

GUIDANCE NOTES
GD001-2024



CHINA CLASSIFICATION SOCIETY

GUIDELINES FOR OFFSHORE FISHERY UNITS AND INSTALLATIONS

2024

Effective from 1 April, 2024

Beijing

Table of Contents

Chapter 1 General	1
Section 1 General Provisions	1
Section 2 Definition	1
Section 3 Acceptable Standards	3
Section 4 Characters of Classification and Class Notations	4
Section 5 Classification Surveys	8
Section 6 Certification Survey	15
Section 7 Operation Manual	16
Chapter 2 Structure	18
Section 1 General Provisions	18
Section 2 Design Loads	19
Section 3 Structural Design	21
Section 4 Special Requirements for Column-Stabilized Fisheries installations	22
Section 5 Special Requirements for Frame-type Fisheries installations	22
Section 6 Special Requirements for Combined-type Fisheries installations	24
Section 7 Corrosion Protection and Corrosion Weight Grow	24
Chapter 3 Stability, Subdivision and Load Lines	26
Section 1 General Provisions	26
Section 2 Stability	26
Section 3 Load Lines	26
Section 4 Watertight and Weathertight Integrity	27
Chapter 4 Outfitting and Positioning System	28
Section 1 General Provisions	28
Section 2 Temporary Anchoring Equipment	28
Section 3 Towing Equipment	28
Section 4 Position Mooring System	28
Section 5 Dynamic Positioning System	30
Section 6 Netting and Its Accessories	30
Section 7 Other Outfitting Equipment	31
Section 8 Living Quarters	32
Chapter 5 Machinery Installations and Systems	33
Section 1 General Provisions	33
Section 2 Pumping System	34
Section 3 Ventilation System, Overflow and Sounding System of Compartments	36
Section 4 Ventilation System	36
CHAPTER 6 Electrical Installations	38
Section 1 General Provisions	38
Chapter 7 Fire Protection and Explosion Prevention	40
Section 1 General Provisions	40

Section 2 Fire Detection	41
Section 3 Containment of Fire	41
Section 4 Fire Control and Firefighting	45
Section 5 Escape	46
Section 6 Special Requirements for Unattended Fisheries installations	47
Chapter 8 Safety Equipment	51
Section 1 Life-saving Appliances and Equipment	51
Section 2 Communication Equipment	53
Section 3 Signal Equipment	54
Chapter 9 Pollution Prevention Structures and Equipment	55
Section 1 General Provisions	55
Chapter 10 Ship-type Marine Fisheries Installations	56
Section 1 General Provisions	56
Section 2 Structure	59
Section 3 Outfitting and Positioning System	62
Section 4 Subdivision and Stability	63
Section 5 Gas Turbine Installation and System	64
Section 6 Electrical Installations and Automation System	64
Section 7 Fire Protection	64
Section 8 Safety Equipment and Pollution Prevention	64
Appendix 1 Certification Requirements for Fishery Aquaculture Products with Class Notations .	66
Appendix 2 Special System and Equipment for Fishery Aquaculture	70
Section 1 General Provisions	70
Section 2 Main Systems and Equipment	70
Appendix 3 Recommended Practices for Netting Effect Analysis and Testing	73
Section 1 General Provisions	73
Section 2 Test on Influence of Netting on Fisheries Installations Performance	73
Section 3 Analysis on Hydrodynamic Characteristics of Netting	74
Section 4 Physical Model Test Method	77
Section 5 References	79

Chapter 1 General

Section 1 General Provisions

1.1.1 General Requirements

1.1.1.1 The Guidelines [are](#) the basis for China Classification Society (hereinafter referred to as "CCS") [for](#) classification survey and certification of marine fisheries installations [and their products](#).

1.1.1.2 [The Guideline provides the basis for the certification and survey of the construction safety, equipment safety, tonnage, load line, and marine and environmental pollution prevention of marine fisheries installations.](#)

[1.1.1.3 The specific requirements from the competent authority, if any, shall prevail.](#)

1.1.2 Scope of Application

1.1.2.1 The Guidelines apply to [the new marine fisheries installations. Major renovations and related parts of marine fisheries installations shall be subject to the Guidelines.](#)

1.1.2.2 The [ship-type marine fisheries installations, unless otherwise specified](#), shall meet the requirements of Chapter 10 of the Guidelines.

1.1.3 Equivalent and Exemption

1.1.3.1 Provisions inconsistent with the requirements of the Guidelines (including the requirements of acceptance standards), if any, may be accepted, to substitute the corresponding requirements of the Guidelines, provided that they are demonstrated or shown in written documents to reach at least the same safety level as the requirements of the Guidelines, [and approved by CCS.](#)

[1.1.3.2 Any device, material, equipment, or appliance installed on the installation, if proven by tests and other methods to reach at least the same safety performance as required in the Guidelines, may replace the device, material, equipment and appliance specified in the Guidelines upon the approval of CCS.](#)

[1.1.3.3 The calculation methods, assessment criteria, manufacturing procedures, materials, survey, and testing methods specified in the Guidelines, if provided with the supporting test and theoretical basis, service experience, or standards accepted by the Guidelines, may be accepted as alternative and equivalent methods with the approval of CCS.](#)

1.1.3.4 For marine fisheries installations with new structures and novel features, if the application of any provisions of the Guidelines may seriously hinder the application of the features or the use of the structures, such provisions may be excluded with the consent of CCS. [However, the installations shall be used for its intended purpose and its overall safety shall be guaranteed.](#)

[1.1.3.5 For marine fisheries installations with new structures and novel features uncovered in the Guidelines, if the owner or its agent intends to design, manufacture, or operate the entire installation or a system or element of the installation through the risk assessment technique, the risk assessment data shall be reviewed and approved by CCS.](#)

[1.1.4 Risk assessment](#)

[1.1.4.1 The owner or applicant should conduct a comprehensive and systematic analysis of the possible risks exposed in the design, construction, migration, commissioning, and production stages of novel marine fisheries installations, and take appropriate risk control measures.](#)

Section 2 Definition

1.2.1 Definition

1.2.1.1 Unless otherwise specified, the definitions of the terms adopted for the purpose of the

Guidelines are as follows:

(1) Marine fisheries installations

The marine fisheries installations (including aquaculture vessels), floating fisheries units, and fixed fisheries platform directly used for aquaculture in designated marine areas. Generally, the main structure is made of steel, including the column stabilized type, frame type, combined type, ship type, barge type, submersible type, self-elevating type, and jacket type.

(2) Installation Type

① Column Stabilized/Semi-submersible Type

The structural form connecting the upper shell to the lower shell or footing column with the columns or caissons.

② Frame Type

A structural form that is mainly composed of a steel frame floating structure.

③ Combined Type

The form connecting multiple floating bodies together in a rigid or flexible manner, with some individual units equipped with the storage, living, and other functional modules.

④ Ship Type

The ship type structure (boat-shaped, displacement-type), equipped with the fishery holds formed by the bulkheads and/or side plates. Such structure supporting the self-propulsion function is called an aquaculture vessel.

⑤ Barge Type

The ship type structure (boat-shaped, displacement-type), equipped with the fishery holds formed by the bulkheads and/or side plates. Such structure, supporting no self-propulsion function, is a marine fisheries installation for aquaculture in the specified water area.

⑥ Submersible Type

A marine fisheries installation, in which the lower shell and several columns supports the upper shell on the surface, the lower shell is placed on the seabed and the entire weight of the upper shell is supported by the columns during the operation.

⑦ Self-elevating Type

A marine fisheries unit, in which a movable leg is provided, allowing to raise the main body to a predetermined height above the sea surface for operation along the leg supported on the seabed, to lower the main body into the sea and to retrieve the leg.

⑧ Jacket Type

A fixed fisheries platform, in which the main structure is constructed by tubular components welded and the entire weight of the unit is supported by piles driven into the seabed.

(3) Installation Category

① Marine fisheries unit

A marine fisheries unit that can be moved from one place to another for operations according to the working needs.

② Floating Fisheries Installation

The marine fisheries installation that is moored at a location by means of non-rigid fixing, such as

ropes, anchor chains or tension tendons or ballasts or mooring yokes, for a long time and floats on the sea (including the submersible conditions).

③ Fixed Fisheries Platform

A marine fisheries unit that is fixed to the seabed through the bottom support structures such as the jackets, pile foundations, and gravity-type foundations.

(4) Nearshore Fishery Installation

A marine fisheries installation that are located within a distance of no more than 2nmi from the mainland coast of China.

(5) Unattended marine fisheries installation

A marine fisheries installation without any people living on. Under special circumstances, such as the maintenance, emergency troubleshooting, approved visits, survey and regular inspections, the number of people accessing to the installation shall be minimized. Boarding personnel are not allowed to stay overnight on the installation.

Section 3 Acceptable Standards

1.3.1 General Requirements

1.3.1.1 In addition to the requirements of the Guidelines, CCS recognizes the applicable parts of international standards, national standards and industry standards for marine fisheries installations. In case of any inconsistency between the accepted standards and the requirements of the Guidelines, the latter shall prevail. References to relevant documents in the Guidelines constitute requirements of the Guidelines. For all undated documents, their latest version applies to the Guidelines.

1.3.1.2 The certificate of compliance may be issued for the installations in accordance with the Guidelines, the main conventions and national technical regulations, as follows:

(1) IMO *International Convention for the Safety of Life at Sea, 1974 and Amendments* thereto (referred to as “Convention for the Safety of Life of at Sea”);

(2) IMO *International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978* relating thereto (referred to as “Convention on Pollution Prevention”);

(3) IMO *International Convention on Load Lines, 1966, the Protocol of 1988 Relating to International Convention on Load Lines, 1966 and Amendments* (referred to as the “Load Lines Convention”);

(4) IMO *International Convention on Tonnage Measurement of Ships, 1969* (referred to as “Tonnage Measurement Convention”);

(5) IMO *International Regulations for Preventing Collisions at Sea, 1972* (referred to as “Regulations for Preventing Collisions”);

(6) IMO *International Convention on the Control of Harmful Ant-fouling Systems on Ships, 2001* (referred to as “Anti-fouling Convention”);

(7) IMO *International Convention for the Control and Management of Ship’s Ballast Water and Sediments, 2004* (referred to as “Ballast Water Convention”);

(8) China MSA *Technical Regulations for Statutory Survey of International Sea-going Ships*;

(9) China MSA *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*;

(10) *Discharge Standard for Water Pollutants from Ships* of the Ministry of Ecology and Environment of the People's Republic of China;

(11) China MSA *Technical Regulations for Offshore Mobile Units* (2023);

[\(12\) China MSA Survey Regulations for Statutory Survey of Offshore Mobile Units \(2023\);](#)

[\(13\) China MSA Technical Regulations for Statutory Survey of Lifting Appliances;](#)

[\(14\) China MSA Technical Regulations for Statutory Survey of Towage at Sea;](#)

[\(15\) China MSA Tonnage Measurement Regulations.](#)

Section 4 Characters of Classification and Class Notations

1.4.1 General requirements

1.4.1.1 [Upon application by the owner or its agent for the marine fisheries installations,](#) if the structural strength and integrity of the main components of the installation and its appendages, as well as the reliability and functionality of the propulsion system and steering system (where applicable), power generation system, and other equipment or auxiliary systems installed on the installation, comply with [the requirements of the Guidelines](#) and are qualified to maintain the basic services through [CCS classification survey](#), [the characters of classification and class notations may be granted By CCS accordingly.](#)

1.4.1.2 [The classification survey includes the approval of design plans, survey during construction, and post-construction survey. If it is confirmed that the installation meets the requirements of the Guidelines, the appropriate characters of classification and class notations will be granted, and the classification certificate will be issued. If the installation is proved by post-construction survey to meet the requirements of the Guidelines, a classification certificate is signed or issued.](#)

1.4.2 Character of classification

1.4.2.1 The character of classification, as a statement of major features of the marine fisheries installation, is mandatory.

