacity

The power supply parameters above shall be in consistence with the requirements of the corresponding level of Clause 2 Testing capacity of the Guidelines.

### 2.3.3 Simulated propeller load

A hydraulic dynamometer or equivalent functional equipment shall be used to simulate the load characteristics of the marine propeller. The steady-state speed and power of the simulated propeller load can be manually set based on the input power and speed results of the propeller at different speeds of the ship. Alternatively, an "Power-Speed" characteristic map can be set at first and then automatic loading and unloading of simulated propeller loads can be performed with the propulsion motor speed regulated. The corresponding measurement accuracy of torque and speed shall comply with requirements of the Society.

- (1) Maximum RPM
- (2) Maximum torque
- (3) Maximum absorption power
- (4) Speed measurement accuracy
- (5) Torque measurement accuracy
- (6) Speed control accuracy
- (7) Torque control accuracy

### 2.3.4 Short circuit cabinet

It is dedicated to simulate the short points for short-circuit tests of the power distribution system below 1000 VDC and the three-phase 380 V AC daily power distribution system (including the DC short-circuit between the positive and negative

terminals, and phase-to-phase short circuits of three-phase AC power). During the short-circuit fault and the corresponding protective action in the system under test, the short-circuit cabinet shall be able to withstand the short-circuit current of the system and shall not actively cut off the short-circuit fault point.

## **2.4 Measuring instruments**

The measuring instruments of the testing institute applying for accreditation shall satisfy the requirements of the commissioning tests of the ship system to be jointly commissioned onshore, and each of the grading requirements (including quantity, measuring range, accuracy, validity, etc.) . At a minimum, measuring instruments shall include, but not be limited to:

- (1) Power analyzer
- (2) Data acquisition system
- (3) Oscilloscope
- (4) High resolution voltage and current probe
- (5) Temperature data logging device
- (6) Digital clamp meter
- (7) Digital multimeter
- (8) Temperature detector
- (9) Insulation resistance tester

## **2.5 Test items**

At a minimum, the onshore joint commissioning project shall cover:

### **2.5.1 Battery system**

2.5.1.1 Check and measure the battery system parameters. The monitored value shall be within the normal range. The parameters monitored shall include but not be limited to:

- (1) Total voltage of battery bank;
- (2) SOC of battery bank;
- (3) Cell temperature;
- (4) Cell voltage;
- (5) Ambient (circumstance) temperature of battery compartment;

(6) Alarm status.

2.5.1.2 Conduct the safety protection functional test of the battery system, including but not limited to:

- (1) Overvoltage and undervoltage protection functional test of battery cell;
- (2) Over-temperature protection functional test of battery cell;
- (3) Fail-safe (overcharge, over-discharge, over-current, over-temperature, external short circuit) functional test of the battery bank;
- (4) Fail-safe functional test of BMS communication (including internal communication, and communication with PMS/EMS/AMS, charging device and other equipment);
- (5) Emergency stop test of battery system;
- (6) Minimum SOC alarm test of battery system;
- (7) Interlocking test at operation location.

2.5.1.3 Conduct the input and output tests on each battery bank (or box power supply, the same below), record the status of the battery system and DC busbar.

2.5.1.4 Conduct operation tests of battery banks, including but not limited to:

- (1) Operation test of single battery bank;
- (2) Manual parallel test: manually put each battery bank in turn, record parameters of the battery system including current, voltage, power and temperature when stabilized;
- (3) Automatic parallel test: conduct the automatic parallel test of the battery bank via the power supply control panel on the driver's console, record parameters of the battery system including current, voltage, power and temperature when stabilized;
- (4) On-load test: put the battery system into the power grid, start the propulsion converter and daily inverter, record the voltage, current, power, temperature, current difference between battery banks under each working condition (25%, 50%, 75% and 100% of the load shall be applied respectively, and the load is determined depending on the electric power calculation).

2.5.1.5 Conduct the charging test according to the actual design of the ship's charging conditions. Stop the charging process when preset charge capacity or

charging time is reached. The corresponding charging time, start and end SOC, voltage, current, power, temperature, current difference between battery banks shall be recorded.

2.5.1.6 Check the implementation of safety measures taken in response to risks of the battery systems identified in the risk assessment report, and conduct tests for verification.