(1) The character of classification of the marine fisheries unit shall comply with the provisions of 2.3.1, Section 3, Chapter 2, Part 1 in *CCS Rules for Classification of Mobile Offshore Units (2023)*. If the aquaculture vessel meets the relevant requirements of the Guidelines, the corresponding character of classification may be assigned by CCS.

(2) The character of classification of floating fisheries installation shall comply with the provisions of 2.3.1, Section 3, Chapter 2, Part 1, in *CCS Rules for Classification of Offshore Floating Installation (2023)*.

(3) The characters of classification of fixed fisheries platforms shall conform to the following requirements:

★ CSA - denotes that the product survey, plan approval, and survey during construction of the main body and essential auxiliary equipment of the unit are conducted by CCS, and they meet CCS rules. In special circumstances, before the unit delivery, its main body and equipment shall undergo CCS classification survey, and comply with the equivalent CCS rules, and ★ can be replaced by ★ (--).

★ CSA - denotes that the product survey, plan approval, and survey during construction of the main structure and essential auxiliary equipment of the unit are NOT conducted by CCS, but later, their classification survey is conducted by CCS, which regards they meet CCS rules.

1.4.3 Class notation

1.4.3.1 Class notations are used to describe the different features of marine fisheries installations and are attached to the character of classification, including the mandatory and optional notations, as shown in Table 1.4.3.1.

1.4.3.2 In terms of optional class notations, the owner or its agent shall apply to CCS for plan approval and survey, and after the compliance with the relevant provisions of the Guidelines is proved, the relevant class notation will be granted by CCS.

1.4.3.3 Class notations include 1 or 1 set of notations indicating the installation type, installation category, special systems and facilities, automatic control, green ecology, restricted aquaculture areas, and other meanings.

1.4.3.4 For marine fisheries installations constructed in accordance with CCS regulations or other standards accepted, CCS will assign the appropriate class notations on a case-by-case basis upon the request from the owner, the designer or the shipyard.

1.4.3.5 Table 1.4.3.1 shows a list of class notations for marine fisheries installations, in which the classification certificate can be filled in English only. The table covers the following categories:

A: Class notation for installation type: All marine fisheries installations shall be marked with corresponding class notations;

B: Class notation for installation [category](#): All marine fisheries installations shall be marked with appropriate class notations;

C: Class notations for special systems and facilities: Special systems and facilities on the marine fisheries installations shall be designed and constructed in accordance with relevant specifications and guidelines, and can be assigned with corresponding class notations;

D: Class notations for automatic control: Automatic control and remote control devices on the marine fisheries installations shall be designed and constructed in accordance with relevant specifications and guidelines, and can be assigned with corresponding class notations;

E: Class notations for [green ecology](#): The marine fisheries installations that comply with the relevant provisions of CCS rules may be assigned with the corresponding class notations;

F: Class notations for [restricted](#) aquaculture area: The marine fisheries installations with restricted aquaculture areas shall be marked with corresponding class notations.

Class Notations

Table 1.4.3.1

Class Notation	Description		Applicable technical requirements
A Class notation for installation type			
Column Stabilized/ Semi-submersible	Column Stabilized/ Semi-submersible	The structural form defined in 1.2.1.1 (2) ① of this Chapter	Applicable requirements of Chapters 1 to 7 of the Guidelines
Frame Type	Frame Type	The structural form defined in 1.2.1.1 (2) ② of this Chapter	Applicable requirements of Chapters 1 to 7 of the Guidelines
Combined Type	Combined Type	The structural form defined in 1.2.1.1 (2) ③ of this Chapter	Applicable requirements of Chapters 1 to 7 of the Guidelines
Ship Type (Fishery Aquaculture Ship)	Ship Type	The structural form defined in 1.2.1.1 (2) ④ of this Chapter	Applicable requirements of Chapter 1 and Chapter 10 in the Guidelines
Barge Type	Barge Type	The structural form defined in 1.2.1.1 (2) ⑤ of this Chapter	Applicable requirements of Chapters 1 and 10 in the Guidelines
Submersible	Submersible Type	The structural form defined in 1.2.1.1 (2) ⑥ of this Chapter	The relevant provisions of CCS

Class Notation	Description		Applicable technical requirements
			Rules for Classification of Mobile Offshore Units (2023)
Self-elevating	Self-elevating	The structural form defined in 1.2.1.1 (2) ⑦ of this Chapter	The relevant provisions of CCS Rules for Classification of Mobile Offshore Units (2023)
Jacket Type	Jacket Type	The structural form defined in 1.2.1.1 (2) ⑧ of this Chapter	Applicable requirements of Chapter 1 - 7 of the Guidelines and provisions of CCS Rules for Classification and Construction of Fixed Offshore Units (2012)
B Class notation for installation category			
Marine Fisheries Unit	Marine fisheries unit	Marine fisheries unit defined in 1.2.1.1 (3) ①	Applicable requirements of Chapter 1 - 7 of the Guidelines; the ship-type and barge-type facilities meet the applicable requirements of Chapters 1 and 10
Floating Fisheries Installation	Floating fisheries installation	The floating fisheries installation defined in 1.2.1.1 (3) ②	Applicable requirements of Chapter 1 - 7 of the Guidelines; the barge-type installation meets the applicable requirements of Chapters 1 and 10
Fixed Fisheries Platform	Fixed fisheries platform	The marine fisheries installation defined in 1.2.1.1 (3) ③	Applicable requirements of Chapter 1 - 7 of the Guidelines and provisions of Rules for Classification and Construction of Fixed Offshore Units (2012)
C Class notation for special systems and facilities			
PM	Position mooring system	Fisheries facilities with the position mooring system shall be marked with this class notation	Section 4 of Chapter 4 in the Guidelines
Thruster	Thruster	The non-self-propelled units that achieve the short-distance shift within the aquaculture area using their own propulsion devices can be assigned with this notation	Part 4 and Chapter 6 of Part 9 in CCS Rules for Classification of Mobile Offshore

Class Notation	Description		Applicable technical requirements
			Units (2023)
IWS	In-water survey	The marine fisheries unit with in-water survey conditions can be assigned with this class notation symbol, to replace the survey of the installation bottom and related items in the dry dock state	Chapter 2 of Part 9 in CCS Rules for Classification of Mobile Offshore Units (2023)
Lifting Appliance	Lifting appliance	The crane for marine fisheries installations. If it meets the relevant requirements of CCS, this class notation can be marked	CCS Rules for Lifting Appliances of Ships and Offshore Installations
Fishery Equipment	Fishery equipment	Fishery equipment for marine fisheries installations can be marked with this class notation.	Comply with the design specifications or industry standards and Appendix 2 of the Guidelines
Free-flooding Fishery Holds Nos(X1,X2,)	Free-flooding fishery holds	One or more free-flooding fishery holds are connected to the open seas through side openings, and the specific fishery holds are indicated in parentheses. This class notation is only applicable to the ship-type marine fisheries installation with free-flooding fishery holds	Applicable requirements of Chapter 10 in the Guidelines
D Class notation for automatic control			
AUT-0	Machinery space (periodically unattended)	The propulsion device can be remotely controlled at the bridge control station, and the machinery space includes the compartment centralized control station (room), which is periodically unattended and can be assigned with this class notation	Part 6 in CCS Rules for Classification of Mobile Offshore Units (2023)
MCC	Centralized control at machinery space	The unit is equipped with a compartment centralized control station (room) and a local control station. During the normal operation of electromechanical equipment, the compartment centralized control station (room) is continuously manned, and can be assigned with this class notation	Part 6 in CCS Rules for Classification of Mobile Offshore Units (2023)
BRC	Bridge remote control	The main propulsion device is remotely controlled at the bridge control station. The unit continuously manned at the machinery space can be assigned with this class notation	Section 3, Chapter 4 of Part 7 in the Rules for Classification of Sea-going Steel Ships (2023)
E Class notation for green ecology			
AFS	Anti-fouling system	Anti-fouling system contains no organo-tin compounds used as biocides in the marine fisheries installations	CCS Green Ecological Ship Code
GWC	Gray water discharge control	The waste water discharged from the laundry, bathroom, kitchen, and residential apartment on marine fisheries installations is controlled as	CCS Green Ecological Ship Code

Class Notation	Description		Applicable technical requirements
		required, and the marine fisheries installations are equipped with the gray water collection tanks, high-level alarms, and sewage treatment systems with the required capacity, and can be assigned with this class notation	
F Class notation for restricted aquaculture area			
Service Area	Service area	The marine fisheries installations are designed according to the predetermined service area, with the service area indicated, and can be assigned with this class notation, which indicates the smallest unit of longitude and latitude known, corresponding to floating fisheries installation and fixed fisheries unit	Applicable requirements of Chapters 1 to 7 of the Guidelines
Service Restricted	Service restricted	For units operating in the sheltered area, the design wind speed is less than 36m/s but no less than 25.8m/s during the normal operating conditions. For other services restricted, refer to domestic marine vessels. The operation manual shall specify the restricted operating conditions of the unit, corresponding to the marine fisheries unit	The sheltered area is subject to Chapter 2 of Part 2 and Chapter 2 of Part 3 in <i>CCS Rules for Classification of Mobile Offshore Units</i> (2023). For other services restricted, refer to relevant provisions on domestic marine vessels.

1.4.4 Combination of characters of classification and class notations

1.4.4.1 [The class notation is attached to the character of classification, and the class notation for marine fisheries installations](#) shall be filled into the classification certificate in the order of 1.4.3.5.

Section 5 Classification Surveys

1.5.1 General requirements

1.5.1.1 [In addition to fulfilling the special provisions in this section, the classification survey of marine fisheries unit shall comply with the applicable provisions of *CCS Rules for Classification of Mobile Offshore Units* \(2023\), and the classification survey of floating fisheries installation shall comply with the applicable provisions of *CCS Rules for Classification of Offshore Floating Installation* \(2023\). The classification survey of fixed fisheries platform shall comply with the applicable provisions of *CCS Rules for Classification and Construction of Fixed Offshore Units or Rules for Construction and Surveys of Fixed Units in Shallow Sea*.](#)

1.5.1.2 The scope of the plans to be submitted for the classification surveys shall meet the applicable rules specified in 1.5.1.1, and shall be determined by considering the structural types and functions of the installation. The ship-type marine fisheries installations shall meet the requirements of Chapter 10 of the Guidelines.

1.5.1.3 Product survey is part of the installation classification survey and certification survey. In addition to meeting the applicable requirements of the Guidelines, the product survey shall also comply with the applicable requirements for product survey stipulated in 1.5.1.1. If the class notation "Fishery Equipment" is selected, the requirements of Appendix 1 "Certification Requirements for Fishery Aquaculture Products with Class Notations" shall be met.

1.5.1.4 [For fixed fisheries platforms, the review and inspection of offshore installation shall be](#)

conducted.

1.5.2 Surveys during construction

1.5.2.1 For facilities applied to CCS for construction survey, the applicant shall submit a written application for installation construction survey to the Headquarters of CCS or its local branch before the construction.

1.5.2.2 For the shipyard applying for the construction of CCS-class facilities for the first time or those constructing a new type of CCS-class installation for the first time, the surveyor shall assess the production capacity of the shipyard, including the quality assurance system of the production site, facilities and the shipyard, the qualifications of construction personnel, subcontractors, as well as the applicability and effectiveness of the installations to be constructed.

1.5.2.3 Pre-commencement survey

Before the commencement, the surveyor shall inspect and confirm the relevant preparations for the construction and inspection of the shipyard, and ensure that they meet the requirements of Article 4.1.3 of Chapter 4.1 of Part 11 in CCS *Rules for Classification of Mobile Offshore Units* (2023).

1.5.2.4 Verification of other test/survey documents

(1) The surveyor shall review or confirm the field test and process documents provided by the shipyard for the preparation work and related information of the installation to be constructed, including the machinery, equipment, and system installation processes (excluding proper alignment of the shafting), inclining test, mooring test, and sea trial outline.

(2) The surveyor shall confirm that the testing company, testing personnel, and testing equipment are provided with valid qualification certificates recognized or accepted by CCS.

1.5.2.5 Inspection and test

(1) The surveyor shall conduct the survey in accordance with approved drawings and documents (including the drawing review comments), and confirm the implementation of measures taken by the shipyard. Any objections to the shipyard's implementation of approved drawings and their review comments shall be promptly reported to the plan approval department.

(2) The shipyard shall compile a list of certified products related to the proposed installation in accordance with the requirements of the specifications and Appendix 1 of the Guidelines, and submit it to the field surveyor for confirmation. Among them, the classification survey of marine fisheries unit shall comply with the applicable provisions of Chapter 3 of Part 1 in CCS *Rules for Classification of Mobile Offshore Units* (2023), and the classification survey of floating fisheries installation shall comply with the applicable provisions of Chapter 3 of Part 1 in CCS *Rules for Classification of Offshore Floating Installation* (2023). The classification survey of the fixed fisheries platform shall comply with the applicable provisions of CCS *Rules for Classification and Construction of Fixed Offshore Units* (2023);

(3) Facilities of same series, constructed by the same shipyard, can be exempted from partial test items specified in the application rules as sister ships.

1.5.2.6 Inspection and test items

(1) Inspection and test items of main body:

① The surveyor shall confirm the main structural materials (metal materials, castings, forgings, welding materials, non-metal materials, etc.), anchoring and mooring equipment and systems specified in the regulations and the required product certificates or documents;

② The surveyor shall inspect the main structure and equipment of the installation, and ensure that the materials, dimensions, manufacturing, layout, and installation of the installation are consistent with the approved drawings, charts, instructions, calculation sheets, and other technical documents,

and that the processes and other aspects are satisfactory to the surveyor;

③ If the surveyor finds any scantlings of main structural members, materials or poor materials, construction, layout, processes, devices, or equipment that fail to comply with the approved drawings, charts, instructions, calculation sheets, and other technical documents, correction is required;

④ The surveyor shall conduct the construction survey of the installation, which includes the control inspection of main stages, component dimension inspection, welding quality inspection, and the inspection of important structural welding specifications;

⑤ Inspect the compartment structure and confirm the integrity of the installation structure;

⑥ Conduct the structure test or leakage test, flushing test, or other alternative tests on compartment structures, including the transverse bulkheads and longitudinal bulkheads;

⑦ Inspect and test the hatch, opening and its closing devices, including the operation test for the remote control device;

⑧ Inspect the foundation structure and trunk structure (pile leg trunk) of pile legs, pile shoes/mats, lifting devices and locking devices (if applicable);

⑨ Inspect the supporting structure of important equipment such as thrusters, cranes, anchor windlasses, and anchor chain guides (if applicable);

⑩ Inspect and test the watertight doors, weather-tight doors, windows, and their closing facilities;

⑪ Inspect and test the steering devices, anchoring and mooring equipment after the installation (if applicable);

⑫ Carry out the welding inspection of towing assembly, and check the spare towing parts;

⑬ Confirm the centerline of the rudderstock and the shafting centerline of the propulsion machinery (if applicable);

⑭ Confirm the main dimensions of the installations, load line marks, draft marks, and other markings of the installations;

⑮ Participate in the inclining test, including the pre-test installation condition check and post-test evaluation, and confirm the lightship weight and the center of gravity of the installation;

⑯ Inspect and test class notation items, including the compliance of the materials, equipment, devices, and systems required in the specifications with the approved drawings, calculations, and other technical documents, certificates required by the specifications, and satisfaction of processes and other aspects to the surveyor;

⑰ Participate in the mooring test;

⑱ Inspect the safety measures for personnel protection on the deck, such as the escape routes, ladders, railings, and safety ropes;

⑲ In terms of the main body inspection of combined-type installation structure, check that the connection structure between combined-type units, and the fender are consistent with approved drawings, and carry out the field inspection after the connection of each unit;

⑳ Sea trials;

㉑ Other items that CCS considers necessary for inspection and testing.

(2) Mechanical inspection and test items:

① The surveyor shall confirm that the specified mechanical equipment, devices, facilities, and systems are provided with the product certificates or documents specified in the regulations;

- ② The surveyor shall check the arrangement, installation, and process of machineries, equipment, devices and systems, to ensure the compliance with approved drawings, charts, manuals, calculations, and other technical documents;
 - ③ The surveyor shall participate in the manufacturing, installation inspection, and testing of pipelines, including the strength test in the workshop and tightness test after the installation;
 - ④ Functional tests after the installation of pump and piping systems, such as the fuel, lubricating oil, seawater lift, cooling, heating, sweeping, bilge, ballasting, fire protection, ventilation, measurement, ventilation, installation lifting, and installation locking systems;
 - ⑤ Inspection and functional test after the installation of machineries, equipment, devices, and systems, such as the main units, propulsion shafting, propellers, gearboxes, generator sets, boilers, pressure vessels, steering engines, anchor windlasses, air compressors, heat exchangers, sea valves, and overboard discharge valves;
 - ⑥ Inspection and functional test after the installation of control system or remote control system for main unit, auxiliary unit and other auxiliary machinery and devices;
 - ⑦ Inspection and functional test after the installation of remote shutdown devices, such as the emergency shutdown devices for fuel tanks, ventilation systems, and opening closure devices;
 - ⑧ Inspection and functional test after the installation of equipment, devices, and systems with class notations;
 - ⑨ Check the arrangement of fire pumps and fire mains, verify the separate operation of each fire pump (including the emergency fire pump), and ensure the required pressure of the fire main at any part of the installation;
 - ⑩ Check the special arrangement, mechanical ventilation and exhaust fans for the fixed fire extinguishing systems, machinery spaces, and boiler spaces, as well as the operation of remote shutdown devices;
 - ⑪ Participate in the mooring tests and sea trials (where applicable);
 - ⑫ Items that CCS considers necessary for inspection and test.
- (3) Electrical inspection and test items:
- ① The surveyor shall confirm that the specified electrical equipment and systems are provided with the product certificates or documents specified in the regulations;
 - ② The surveyor shall check the arrangement, installation, and process of electrical equipment, such as the generators, motors, cables, main switchboards and emergency switchboards, to ensure the compliance with approved drawings, charts, manuals, calculations, and other technical documents;
 - ③ Inspection and test after the installation of electrical equipment such as the generators, motors, cables, main switchboards and emergency switchboards;
 - ④ Inspect and test the steering systems, including the emergency steering system (where applicable);
 - ⑤ Inspect and test the installation communication systems and installation alarm systems;
 - ⑥ Inspect and test the electrical equipment in hazardous areas after the installation (where applicable);
 - ⑦ Inspect and test the emergency power supplies, including the temporary emergency power supplies;
 - ⑧ Inspect and test the equipment, devices, and systems with class notations after the installation,

such as the control of the mechanical automatic control system and remote control system - main unit, auxiliary unit, other auxiliary machinery, and the inspection, fault modes and effect analysis test and functional test of boiler control, safety systems, alarm systems, and dynamic positioning systems;

⑨ Failure modes, effect analysis and functional test (where applicable);

⑩ Grounding inspection of movable equipment and aluminum structures (where applicable);

⑪ Participate in the mooring tests and sea trials (where applicable);

⑫ Items that CCS considers necessary for inspection and test.

(4) Fire prevention inspection and test items:

① Check the compliance of overall layout of installations and hazardous areas with design plans;

② Check the escape routes and evacuation routes;

③ Check the ventilation system layout and technical requirements;

④ Inspect the fire-resistant partitions;

⑤ The surveyor shall confirm that the required structural fireproof materials, fire and explosion-proof equipment and systems are provided with the product certificates or documents specified in the regulations;

⑥ Inspect the fire control drawings and their posting;

⑦ Inspect the arrangement and ventilation of fire extinguisher storage rooms;

⑧ Inspect and test the fixed fire extinguishing systems;

⑨ Inspect the fire equipment, firefighter equipment, and breathing apparatus for emergency escape;

⑩ Inspect and test the fire detection and alarm systems;

⑪ Inspect and test the combustible gas detection and alarm systems;

⑫ Inspect and test the explosion-proof equipment;

⑬ Inspect and test the emergency shutdown system;

⑭ Items that CCS considers necessary for inspection and testing.

(5) Inspect the items of life-saving appliance, as the case may be:

① Verify the configuration and arrangement of lifeboats, life rafts, the marine evacuation systems (if applicable) and rescue boats;

② Confirm that notices or signs are marked near the containers, brackets, shelves, and other similar storage locations of lifeboats and life rafts and their launching stations and life-saving appliance;

③ Inspect the lifeboats and their accessories;

④ Inspect the boarding arrangements of lifeboats and life rafts, and test the launching and recovery devices at each launching position, including the overload test, the test to determine the launching speed, and the test of the lifeboats and life rafts lowering onto the water surface during the light draught (or the design water depth of the fixed unit); verify the recovery devices of each lifeboat and life raft, and check that the lifeboat can be launched by the self-propelled unit at the forward speed of 5kn on calm water. In cases where the test is impractical due to special

arrangements of the unit, the test may be exempted with the consent of CCS;

⑤ Inspect the rescue boats and their accessories;

⑥ Inspect the boarding and recovery devices of each rescue boat, and test the launching and recovery devices, including the overload test and the test to determine the launching and recovery speed, ensuring that the rescue boat can be lowered onto the water surface and be recovered during the light draught; check that the rescue boat can be launched by the self-propelled unit at the forward speed of 5kn on calm water. In cases where the test is impossible due to special arrangements of the unit, the test may be exempted with the consent of CCS;

⑦ Check that the thrusters of the rescue boat and each lifeboat (when installed) can be started normally and operated in forward and reverse manner through the test;

⑧ Check the configuration and storage of portable communication equipment (if any), two-way VHF radio telephone equipment, and search and rescue positioning systems on the installation, and verify their operation status;

⑨ Check the configuration and storage of distress flare and line-throwing appliance, verify the configuration and operation status of fixed communication equipment (if any) on the installation, and test the operation device of the general alarm system;

⑩ Check the configuration, arrangement, and storage of lifebuoys (including those with self-igniting lights, self-activating smoke signals, and buoyant lifelines) and life jackets, life suits, and thermal protective aids;

⑪ Check the lighting of the assembly and boarding station, as well as the corridors, stairways, and exits leading to the assembly and boarding station, including the emergency power supply;

⑫ Items that CCS considers necessary for inspection and test.

(6) Inspection and test items for position mooring systems (if applicable):

① Verify product certificates for positioning and mooring equipment;

② Inspect the anchor windlass, chain/wire stoppers, fairlead, guide apparatus, and anchor rack after the installation;

③ Anchoring trial;

④ Items that CCS considers necessary for inspection and testing.

(7) Inspection and test items for helicopter deck facilities (if applicable):

① Inspect the helicopter deck layout, structure, and installations;

② Inspect the oil storage, refueling, and firefighting facilities;

③ Items that CCS considers necessary for inspection and testing.

(8) Inspection and test of lifting/locking devices (if applicable):

① Inspect lifting/locking devices and carry out the functional test after the installation;

② Carry out the full-range lifting and load tests for the lifting devices;

③ Carry out the emergency lifting test;

④ Items that CCS considers necessary for inspection and testing.

(9) Inspection and test items for other special systems and facilities (if applicable):

① Inspect the feed processing system, feed feeding system, fishing net cleaning system, dead fish

recovery system, and monitoring system;

② Inspect and test the fish lifting machine;

③ Inspect and test the working winch (including the net winch, tension winch, umbilical winch, equipment deployment winch, etc.);

④ Inspect and test the new energy power supply system (including the solar power system, wind power generation system, battery, switchboard, etc.);

⑤ Inspect the discharge function of the aquaculture area;

⑥ Inspect and test the aquaculture water exchange system;

⑦ Inspect and test other items in accordance with the applicable conventions, regulations, or standards listed in Section 3 of this Chapter.

1.5.2.7 Test requirements

(1) In terms of the compartment tightness and structure tests, the marine fisheries unit shall comply with the applicable provisions of Section 3, Chapter 4 of Part 1 in CCS *Rules for Classification of Mobile Offshore Units* (2023), the floating fisheries installation shall comply with the applicable provisions of Section 3, Chapter 4 of Part 1 in CCS *Rules for Classification of Offshore Floating Installation* (2023), and the fixed fisheries platform is subject to relevant provisions of CCS *Rules for Classification of Mobile Offshore Units* (2023).