## **2.5.2 Power distribution system**

2.5.2.1 Conduct DC power distribution system tests, including but not limited to:

(1) Complete operation of the disconnecter (or circuit breaker) and bus tie circuit breaker of battery circuit, propulsion circuit, charging circuit on the DC distribution board;

(2) Setting value verification of protection devices;

(3) Following requirements shall be met in interlocking test of the switch:

①When electricity power presents on both ends of the bus disconnecter (or circuit breaker), the closing operation shall not occur;

②When electricity power presents in circuit where the maintenance switch is, the breaking operation shall not occur.

③When the bus disconnecter (or circuit breaker) is closed, the insulation monitoring instruments on either side shall not be online at the same time.

(4) Conduct appropriate verification tests according to the analysis report for selective protection, including but not limited to:

①Short circuit between the positive and negative terminals of the DC busbar of DC power distribution system;

②Short circuit between the positive and negative terminals on output side of the battery system (including the converters);

③Short circuit between the positive and negative terminals on input side of DC power distribution system load device (including converters).

(5) Conduct functional test of PMS/EMS, including but not limited to:

①Battery bank grid connection/disconnection, electrical load power distribution,

non-vital loads automatic unloading, power/energy reserve analysis, heavy load inquiry;

②Real-time accounting available power and charging volume based on state of charge of the energy storage system;

③Charging/discharging the battery system under control;

④It shall have the power limitation function. The propulsion power shall be limited immediately once a battery bank/banks disconnected due to fault, preventing power loss of the whole ship due to tripping caused by overload of the other power supply devices on-grid.

⑤It shall be able to monitor fault in the power system. When power supply of the system and equipment on a non-fault section is interrupted, it shall be able to automatically take relevant measures to restore the power supply of the system and equipment;

⑥Verify that the system automatically enters into a safe state when following conditions occur:

(a) Power supply fault of power/energy management system (PMS/EMS);

(b) Programmable controller fault of power/energy management system (PMS/EMS);

(c) Communication fault of power/energy management system (PMS/EMS);

(d) Other faults with a higher risk level in the FMEA analysis report.

(6) Carry out the DC system short circuit test. Be sure that the battery system and propulsion system function normally before test. The short points protection test, including:

①Short circuit in output of the battery bank;

②Short circuit of DC busbar, including short circuit on output side of the fuse of the DC/DC conversion device, in the DC busbar, in the inverter unit, on the input side of the fuse of the main propulsion unit, and on the output side of the inverter;

③Short circuit between the positive and negative terminals on input side of DC power distribution system load device (including converters).

2.5.2.2 Conduct daily AC power distribution system tests, including but not limited to:

(1) Complete operations of relevant circuit switches on the daily AC distribution board;

(2) Safety protection functional test, including:

① Verification test of protection devices;

② Protection functional test of the inverter in case that short circuit occurs on output side, which should include AC busbar three-phase short circuit of AC daily power distribution system, three-phase short circuit on output side of the AC daily power distribution system power supply unit, three-phase short circuit on input side of load of the AC daily power distribution system; monitor and record output voltage, current, frequency, and isolation transformer of the inverter, and switch status and current of each branch of the AC power distribution board;

③ Shore power/ship power interlocking test.

(3) Following requirements shall be met in interlocking test of switch:

① The secondary side switch and bus tie switch of the isolation transformer must not be closed at the same time;

② The secondary side switch and shore power switch of the isolation transformer must not be closed at the same time;

③ When the bus tie switch is closed, the insulation monitoring instrument on either side shall not be online at the same time.

(4) The corresponding verification tests shall be carried out according to the analysis report of selective protection, including but not limited to:

① Three-phase short-circuit on AC busbar of daily power distribution system;

② Three-phase short circuit on output side of the AC daily power distribution system power supply unit;

③ Three-phase short circuit on input end of load of the AC daily power distribution system.