(2) After the installation of mechanical equipment, boilers, pressure vessels and piping systems, the tightness test shall be conducted at the test pressure complying with the relevant requirements of Part 4 in CCS *Rules for Classification of Mobile Offshore Units* (2023), and the test time is generally no less than 3min-5min.

(4) In terms of the inclining test, the marine fisheries unit shall comply with the relevant provisions of Section 1, Chapter 2 of Part 3 in CCS *Rules for Classification of Mobile Offshore Units* (2023), and the floating fisheries installation shall comply with the relevant provisions of Section 1, Chapter 2 of Part 3 in CCS *Rules for Classification of Offshore Floating Installation* (2023).

(4) The mooring test and navigation test of the ship-type marine fisheries unit shall be conducted in accordance with the approved test outline.

1.5.3 Post-construction Survey

1.5.3.1 Installations that have been classified by CCS shall undergo various surveys (where applicable) in accordance with the provisions of this section, to maintain the validity of the certificate. Where applicable, CCS may adopt the remote survey technique to assist in conducting the required external and internal surveys, including the close-up survey and thickness measurement. Such surveys may be extended by CCS Surveyors at their professional judgment, and the owner or its agent shall provide appropriate survey conditions, make arrangements accordingly, and bear the costs incurred.

1.5.3.2 During the survey, if any damage or defect affecting the validity of the certificate is found, requiring the immediate processing, the surveyor shall inform the owner or its agent of the recommendations in time when he/she deems necessary. When such recommendations are not executed, the surveyor shall report this required for the Headquarters of CCS immediately.

1.5.3.3 It is the responsibility of the owner or its agent to apply to CCS for all surveys necessary for the maintenance of the validity of the certificate and to make preparations and take safety precautions for surveys in accordance with the requirements of the Guidelines.

1.5.3.4 The granting, maintenance, suspension, cancellation, and restoration of characters of classification shall be carried out in accordance with the requirements of Section 9, Chapter 2 of Part 1 in CCS *Rules for Classification of Mobile Offshore Units* (2023).

1.5.3.5 Damage and repair survey

(1) If components such as the hull, equipment, and turbine (including electrical equipment) related to the ship's classification are damaged and considered to potentially affect the classification, CCS shall be notified in a timely manner. In such case, CCS will assign a surveyor to inspect the damage on board. The survey scope shall be sufficient for the surveyor to determine the extent and cause of the damage.

(2) Any repair involving the hull, equipment and turbine (including electrical equipment) related to the ship classification shall be carried out in the presence of a CCS surveyor. In case of no CCS surveyor present at the repair location, the owner or its agent shall notify CCS promptly.

1.5.3.6 Modification or reconstruction survey

(1) During the alternation or reconstruction of structural dimensions or installations of the hull, equipment, and turbine (including electrical equipment) related to the ship's classification, the relevant drawings shall be submitted to CCS for approval. Alternation or reconstruction and related parts shall generally comply with the provisions of the current CCS guidelines or at least meet the requirements of the original applicable guidelines.

1.5.3.7 In addition to the special provisions in this section, the post-construction survey for the marine fisheries installations shall be as follows:

(1) The types, periods, and requirements of the post-construction survey for marine fisheries installations shall comply with the applicable provisions of Chapter 5, Part 1 in *CCS Rules for Classification of Mobile Offshore Units* (2023);

(2) The types, periods and requirements of the post-construction survey for floating fisheries installation shall comply with the applicable provisions of Chapter 5, Part 1 in *CCS Rules for Classification of Floating Fisheries Installation* (2023);

(3) The types, periods, and requirements of the post-construction survey for the fixed fisheries platform shall comply with the applicable provisions of Chapter 2 in *CCS Rules for Classification and Construction of Fixed Offshore Units* (2023);

1.5.3.8 The minimum requirements for structural thickness measurement of the frame-type marine fisheries installations shall comply with the applicable requirements for submersible-type units in *CCS Rules for Classification of Mobile Offshore Units* (2023).

Section 6 Certification Survey

1.6.1 General Requirements

1.6.1.1 CCS may provide certification survey items of partial or all marine fisheries installations listed in the Guidelines upon the written application from the owner or its agent.

1.6.1.2 Certification survey provided as per the Guidelines should first be confirmed by CCS that the classification part has met the requirements of CCS classification specifications.

1.6.1.3 CCS will combine the classification survey and certification survey for the marine fisheries installations, for which both surveys are applied simultaneously.

1.6.1.4 For the marine fisheries installations subjected to both classification survey and certification survey by CCS, where the invalidation of the classification certificate, if any, affects the conditions for issuance of relevant compliance certificate, the latter (such as the safety and environmental protection certificate) will be invalidated accordingly.

1.6.1.5 In order to maintain the validity of the compliance certificate, the operation survey shall be applied to CCS in accordance with the provisions of the Guidelines for the marine fisheries installations with the compliance certificate issued by CCS through the certification survey. The operation survey may be carried out according to the applicable requirements of 1.5.3. Such surveys may be extended by CCS Surveyors at their professional judgment, and the owner or its agent shall provide appropriate survey conditions, make arrangements accordingly, and bear the

costs incurred.

1.6.1.6 During the operation survey, if any damage or defect affecting the validity of compliance certificate is found, requiring the immediate processing, the surveyor shall inform the owner or its agent of the recommendations in time when he/she deems necessary. When such recommendations are not executed, the surveyor shall report this required for the Headquarters of CCS immediately.

1.6.1.7 It is the responsibility of the owner to apply to CCS for all surveys necessary for the maintenance of the validity of compliance certificate and to make preparations and take safety precautions for surveys in accordance with the requirements of the Guidelines.

1.6.1.8 The personnel working on marine fisheries installations shall hold valid training certificates of "Survival at Sea", "Lifeboat and Life Raft Handling", "Ship Firefighting", and "First Aid at Sea", or valid certificates required by the local competent authority.

1.6.1.9 Garbage management plans and ship oil pollution emergency plans shall be formulated for the marine fisheries installations.

1.6.1.10 Training and drills records related to life-saving appliance and fire protection shall be provided.

1.6.2 Compliance Certificate

1.6.2.1 The certification survey of marine fisheries installations operating outside waters under the jurisdiction of the People's Republic of China generally shall meet the relevant requirements of the international conventions or rules and their amendments listed in Section 3 of this Chapter. The certification survey of marine fisheries installations operating in waters under the jurisdiction of the People's Republic of China generally shall meet the relevant requirements of the Guidelines and the applicable requirements of the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*.

1.6.2.2 After the survey by CCS surveyor for the marine fisheries installations operating domestically, the corresponding compliance certificates will be issued or signed:

- (1) Compliance certificate for safety and environmental protection;
- (2) Inspection and test certificate/record for lifting and cargo handling equipment;
- (3) Other compliance certificates/reports, etc.

1.6.2.3 After the certification survey by CCS surveyor for the marine fisheries installations operating internationally, the corresponding compliance certificates (if optional) will be issued:

- (1) Safety compliance certificate;
- (2) International tonnage compliance certificate;
- (3) International load line compliance certificate;
- (4) International oil pollution prevention compliance certificate;
- (5) International sewage pollution prevention compliance certificate;
- (6) International air pollution prevention compliance certificate;
- (7) International garbage pollution prevention and inspection compliance certificate;
- (8) International anti-fouling system compliance certificate;
- (9) Inspection and test certificate/record for lifting and cargo handling equipment;
- (10) Other compliance certificates/reports, etc.

Section 7 Operation Manual

1.7.1 General Requirements

1.7.1.1 The operation manuals shall be available on marine fisheries installations for use by installation personnel. This manual can be used as the guidelines for safe operation of installations under normal conditions and in anticipated emergencies. In addition to the introduction of the necessary overall condition of the installation, its contents shall also include the guidelines and procedures of important operation of personnel and installations. The manual shall be simple, concise and pellucid. It shall be provided with a table of contents and an index, and shall enable the cross-reference retrieval of the detailed data that are accessible for the installation.

1.7.1.2 In terms of the normal operations and emergency operations, [the contents of the operation manual of the marine fisheries unit are subject to the applicable provisions of the *Rules for Classification of Mobile Offshore Units* \(2023\), the contents of the operation manual of floating fisheries installation are subject to the applicable provisions of the *Rules for Classification of Offshore Floating Installation* \(2023\), and the fixed fisheries platform is provided with the reasonable operation manuals based on actual operation needs.](#)

1.7.1.3 If necessary, the data provided in the operation manual shall be supported by the corresponding data, which can be in the forms of plans, the product manuals of manufacturers and other data that are necessary for the operation and maintenance of the installation. It is not necessary to include the detailed data provided in the product manual of the manufacturer again in the operation manual. These data can be listed as reference items. The operation manual shall be kept at an easily accessible place on the installation for reference at any time.

[1.7.1.4 The operation manuals for marine fisheries installations shall clearly specify the restrictive environmental conditions for the transit conditions. The owner or the operator shall pay close attention to weather changes, formulate corresponding management regulations, and choose suitable time windows for transit operations, to ensure the safe operation of marine fisheries installations.](#)

Chapter 2 Structure

Section 1 General Provisions

2.1.1 General Requirements

2.1.1.1 The structural design of marine fisheries unit shall comply with the relevant applicable provisions of CCS Rules for Classification of Mobile Offshore Units (2023). The structural design of floating fisheries installation shall comply with the relevant applicable provisions of CCS Rules for Classification of Floating Fisheries Installation (2023). The structural design of fixed fisheries platforms shall comply with the relevant applicable provisions of CCS Rules for Classification and Construction of Fixed Offshore Units. In addition, the structural design of marine fisheries installations shall also comply with the relevant applicable provisions of the offshore unit and fishery industry standards.

2.1.1.2 The materials and welding of marine fisheries installations shall comply with the relevant provisions of CCS Rules for Materials and Welding.

2.1.2 Design condition

2.1.2.1 Design operating conditions refer to the operation or activity conditions or states of fisheries installations at the operating point or during the transition. In the Guidelines, the design operating conditions of fisheries installations are classified into the following 3 types:

(1) Normal operating condition: It refers to the state of the fisheries installation under the combined environmental load and operating load that is suitable for the operation and within the design limits during the operation at the operating point or other operations;

(2) Survival condition: It refers to the state where the environmental resistance of the fisheries installation is improved to the optimal by stopping operations or other operations under the maximum designed environmental load;

(3) Transit condition (if applicable): It refers to the state of the fisheries installations transiting from one area to another.

2.1.2.2 Design operating condition refers to the combination of various loads in the most unfavorable state for the structural strength evaluation of fisheries installations. The design operating condition is determined by the load combination through the hydrodynamic analysis and according to the actual situation and operating status of the fisheries installations. The operating conditions, considered for different types of fisheries installations, are as shown in Table 2.1.2.2:

Operating Conditions Considered for Different Types of Fisheries installations Table 2.1.2.2

Structural form Design condition	<u>Column Stabilized</u>	<u>Frame Type</u>	<u>Combined Type</u>	<u>Submersible Type</u>	<u>Self-elevating</u>
Normal operating condition	√ ¹	√	√	√	√
Survival condition ²	√	√	√	√	√
Transit condition	√	√	√	√	√

Note: 1. "√" indicates "applicable";

2. If the loading status of the survival condition is consistent with the normal operating condition, only the survival condition needs to be considered, and the normal operating condition can be omitted.

2.1.2.3 For the jacket type fixed fisheries platform, the normal operating conditions and survival conditions shall be considered, and the structural safety of the offshore transportation and installation operations shall be also taken into account.

2.1.2.4 In the entire process of the marine fisheries installations changing from a floating state to a submersible state or from a submersible state to a floating state, the sinking and floating conditions shall be checked, and the applicable requirements in Part 3 of the *Rules for Classification of Mobile Offshore Units* (2023) shall be met.

2.1.2.5 For the state where the bottom of the fisheries installation is located on the seabed, the submersible condition shall be checked.

2.1.2.6 If CCS believes that there are other special conditions that affect the safety of the installation, such conditions shall be considered according to the requirements of CCS.

Section 2 Design Loads

2.2.1 General Requirements

2.2.1.1 Based on the actual loads (gravity and functional loads and related environmental loads) on the fisheries installation, the motion response and loads of the fisheries installation under design operating conditions such as the transit, operation, and survival conditions shall be studied, and the influence of the netting shall be taken into account. If it is impossible to effectively clear or control marine organisms on the marine fisheries installations, their influence on the loads shall be considered.

2.2.1.2 The various design operating conditions and corresponding environmental conditions, as the basis for classification, shall be specified by the owner/designer.

2.2.1.3 The design basis and environmental conditions of the mobile unit shall comply with provisions of Chapter 2, Part 2 in *CCS Rules for Classification of Mobile Offshore Units* (2023). The recurrence period of the designed environmental conditions for the survival conditions shall be no less than 50 years, assuming the simultaneous occurrence of wind, waves, and currents within a 50-year period. The designed environmental conditions for transit conditions shall comply with Chapter 2 of Part 2 in *CCS Rules for Classification of Mobile Offshore Units* (2023), and shall also meet the relevant applicable requirements of the competent authority and the governments of coastal states for transit conditions, with the minimum period of 1 year. The recurrence period of the designed environmental conditions of the operating conditions shall be specified by the owner/designer and shall be no less than 1 year.

Design Operating Conditions and Recurrence Period of Marine Fisheries Unit **Table 2.2.1.3**

<u>Design condition</u>	<u>Operating condition</u>	<u>Survival conditions</u>	<u>Transit condition</u>
<u>Recurrence period</u>	<u>No less than 1 year</u>	<u>No less than 50 years (recommended)</u>	<u>No less than 1 year</u>
<u>Environmental conditions</u>	<u>Sea conditions in the operating sea area</u>	<u>Sea conditions in the operating sea area</u>	<u>Sea conditions in the transit route</u>

2.2.1.4 The design basis and environmental conditions of the floating unit shall comply with provisions of Chapter 5, Part 2 in *CCS Rules for Classification of Floating Fisheries Installation* (2023). The recurrence period of survival conditions on structural site shall be no less than 100 years. For the unattended or nearshore marine fisheries installations, recognized by CCS, a 50-year recurrence period may be considered. The designed environmental conditions for transit conditions shall comply with Chapter 5 of Part 2 in *CCS Rules for Classification of Floating Fisheries Installation* (2023), and shall also meet the relevant applicable requirements of the competent authority and the governments of coastal states for transit conditions. The recurrence period of the designed environmental conditions of the operating conditions shall be specified by the owner/designer and shall be no less than 1 year.

Design Operating Conditions and Recurrence Period of Floating Fisheries Installation
Table 2.2.1.4

<u>Design condition</u>	<u>Operating condition</u>	<u>Survival conditions</u>	<u>Transit condition</u>
<u>Recurrence period</u>	<u>No less than 1 year</u>	<u>100 year</u>	<u>No less than 10 years ¹</u>
<u>Environmental conditions</u>	<u>Sea conditions in the operating sea area</u>	<u>Sea conditions in the operating sea area</u>	<u>Sea conditions in the transit route</u>

Note: 1. Transit conditions may be seasonal environmental conditions, with the recurrence period of no less than 10 years, and shall also meet the applicable requirements of the competent authority and the governments of coastal states for towing.

2.2.1.5 The design basis and environmental conditions of fixed fisheries platforms shall comply with the provisions of Chapter 2 of Part 2 in CCS Rules for Classification and Construction of Fixed Offshore Units. For the unattended marine fisheries installations, recognized by CCS, a 50-year recurrence period may be considered under the survival condition.

2.2.1.6 Unless otherwise specified in the regulations, the recurrence period of designed environmental conditions for other conditions shall be determined by the owner/designer and generally no less than 1 year. The designed environmental conditions, with a recurrence period less than 1 year, shall be approved by CCS.

2.2.2 Environmental loads

2.2.2.1 Environmental loads are those which are directly or indirectly generated by environmental actions, including all external forces due to environmental loads, for example, mooring forces, inertia forces, sloshing forces and dynamic loads of the netting.

Environmental loads are usually composed of the following loads:

- (1) Wind loads;
- (2) Wave loads;
- (3) Current loads.

If required and necessary, the impact of earthquake, seabed bearing capacity, temperature, fouling, ice/snow and other parameters on loads shall be also taken into account. For [marine fisheries unit](#) with unrestricted service area, the minimum design wind speed for the structure under the survival condition is no less than 51.5m/s (100kn), and that under the operating condition is no less than 36.0m/s (70kn).

2.2.2.2 For the specific calculation method of wind load, refer to Section 2, Chapter 2 of Part 2 in CCS Rules for Classification of Mobile Offshore Units (2023).

2.2.2.3 For specific calculation method of wave load, refer to Section 3, Chapter 2 of Part 2 in CCS Rules for Classification of Mobile Offshore Units (2023). For smaller-scale fisheries installations, their pile/column components (generally $D/L \leq 0.2$, D is the characteristic scale of the component section, and L is the wavelength) are used as small-scale isolated piles, and the wave force can be calculated using the Morison formula.

2.2.2.4 For the specific calculation method of current load, refer to 5.3.4, Section 4, Chapter 2 of Part 2 in CCS Rules for Classification of Mobile Offshore Units (2023).

2.2.2.5 The deck load shall be no less than the pressure value specified in Section 5, Chapter 2 of Part 2 in CCS Rules for Classification of Mobile Offshore Units (2023). In case of water on deck and the deck load exceeding the specified value, the design deck load shall be selected according to the maximum possible pressure.

2.2.3 Special considerations for netting load

2.2.3.1 The hydrodynamic force borne by the fisheries installation netting has a significant impact on the installation performance and mooring system. Numerical simulation combined with experimental analysis is an effective means to evaluate the netting load. Recommended practices are as shown in Appendix 3 of the Guidelines.

2.2.4 Special considerations for CRSF cage load

2.2.4.1 In addition to the gravitational load of the CRSF cage, the influence of the hydrodynamic force borne by the CRSF cage on installation performance and mooring system shall not be ignored. It is recommended to conduct the physical model test to study the motion response characteristics of the installation and the mooring force under wave and current actions.

Section 3 Structural Design

2.3.1 General Requirements

2.3.1.1 The scantlings of main structural members are the minimum structural dimensions required by the specifications, and the strength shall also meet the overall strength requirements for the fisheries installation.

2.3.1.2 If the safety distance from the freeboard deck of the marine fisheries installations to the water surface is insufficient, the impact of wave slamming on the superstructure, deck room, railings, and other deck equipment shall be considered.

2.3.1.3 The hook structure of the netting shall be able to withstand the breaking load of the netting components directly connected to it.

2.3.2 Strength verification

2.3.2.1 The yield strength of the marine fisheries unit and floating fisheries installation shall be checked according to the installation type, to ensure the compliance with the relevant provisions of Section 4, Chapter 3 of Part 2 in CCS Rules for Classification of Mobile Offshore Units (2023) or the applicable provisions of Chapter 8 of Part 2 in CCS Rules for Classification of Offshore Floating Installation (2023). The yield strength of fixed fisheries platforms shall be checked in accordance with the relevant provisions of Chapter 3 of Part 2 in CCS Rules for Classification and Construction of Fixed Offshore Units.

2.3.2.2 The buckling strength of marine fisheries installations shall be checked in accordance with the relevant requirements of CCS Technical Guidelines for Assessment of Buckling Strength of Offshore Engineering Structures.

2.3.2.3 The fatigue strength of marine fisheries installations shall be checked in accordance with the relevant requirements of CCS Technical Guidelines for Fatigue Strength Assessment of Offshore Engineering Structures.

2.3.2.4 In case of the tube joint structures in marine fisheries installations, the impact shear strength and nominal stress of the tube joint shall meet the relevant requirements of Section 7, Chapter 4 of Part 2 in CCS Rules for Classification and Construction of Fixed Offshore Units.

2.3.2.5 The strength of lifeboat units shall be checked, to ensure the compliance with the relevant requirements of Section 7, Chapter 3 of Part 2 in CCS Rules for Classification of Mobile Offshore Units (2023) or Section 9, Chapter 9 of Part 2 in CCS Rules for Classification of Offshore Floating Installation (2023).

2.3.2.6 The strength of crane pedestals and support structures shall be checked according to the relevant requirements of Chapter 3 in CCS Rules for Lifting Appliances of Ships and Offshore Installations.

2.3.2.7 The strength of the helicopter deck structure shall be checked, to ensure the compliance

with the relevant requirements of Section 3, Chapter 5 of Part 9 in CCS *Rules for Classification of Mobile Offshore Units* (2023) or Section 3, Chapter 7 of Part 9 in CCS *Rules for Classification of Offshore Floating Installation* (2023).

Section 4 Special Requirements for Column-Stabilized Fisheries installations

2.4.1 General Requirements

2.4.1.1 Except for the bottom and side wall structures of the shell, which are designed to withstand wave slamming and approved by CCS, a reasonable gap shall be reserved between the bottom of the upper shell and the wave crest after the consideration of the relative motion of the unit to the sea surface in various floating states. The size of the peak gap shall be determined by considering the influence of the relative motion between the marine fisheries installations and the sea surface, and its value may be determined through the calculation, model tests, or existing experience in marine fisheries installations. The determined peak value of the gap shall be approved by CCS.

2.4.1.2 The scantlings of main structural members in the upper shell shall be no less than that required by the load in the deck load diagram.

2.4.1.3 If the upper shell floats on the water surface under a certain approved condition or a damage condition that complies with stability requirements, special consideration shall be given to the structural loads incurred.

2.4.1.4 The structural dimensions of the column and lower shell shall be based on the evaluated hydrostatic pressure load and combined load (including the wave and current considered).

2.4.1.5 Special consideration shall be given to the structural arrangement and details within the local high load area caused by the external damage, wave slamming, partially filled liquid compartments, or bottom-loading operations.

2.4.1.6 The brace rod shall be designed, allowing the structure to effectively withstand the applicable combined load, and the combined stress of the bracing components shall be analyzed, including the local bending stress caused by the buoyancy, wave force, and current force.

2.4.1.7 For marine fisheries installations with a single-deck superstructure, the integrity of the installation structure shall be considered by assuming the failure of any girder. CCS may require a structural analysis report, to demonstrate that the overall installation collapse can be prevented in case of the assumed failure of any girder when the installation is subjected to equivalent environmental loads in the designated service area once a year.

2.4.1.8 If applicable, consideration shall be given to the local stress caused by the wave slamming.

2.4.1.9 If the brace rod is watertight, it shall be designed to prevent damage caused by the hydrostatic pressure. If the underwater brace rod is watertight, a leakage detection system shall be provided. With the approval of CCS, a leakage detection system may be omitted if the brace rod is small and has limited impact on the safety performance of marine fisheries installations.

2.4.1.10 For the tubular bracing, the necessity of setting up a ring reinforced structure to maintain its rigidity and shape shall be considered.

2.4.1.11 When the structure is subjected to equivalent environmental loads in the designated service area once a year, the overall installation collapse can be prevented in case of the loss of any slender brace rod.

2.4.1.12 Under the submersible condition, the strength and stability of the unit shall meet the applicable requirements for submersible units in CCS *Rules for Classification of Mobile Offshore Units* (2023).

Section 5 Special Requirements for Frame-type Fisheries installations

2.5.1 General Requirements

2.5.1.1 In addition to the special requirements in this section, the frame-type fisheries installations

shall also meet the other requirements in this Chapter.

2.5.1.2 The structural design of frame-type installations with novel structural forms shall be subject to the applicable provisions of this section.

2.5.1.3 For pile-supported fisheries installations, the design of the piles shall meet the applicable requirements of *CCS Rules for Classification and Construction of Fixed Offshore Units*.