(5) Daily inverter tests, including but not limited to:

① No-load test of daily inverter: Start and stop the inverter under control, record the no-load voltage and frequency of the secondary side of the isolation transformer;

② On-load test of the daily inverter: start the inverter, run for 1 to 5 minutes for each

with the load adjusted to 25%, 50%, 75%, 100% and 110% respectively. Record operation parameters of the inverter, including output voltage, current, frequency, power, unit temperature and voltage harmonics, winding temperature of isolation transformer, winding temperature of filter;

③ Sudden loading/unloading test of daily inverter: with the inverter loaded to rated value after started and then operating stably, suddenly unload by 100% and record change of voltage output of the inverter and time for stabilization; then suddenly load by 0-50% to 100% and record change of voltage output and time for stabilization;

④ Transferring test between daily inverters, record the time of automatic switching and manual switching;

⑤ Transferring test between daily transformers, record the time of automatic switching and manual switching;

⑥ Parallel operation test of day inverters, record the output voltage, current and frequency of the two daily inverters during long-term parallel operation, calculate difference between the active and reactive power distribution.

(6) Check the function of mutual transferring between ship power and shore power.

2.5.2.3 Check the implementation of safety measures taken in response to the risks of the power distribution system identified in the risk assessment report, and conduct test to verify.

### **2.5.3 Propulsion system**

2.5.3.1 Single motor/multi-motor starting / stop test.

2.5.3.2 Propulsion system protection test, including but not limited to:

(1) Emergency shutdown test of propulsion motor: start the propulsion motor to run at rated speed. Test the functions of emergency stop buttons on the propulsion control panel and the propulsion control box respectively;

(2) Overspeed protection test of propulsion motor: conduct this test by changing the overspeed alarm and protection thresholds of the propulsion system;

(3) Starting interlock functional test of propulsion motor: by simulating a fault condition of the propulsion system, it can be tested whether the propulsion system can

be started when the fault is not restored.

(4) Power supply failure test of the propulsion control system: test to verify that the control system can be switched to run normally on standby power supply when main power supply fails;

(5) Communication fault alarm functional test: when the communication between the inverter and the propulsion control system is disconnected, and the propulsion system shall report communication fault;

(6) Over-temperature protection functional test of propulsion motor: when temperature of the motor reaches to or above the alarm setting point, the propulsion control system shall report appropriate fault and block the starting signal;

(7) Interlocking test of space heater and operation of the propulsion motor;

(8) Overriding control functional test.

2.5.3.3 The functional tests of the propulsion system shall include:

(1) Start, speed-up, slow-down, stop and other control functions of each propulsion motor;

(2) Reversing test for each propulsion motor;

(3) Conduct control transferring and control tests including multi-operation site, multi-propulsion units joint control/sub-control, etc.

2.5.3.4 Load test of propulsion system, including:

(1) No-load test for each motor;

(2) For on-load test of each propulsion motor, the load shall be increased and then decreased according to 0-25%-50%-75%-100%-75%-50%-25%-0, and the parameters of each test point shall be recorded.

2.5.3.5 Check the implementation of safety measures taken in response to the risks of the propulsion system identified in the risk assessment report, and conduct test to verify.

## **2.5.4 Cooling system**

2.5.4.1 Monitor the temperature variation of the battery system equipment, propulsion system and power distribution system, to verify the temperature regulation

capacity of the cooling system.

2.5.4.2 Test the safety protection strategy of the cooling system under condition with a single fault.

### **2.5.5 Continuous operation stability test of integrated power system**

According to the task profile of a typical voyage of the ship (determined by the surveyor in consultation with the shipowner and the design institute, but at least including the main working conditions of berthing, entering and leaving the port, cruising, full speed, etc.), complete continuous operation stability test for one complete task profile at least. The test shall not be Interrupted due to fault of the participating equipment.

## **3 Quality system of testing institute**

The accreditation for quality system of the testing institute shall be carried out in accordance with relevant requirements of the Guidelines for the Accreditation of Marine Product Testing Institutes.

## **4 Format and requirements of report**

4.1 The test report shall be in a format acceptable to the Society. The test report shall be prepared, reviewed and approved in accordance with the prescribed requirements.

4.2 In general, the test report should include the name of the applicant, the name of the entrusting party, the information on the test sample (number, type/specification), test methods, technical requirements, test results, relevant test photos, conclusions or results of judgment, etc.

4.3 Test certificates and reports shall also include:

Name, model and calibration status of measuring equipment;

Name, model and calibration status of auxiliary equipment;

Name, model and connection mode of auxiliary equipment related to the equipment under test;

Connection diagram of the equipment under test;

Layout of testing;

Test data.