2.5.2 Scantlings of Structural Members

2.5.2.1 The scantlings of main structural members in the frame-type fisheries installations of the beam-slab structure shall comply with the relevant requirements for the column stabilized type in Section 2, Chapter 3 of Part 2 in *CCS Rules for Classification of Mobile Offshore Units* (2023). For the small-scale fisheries installations, the calculated pressure head h in the outer boundary calculation formula can be reduced according to actual conditions, and shall be no less than the maximum possible pressure head under any circumstances. The deck dimensions shall meet the requirements of 3.2.3, Section 2, Chapter 3 of Part 2 in *CCS Rules for Classification of Mobile Offshore Units* (2023), and the deck load shall be selected according to the requirements of 2.2.2.5, Section 2 in this Chapter. For the heavy-draught installations, the pressure head h can be calculated according to actual conditions.

2.5.2.2 The scantlings of main structural members in the frame-type fisheries installation (truss structure) shall comply with the applicable requirements of *CCS Rules for Classification and Construction of Fixed Offshore Units*.

2.5.3 Requirements for Direct Calculation

2.5.3.1 Global strength

During the wave load calculation, the structural characteristics of the fisheries installation, the shape and size of the components, as well as factors such as the wave height, wave period, wave direction angle, and the relative position of the wave crest to the fisheries installation shall be considered. Under typical loading conditions, the following calculation cases shall be checked:

(1) For the frame-type installations of the plate-girder (stiffened plate) structure, the main structure is a rectangular frame, the following control loads of the ship hull girder shall be considered in the global strength analysis combination cases:

- ① The maximum hogging bending moment
- ② The maximum sagging bending moment
- ③ The maximum shear force
- ④ The maximum torque bending moment
- ⑤ The maximum acceleration

If the structural scale is close to the square, symmetrical on the left and right but asymmetrical at the front and back, the maximum hogging/sagging bending moment and the maximum shearing force in the lateral direction shall be also considered.

(2) For the frame-type fisheries installations of the truss structure, if it is impossible to obtain the control load response of the ship hull girder, the stress response of the components shall be taken as the controlling factor, to calculate the maximum stress response of the components under the wave load.

(3) The submersible conditions shall be considered for the submersible installations separately, and the influence of scouring on the submersible area shall be also taken into account.

2.5.3.2 Local strength

During the local strength analysis, the local strength analysis of mooring attachment points (if any)

and the local strength analysis of lifting facilities foundations (if any) shall be considered.

2.5.3.3 Buckling strength

The buckling strength of any structure exposed to buckling risk under pressure or shearing force shall be checked, and it shall meet the relevant requirements of CCS *Technical Guidelines for Assessment of Buckling Strength of Offshore Engineering Structures*.

2.5.3.4 Fatigue strength

The fatigue strength of any structure subjected to alternating loads and exposed to fatigue risk shall be checked, and the fatigue strength of the following parts (at least) shall be analyzed:

- (1) Connection area of the main structure;
- (2) Corner area of the frame structure;
- (3) Mooring attachment area.

Section 6 Special Requirements for Combined-type Fisheries installations

2.6.1 General Requirements

2.6.1.1 The dimensions of the main structure of the combined-type fisheries installation shall be determined according to the load distribution under all expected operating conditions using the direct calculation methods.

2.6.1.2 The following factors shall be considered for the combined-type marine fisheries installations:

- (1) Local strength of single-point connection points;
- (2) Strength of single connection devices, which can be determined through the test/numerical analysis methods;
- (3) If there is a risk of collision between single units, protective facilities such as fenders shall be provided. The collision energy and force under the most dangerous situation shall be determined through the test/numerical analysis methods, and the local strength of the collision area shall be analyzed. The relevant calculation report shall be submitted for CCS review. The structural design of the collision area shall be reserved with certain redundancy, and its damage shall cause no failure of the main structure or the loss of stability.

2.6.1.3 The design load shall meet the requirements of the Guidelines and the influence of multi-body connections on the load shall be considered.

2.6.1.4 If it has been determined by the model tests or other methods that the structure will undergo significant elastic deformation under external loads, the influence of elastic deformation shall be considered during the wave load calculation and structural analysis.

Section 7 Corrosion Protection and Corrosion Weight Grow

2.7.1 General Requirements

2.7.1.1 To prevent overall damage caused by the corrosion, the effective protection measures shall be taken for all steel structures. Effective protection systems generally include the coating, metal coating, cathodic protection, corrosion weight grow or other acceptable methods. For the design of the corrosion protection system, special attention shall be paid to the design life of the devices and the protection maintainability. The impact of hazardous [substances](#) in the anti-corrosion coatings on the marine environment and aquaculture organisms requires special consideration.

2.7.1.2 For [floating](#) fisheries installations, if the design of the fisheries installations requires the uninterrupted operation without any docking plan or conditions, the designer or the owner shall provide the expected corrosion data during the service life under the operating environment and take it into account in the design, and shall satisfy the following requirements:

(1) The annual corrosion rate shall be estimated by comprehensively considering the corrosion protection measures to be adopted, previous operating experience, the type and temperature of stored liquids, and other affecting factors. If the annual corrosion rate is unavailable, the corrosion weight grow shall meet the relevant requirements of Section 5, Chapter 13, Part 2 in *CCS Rules for Classification of Offshore Floating Installation* (2023).

(2) In any case, the corrosion weight grow of the bottom plate, deck, and side plate shall be no less than 1.0mm. The corrosion weight grow shall be indicated in the design plans and documents.

2.7.1.3 For the [marine fisheries unit](#), the appropriate corrosion weight grow shall be considered according to its location, environmental conditions of the space and the anti-corrosion measures adopted. The corrosion weight grow shall be indicated in the design plans and documents. [The structural corrosion protection shall comply with the applicable provisions of Section 7, Chapter 1 of Part 2 in the Rules for Classification of Mobile Offshore Units \(2023\).](#)

[2.7.1.4 For the fixed fisheries platforms, the corrosion prevention shall comply with the applicable requirements of Chapter 7, Part 2 in CCS Rules for Classification and Construction of Fixed Offshore Units. In addition to appropriate coating protection measures, the structural design of the unit structure in the splash zone shall be reserved with appropriate corrosion weight grow. The corrosion weight grow of the structure shall be determined according to the unit's designed service life, the annual average corrosion rate of steel, and the protection efficiency of the corrosion protection system. If the above parameters cannot be determined, the corrosion weight grow of the structure in the splash zone may be calculated as 0.3mm per year.](#)

Chapter 3 Stability, Subdivision and Load Lines

Section 1 General Provisions

3.1.1 General Requirements

3.1.1.1 This Chapter applies to the stability, subdivision and load lines of marine fisheries installations and floating fisheries installation.

3.1.1.2 Unless otherwise specified, the stability, subdivision and load line of marine fisheries unit shall comply with the relevant applicable provisions of CCS Rules for Classification of Mobile Offshore Units (2023). The stability, subdivision and load line of the floating fisheries installation shall comply with the relevant applicable provisions of CCS Rules for Classification of Offshore Floating Installation (2023).

Section 2 Stability

3.2.1 General Requirements

3.2.1.1 For the fisheries installations, the stability under the following basic conditions shall be considered:

- (1) Transit conditions;
- (2) Normal operating conditions;
- (3) Survival conditions.

3.2.1.2 The integrity and damage stability of the frame-type installations in the floating state shall comply with the relevant provisions for self-elevating units in Chapter 2 of Part 3 of CCS Rules for Classification of Mobile Offshore Units (2023).

3.2.1.3 When the marine fisheries installations is under the submersible condition, they shall also comply with the relevant provisions for submersible stability and sinking/floating stability in Chapter 2 of Part 3 of CCS Rules for Classification of Mobile Offshore Units (2023).

3.2.1.4 If applicable, the marine fisheries installations shall also comply with the relevant provisions for sinking/floating stability in Chapter 2 of Part 3 of CCS Rules for Classification of Mobile Offshore Units (2023).

3.2.1.5 If applicable, the influence of wind load on marine fisheries installations by the netting shall be considered.

3.2.1.6 For marine fisheries installations in floating state that may be affected by the underwater netting, the intact stability shall also meet the following requirements in the most unfavorable condition:

- (1) The righting arm shall be always positive within the range from the positive flotation to 15 degrees;
- (2) The area under the righting arm curve from the positive flotation to the inclination angle corresponding to the maximum value of the righting arm shall be no less than $0.08 \text{ m}\cdot\text{rad}$;
- (3) Under the action of permanent wind with a wind speed of 70 kn , the first intersection angle between the wind heeling lever and the righting arm in the curve of statical stability shall not exceed half of the angle of immersion at the freeboard deck edge.

Section 3 Load Lines

3.3.1 General Requirements

3.3.1.1 The frame-type installations shall also comply with the relevant provisions for self-elevating units Chapter 3 of Part 3 of CCS Rules for Classification of Mobile Offshore Units (2023).

3.3.1.2 However, for special fisheries installations, the applicability of the load line convention to the [minimum freeboard](#) may be considered according to the actual situation. If inapplicable, the minimum freeboard shall meet the requirements for the stability, structural strength, peak gap, and other requirements deemed applicable by CCS.

Section 4 Watertight and Weathertight Integrity

3.4.1 General Requirements

3.4.1.1 [The watertight and weathertight integrity of marine fisheries unit shall comply with the relevant applicable provisions of CCS Rules for Classification of Mobile Offshore Units \(2023\). The watertight and weathertight of the floating fisheries installation shall comply with the relevant applicable provisions of CCS Rules for Classification of Offshore Floating Installation \(2023\).](#)

Chapter 4 Outfitting and Positioning System

Section 1 General Provisions

4.1.1 General Requirements

4.1.1.1 This Chapter applies to the temporary anchoring equipment, towing equipment, [position mooring system, dynamic positioning system, netting and its accessories, other outfitting equipment and living quarters in the marine fisheries unit and floating fisheries installation.](#)

4.1.1.2 Anchoring and mooring equipment and materials [shall be approved by CCS and provided with product certificates.](#)

Section 2 Temporary Anchoring Equipment

4.2.1 General Requirements

4.2.1.1 Temporary anchoring equipment includes the anchors, anchor chains, anchor windlasses and ancillary equipment. [The marine fisheries installations shall be equipped in accordance with the requirements of the competent authorities.](#)

4.2.2 Outfitting, Anchor, Anchor Chain, Chain Locker and Windlass

4.2.2.1 The anchoring shall be configured according to the calculated equipment number.

4.2.2.2 [The outfitting of the floating installations shall comply with the provisions of Section 2, Chapter 12, Part 2 in CCS Rules for Classification of Offshore Floating Installation \(2023\). The outfitting of the mobile units shall comply with the provisions of Section 2, Chapter 1, Part 9 in CCS Rules for Classification of Mobile Offshore Units \(2023\).](#)

4.2.2.3 The anchor, anchor chain and chain locker shall comply with the provisions of Section 2, Chapter 1, Part 9 in CCS Rules for Classification of Mobile Offshore Units (2023).

4.2.2.4 [The anchor windlass shall comply with the provisions of Section 2, Chapter 5, Part 4 in CCS Rules for Classification of Mobile Offshore Units \(2023\).](#)

Section 3 Towing Equipment

4.3.1 General Requirements

4.3.1.1 The towing device shall comply with the provisions of Section 3, Chapter 1 of Part 9 in CCS Rules for Classification of Mobile Offshore Units (2023).

Section 4 Position Mooring System

4.4.1 General Requirements

4.4.1.1 This section is applicable to the position mooring system of marine fisheries installations, including the radial position mooring system and the single-point position mooring system. [The position mooring system generally consists of the following components and equipment:](#)

[\(1\) Anchors, suction anchors or anchor piles;](#)

[\(2\) Mooring ropes, including anchor chains, steel wire ropes, and fiber ropes;](#)

[\(3\) Mooring rope accessories, including shackles, connecting rings, hawser thimbles, and quick release devices;](#)

[\(4\) Guide apparatus, including guide bend pipes, guide pulleys, and guide holes;](#)

[\(5\) Chain/wire stoppers;](#)

[\(6\) Anchor windlasses/winches;](#)

[\(7\) Other structural or mechanical components that constitute the mooring system.](#)

[4.4.1.2 The operation limits and procedures specified by the owner/the designer shall be included in the operation manual.](#)

4.4.1.3 In addition to meeting the requirements of this section, the mooring system shall also comply with other applicable requirements of the Guidelines and competent authorities.

[4.4.1.4 In addition, for design methods uncovered in this section, relevant applicable provisions of the industry standards for position mooring systems of offshore oil and gas units can be referred to with the approval of CCS.](#)

4.4.2 Environmental Loads and Installation Motions

4.4.2.1 This section only involves the environmental loads required for the mooring system analysis and the motions of mooring facilities caused by the wind, waves, and currents.

4.4.2.2 The environmental loads and motions for the floating installations shall be calculated in accordance with the provisions of Section 2, Chapter 7 of Part 9 in *CCS Rules for Classification of Offshore Floating Installation* (2023). The environmental loads and motions for mobile units shall be calculated in accordance with the provisions of Section 2, Chapter 3 of Part 9 in *CCS Rules for Classification of Mobile Offshore Units* (2023).

4.4.2.3 The influence of netting and CRSF cages on mooring systems shall not be ignored. Numerical simulation combined with experiments is an effective method to evaluate the influence, as specified in Appendix 3 of the Guidelines.

4.4.3 Mooring Analysis and Design Criteria

4.4.3.1 [For multi-point mooring](#), the position mooring system shall be designed so that the sudden failure of any mooring equipment will not cause the subsequent failure of other mooring equipment. For mooring systems designed as the single anchor chain, separate considerations shall be made based on their failure consequences.

[4.4.3.2 For floating installations, if their mooring systems are designed as the single mooring rope, the safety factor shall comply with the requirements of 4.4.4.3, Chapter 4 in *CCS Rules for Classification of Offshore Single Point Moorings*, and that of the anchoring foundation shall be also increased by 1.33 times accordingly. For the mobile units, if their mooring system is designed as a single mooring rope, the safety factor shall be no less than the specified value in Table 4.4.3.2, and that of the anchoring foundation shall be increased by 1.33 times accordingly. In addition, the dedicated monitoring devices \(supporting the remote control and alarm\) shall be installed, to control the risk of anchor dragging for marine fisheries installations.](#)

Safety Factor of Single Mooring Rope (Mobile Unit)

Table 4.4.3.2

Design condition	Quasi-static analysis		Dynamic analysis	
	Unit adequately clear from any adjacent structures	Unit adjacent to other structures	Unit adequately clear from any adjacent structures	Unit adjacent to other structures
Intact operating condition	5.0	5.75	4.0	4.4
Intact survival condition	3.75	4.0	3.0	3.3

4.4.3.3 The design operating conditions, mooring analysis, and design criteria for the floating installations shall comply with the provisions of Section 3, Chapter 7 of Part 9 in *CCS Rules for Classification of Offshore Floating Installation* (2023). The design operating conditions, mooring analysis, and design criteria for mobile units shall comply with the provisions of Section 3, Chapter 3 of Part 9 in *CCS Rules for Classification of Mobile Offshore Units* (2023).

4.4.4 Mooring Equipment

4.4.4.1 The mooring equipment in the mooring system for the [floating](#) installations shall comply

with the provisions of Section 4, Chapter 7 of Part 9 in *CCS Rules for Classification of Offshore Floating Installation* (2023). The mooring equipment of mobile units shall comply with the provisions of Section 4, Chapter 3 of Part 9 in *CCS Rules for Classification of Mobile Offshore Units* (2023).

4.4.4.2 Other requirements for the single-point position mooring system shall comply with *CCS Rules for Classification of Offshore Single Point Moorings*, excluding some industry-recognized standards that should be met.

Section 5 Dynamic Positioning System

4.5.1 General Requirements

4.5.1.1 In terms of the marine fisheries unit with dynamic positioning systems, the dynamic positioning system shall comply with the provisions of Chapter 4, Part 9 in *CCS Rules for Classification of Mobile Offshore Units* (2023).

Section 6 Netting and Its Accessories

4.6.1 General Requirements

4.6.1.1 Netting and its accessories include the netting, float, sinker, etc.

4.6.1.2 This section provides the recommended requirements for fishery machine-woven netting. Other netting such as the metal netting shall comply with requirements of the industry-recognized standards.

4.6.1.3 The integrity of the netting, the maintenance of the netting shape, and the impact of the netting on the surrounding flow field are key factors for the effective implementation of fishery aquaculture. The netting integrity and the change of the surrounding flow field caused by the change of the netting shape under the possible biological adhesion shall be analyzed, to ensure the integrity of the netting and the good growth space for the aquaculture objects. Appendix 3 of the Guidelines provides the recommended practices for hydrodynamic analysis and test of the netting.

4.6.2 Definition

4.6.2.1 Unless otherwise specified, the definitions of the terms adopted for the purpose of the section are as follows:

(1) Netting

A sheet braided fabric made of net lines woven into mesh structure, with a certain size.

(2) Mesh

A hole-shaped structure composed of net lines with a designed shape.

(3) Float

An accessory with buoyancy in water or capable of producing buoyancy during the motion, with a shape and structure suitable for the assembly on fishing gear.

(4) Sinker

An accessory with the sinking force in water or capable of producing the down force during the motion, with a shape and structure suitable for the assembly on fishing gear.

(5) Sinking force

The weight of fishing gear material in water.

4.6.3 Netting

4.6.3.1 The netting is a machine-woven synthetic fiber mesh. Its classification, labeling, requirements, test methods, inspection rules, marks, labels, packaging, transportation, and storage

requirements are subject to GB/T 18673. The breaking strength and elongation at break of the netting are tested according to GB/T 4925.

4.6.3.2 The thickness of the net line and the mesh size depends on the size of the aquaculture object [and the aquaculture environment](#). The netting mesh is measured according to GB/T 6964 and GB/T 6965.

4.6.3.3 The stitching of the netting mesh and the assembly of the netting ropes shall comply with the requirements of SC/T 4005. The stitching thread of the netting fabric and the assembly parts of the netting ropes shall not be loose.

4.6.3.4 The cutting requirements of the netting mesh shall comply with the provisions of SC/T 4004.

4.6.3.5 The netting ropes shall comply with the provisions of GB/T 18674. The breaking strength and elongation at break of the rope are tested according to GB/T 8834.

4.6.3.6 The netting shall be regularly replaced or cleaned according to the attached biomass, fish culture conditions, and water quality in the sea area, to remove attachments.

4.6.4 Float

4.6.4.1 For the float material, refer to the relevant provisions in SC/T 1006.

4.6.4.2 The float shape can be determined according to the material.

4.6.4.3 The float shall produce sufficient buoyancy, with a certain safety factor.

4.6.4.4 The float shall be reinforced or replaced regularly, to prevent detachment, aging, and breakage.

4.6.5 Sinker

4.6.5.1 The sinker shape can be determined according to the material. The sinking force shall be sufficient to maintain the box shape.

4.6.5.2 It is made of materials with higher density. Commonly used materials include the cast iron blocks, stone blocks, perforated bricks, and sandbags. For all block sinkers, the sharp corners and burrs shall be removed, with a smooth surface.

4.6.5.3 The weight and quantity of sinkers depend on the tidal flow rate and specifications of the net cage. Areas with strong currents require more sinkers.

[4.6.6 Fishing Ropes](#)

[4.6.6.1 Fishing ropes are generally made of fibers such as the polyamide, polyethylene, polypropylene, and polyester, and its braiding structure includes the three-strand twisted rope, four-strand twisted rope, eight-strand twisted rope, or twelve-strand twisted rope. The classification, marking, requirements, test methods, inspection rules, labels, packaging, transportation, and storage shall comply with the provisions of GB/T 18674.](#)

[4.6.6.2 The linear density and the minimum breaking strength of fishing ropes shall be tested according to GB/T 8834.](#)

Section 7 Other Outfitting Equipment

4.7.1 General Requirements

[4.7.1.1 The marine fisheries installations shall be provided with effective safety measures for personnel boarding, including but not limited to the passageways, openings, railings \(bulwarks\), handrails, doors, windows and other outfitting, which shall comply with the relevant requirements of the SOLAS Convention and the International Convention on Load Lines, and the provisions of Section 1, Chapter 5 in the Guidelines.](#)

4.7.2 Personnel Boarding Devices

4.7.2.1 The personnel may board the marine fisheries installations by helicopter, hanging basket, side ladder or offshore telescopic gangways. The side ladder, if used, should be the fixed metal ladders or stairways, and the surrounding waters shall be provided with sufficient lighting.

4.7.2.2 Manned shuttle baskets, manned work baskets, and cargo baskets shall comply with the relevant requirements of CCS *Guidelines for Survey of Marine Hanging Basket*.

Section 8 Living Quarters

4.8.1 General Requirements

4.8.1.1 For the living conditions of the personnel stationed on marine fisheries units and floating fisheries installation, the requirements for personnel health and protection in Chapter 16 of Part 1 and Chapter 8 of Part 5 in the *Technical Regulations for Offshore Mobile Units (2023)* should be met.

4.8.1.2 In terms of the living conditions of the personnel stationed on the fixed fisheries platforms, the requirements for personnel health and protection in Chapter 12 of CCS *Rules for Construction and Surveys of Fixed Units in Shallow Sea* should be met.

4.8.1.3 The entertainment room on the installation can be designed according to the actual layout of the unit using the equivalent or multi-purpose rooms, to meet the recreational needs of the staff after work.

Chapter 5 Machinery Installations and Systems

Section 1 General Provisions

5.1.1 Application

5.1.1.1 Unless otherwise specified, this Chapter applies to the mechanical devices and systems installed on marine fisheries installations.

5.1.1.2 This Chapter is intended to provide safe and effective support for the fishery operations, motion, positioning, and staff living on the installations.

5.1.1.3 For different types of marine fisheries installations, mechanical devices and systems shall meet not only the requirements of this Chapter but also the applicable requirements of accepted standards. In case of contradiction, the requirements of this Chapter shall prevail:

(1) The marine fisheries unit shall meet the applicable requirements of *CCS Rules for Classification of Mobile Offshore Units* (2023);

(2) [The floating fisheries installation shall meet the applicable requirements of CCS Rules for Classification of Offshore Floating Installation \(2023\);](#)

(3) [The fixed fisheries platforms shall meet the applicable requirements of CCS Rules for Classification and Construction of Fixed Offshore Units.](#)

5.1.2 Selection and Configuration of Fisheries Installation and Equipment

5.1.2.1 In addition to the functional requirements specified in the corresponding regulations, mechanical devices and systems for marine fisheries installations shall also support the following functions:

(1) The equipment selected should meet the requirements of the cultured aquatic products.

(2) Measures shall be taken to prevent the sump oil from mechanical devices and systems from leaking into the aquaculture area.

5.1.2.2 The configuration of observation equipment and cleaning equipment shall be considered according to the growth of marine organisms in the aquaculture area, to clear fish feces, debris, and marine organisms from the netting in a timely manner.

5.1.2.3 The large-scale blocking of natural light in the aquaculture area [should](#) be prevented.

[5.1.2.4 Considering the characteristics of centralized aquaculture, it is advisable to configure a real-time or regular online aquaculture video monitoring system, realizing the real-time image monitoring of the conditions of aquaculture objects inside the fishery hold and under the water.](#)

5.1.2.5 For the high-density aquaculture and submersible fisheries installations, the oxygenation equipment should be installed. If the compressed air system is used for oxygenation, the requirements of 5.2.4 in this Chapter shall be met.

5.1.2.6 For aquaculture products that may harm marine ecology, appropriate measures shall be taken to prevent product escape and for remediation, and appropriate equipment shall be installed.

5.1.3 Materials

5.1.3.1 In terms of the materials and coatings used for mechanical equipment and components in contact with seawater, the health of aquaculture products shall be considered.

5.1.4 Vibration and Noise

5.1.4.1 Necessary vibration reduction measures shall be taken for mechanical equipment and pipelines on the installations, and even for structural resonance, to avoid affecting the healthy growth of aquaculture products.

5.1.5 Personnel Protection

5.1.5.1 Anti-slip measures shall be taken into account for the floor surfaces of the working areas, walkways, ladder surfaces, and other places where personnel frequently pass through, to ensure the personnel safety.

5.1.5.2 The personnel walkways in the aquaculture area shall be equipped with reliable safety guardrails and skirting boards or equivalent facilities. The height of the guardrails shall be no less than 1m, and the risk of slipping and falling into the sea shall be taken into account and [eliminated. Safety guardrails shall also meet the relevant applicable requirements of the load line convention.](#)

5.1.5.3 Medical room.

(1) For marine fisheries installations with the quota no more than 15 persons, a dedicated medical room may be omitted, but an emergency medical kit suitable for the installation needs to be equipped and properly placed;

(2) For marine fisheries installations with the quota more than 15 persons, a [medical room](#) shall be constructed. [The medical room shall be equipped with drugs according to the actual conditions, at least including one sickbed, a stretcher for transferring patients, as well as a dedicated toilet.](#)

Section 2 Pumping System

5.2.1 Bilge system

5.2.1.1 [The marine fisheries unit and floating fisheries installation](#) shall be provided with effective bilge water pumping system, allowing to extract and drain water from all watertight compartments that affect the buoyancy and floatability under all practical conditions, regardless of whether the installation is in an upright floating state or an heeling state as described in 1.1.4, Chapter 1 of Part 4 in *CCS Rules for Classification of Mobile Offshore Units* (2023), except for the spaces permanently used for the storage of fresh water, ballast water and fuel oil and provided with another effective water pumping device. If necessary, additional suction ports shall be provided for the large compartments or compartments with special shapes, and the compartments shall be arranged to facilitate the water flow to the suction pipe. Compartments without bilge pipe can be used to discharge water into compartments equipped with bilge water pumping devices. The equipment for water accumulation detection shall be installed in compartments adjacent to seawater or liquid tanks, as well as in empty compartments, through which the liquid-carrying pipes pass. [For the offshore fixed fish farming units, one or several sump oil and water tanks with appropriate capacity shall be installed, to collect oily wastewater and residual oil from each deck. Oil drip tray shall be installed underneath the oil tanks, containers, or machinery equipment that may leak oily wastewater, and shall be equipped with pipelines to the sump oil and water tanks, which can be provided with the water level monitoring and alarm systems.](#)

5.2.1.2 In terms of the [marine fisheries unit](#), the arrangement of bilge suction shall comply with the requirements of 3.2.12 and 3.2.13 of Section 2, Chapter 3 of Part 4 in *CCS Rules for Classification of Mobile Offshore Units* (2023).

[5.2.1.3 In terms of the floating fisheries installation, the bilge suction shall be arranged according to the requirements of 3.2.11 and 3.2.12 of Section 2, Chapter 3 of Part 4 in CCS Rules for Classification of Offshore Floating Installation \(2023\).](#)

5.2.1.4 Considering the particularity of marine fisheries, for the [floating fisheries installation](#), where the machinery space meets the following conditions, the emergency suction ports may be omitted (except for installations for avoiding typhoons by ballast diving) with the consent of CCS:

(1) The pump with the maximum displacement on the installation can be used for the bilge system;

(2) Drainage can be carried out through two independent bilge systems at different locations of the machinery space at any time;

(3) Machinery space is installed with the [bilge](#) water level monitoring and alarm systems;

(4) The sewage well grille in the machinery space shall be set in a place that is easily accessible and easy to inspect, to avoid blockage.

5.2.1.5 The capacity of the bilge system shall meet the requirements of Section 2, Chapter 3 of Part 4 in *CCS Rules for Classification of Mobile Offshore Units* (2023). In addition, the spray amount of fire-fighting water in the largest compartment in case of a fire shall be taken into account.

5.2.1.6 The capacity of the bilge system for the floating fisheries installation shall meet the requirements of Section 2, Chapter 3 of Part 4 in *CCS Rules for Classification of Offshore Floating Installation* (2023). In addition, the spray amount of fire-fighting water in the largest compartment in case of a fire shall be taken into account.

5.2.2 Ballast System

5.2.2.1 The ballast system of column-stabilized marine fisheries units and floating fisheries installation can be used to adjust the installation in an intact and undamaged manner from the maximum normal draught to the draught for strong storms or a larger draught recognized by the installation survey agency at least 3 hours before the storm, and the requirements for timely receipt of storm forecasts and operating procedures shall be specified in the operation manual clearly. If the forecast time of the storm cannot be determined accurately, the capacity of the ballast system shall be calculated as 3h.

5.2.2.2 The ballast system shall be equipped with at least two independent pumps, so that the ballast system continues working when any one of them fails. The ballast pumps are not dedicated devices, but they shall be ready for use at any time.

5.2.2.3 The ballast pumps of the column-stabilized marine fisheries installations shall be powered by two power sources, the main power supply and the emergency power supply, which shall be arranged in such way that the installation can be restored from the specified inclination angle to the state of level trim and safe draft using the emergency power supply after the power failure in the ballast system.

5.2.3 Cooling System

5.2.3.1 A main propulsion diesel engine, if any, shall be installed with a main cooling water pump (sufficient capacity) and a backup cooling water pump powered by an independent source. In case of multiple main engines with cooling water pumps, a standby cooling water pump can be installed.

5.2.3.2 If each diesel engine in the power plant is equipped with a cooling water pump, the standby cooling water pump can be omitted. If multiple diesel engines in the power plant share a cooling water system, a standby pump shall be installed, and another pump with sufficient capacity can be used instead of the standby pump.

5.2.3.3 If the main propulsion diesel engine and/or the diesel engine in the power plant is support the fresh water cooling and emergency connection to the seawater system, the standby fresh water pump can be omitted.

5.2.4 Compressed Air System

5.2.4.1 The compressed air system shall be able to provide qualified driving power gas, instrument gas and control gas, and gas for other purposes of the installation in a safe manner.

5.2.4.2 Safety redundancy measures shall be taken for the supply of air for important purposes (such as instrument and control gases).

5.2.4.3 The quality of [compressed air](#) (such as water and oil contents) shall meet the needs of system services.

5.2.4.4 If the compressed air system is used for oxygenation of aquaculture products:

(1) The pipeline shall be set separately;

- (2) Air bottles should be set separately;
- (3) The system shall not be connected to the pipelines for control and instrument gases;
- (4) If the compressed air system is still used under the strong storm condition mentioned in 5.2.2.1, the compressed air system should be set above the waterline under the strong storm condition, and the ventilation system of the compartment shall be used to prevent seawater from entering the system under the condition and to ensure sufficient air supply.

Section 3 Ventilation System, Overflow and Sounding System of Compartments

5.3.1 Ventilation System of Compartments

5.3.1.1 All atmospheric storage compartments, isolated empty compartments, and pipe tunnels shall be equipped with air pipes, and air pipes shall be also installed in shaft tunnels if necessary. Air pipes shall be led out from the top of the compartments and kept away from the injection pipes.

5.3.2 Overflow System

5.3.2.1 For all compartments filled by pumps through injection headers, the total cross-sectional area of the air pipes for each compartment shall be at least 25% larger than the effective cross-sectional area of the injection pipes. If the liquid head corresponding to the height of the air pipe is higher than the pressure that the compartment can withstand, or if the cross-sectional area of the air pipe is less than 25% of the effective cross-sectional area of the injection pipe, the overflow pipes shall be installed for all compartments filled by pumps.

5.3.2.2 The overflow pipe of the fuel and lubricating oil compartments shall be led to an overflow tank with sufficient capacity or a storage compartment with overflow space reserved.

5.3.2.3 Non-polluting overflow liquids without recovery value can be directly discharged into the sea.

5.3.3 Sounding System

5.3.3.1 Principles for setting up sounding systems:

- (1) Measure the storage capacity of liquid compartments/cabinets;
- (2) Measure the water level of bilge wells that are inaccessible;
- (3) Measure whether liquids leak into watertight compartments.

5.3.3.2 All liquid tanks (cabinets) equipped with the liquid level telemetry system shall be provided with measuring tubes. If two independent liquid level telemetry devices are set, measuring tubes can be omitted.

5.3.3.3 Marine fisheries installations with ballast compartments shall be equipped with the remote control liquid level sounding system.

Section 4 Ventilation System

5.4.1 General Requirements

5.4.1.1 Under the normal dynamic, statical inclination and assumed damage conditions of marine fisheries installations, the intake and exhaust vents shall lead to no flooding at the service space.

5.4.1.2 For marine fisheries installations not evacuated during typhoons, the height and location of the ventilation openings shall be designed to prevent large amounts of seawater from entering.

5.4.2 Enclosed Space Storing Feed

5.4.2.1 The intake and exhaust devices of the enclosed space for storing feed shall be set separately.

5.4.2.2 For enclosed spaces storing powdered feed, the height, location, and air velocity of the ventilation openings shall be arranged to avoid blowing the powdered feed.

5.4.3 Feed Conveyor

5.4.3.1 Effective ventilation devices shall be installed in the box-type feed conveyor supporting the vertical lifting, and the intake vent should be set at the top of the lifter.

CHAPTER 6 Electrical Installations

Section 1 General Provisions

6.1.1 General Requirements

6.1.1.1 The provisions of this Chapter apply to electrical installations on the non-self-propelled marine fisheries installations.

6.1.1.2 In terms of the equipment and systems uncovered in this Chapter, the marine fisheries unit shall comply with the applicable provisions of Part 5 in CCS *Rules for Classification of Mobile Offshore Units* (2023). The floating fisheries installation shall comply with the provisions of Part 6 in CCS *Rules for Classification of Offshore Floating Installation* (2023). The fixed fisheries platform shall comply with the applicable provisions of Part 5 in CCS *Rules for Classification and Construction of Fixed Offshore Units* or Part 8 in *Rules for Construction and Surveys of Fixed Units in Shallow Sea*.

6.1.1.3 Electrical installations shall be able to:

(1) Ensure power supply to all electrical devices necessary for maintaining normal production of fishery fisheries installations and meeting normal living conditions without activating emergency power supply;

(2) Ensure power supply to electrical devices necessary for safety in case of main power supply failure;

(3) Ensure the safety of personnel and units, and protect them from electrical accidents.

6.1.2 Main Power Supply

6.1.2.1 The main power supply shall consist of at least two power sources as described in 6.1.2.2, with the new energy and external power supply as only one of the main power sources.

6.1.2.2 Optional power sources for the main power supply:

(1) Generator set;

(2) External power supply;

(3) New energy sources such as THE solar energy, wind energy, wave energy, and temperature difference energy.

6.1.2.3 If any main power supply system stops working, other power sources shall have sufficient reserve capacity to ensure the power supply for all electrical equipment necessary to maintain normal unit operation and meet normal living conditions without activating the emergency power.

6.1.2.4 The energy storage device connected to the new energy system shall be able to timely regulate the charging and discharging status according to the load demands.

6.1.3 Emergency Power Supply

6.1.3.1 The marine fisheries installations shall be provided with independent emergency power supply.

6.1.3.2 The emergency power supply shall be a generator set or a battery pack.

6.1.3.3 The emergency power supply shall have sufficient capacity to ensure power supply to necessary safety equipment in emergency situations, and the possibility that these devices may need to work simultaneously shall be taken into account.

6.1.3.4 Considering the starting current and transient characteristics of certain loads, the emergency power supply shall be able to supply power to the following equipment (when relying on electricity) for the specified time:

(1) For emergency lighting in the following spaces, 6h:

- ① The assembly points, boarding locations, and outboard lighting locations of each lifeboat and life raft;
 - ② The aisles, stairways, and exits leading to the assembly points and boarding locations of lifeboats and life rafts;
 - ③ Machinery spaces and main power stations, including their control positions;
 - ④ All control stations, machinery control rooms, and each main switchboard and emergency switchboard;
 - ⑤ Passageways, stairways, exits, and passenger elevators in all service and accommodation spaces;
 - ⑥ Spaces for storing firefighting equipment;
 - ⑦ Spaces of fire pumps, emergency bilge pumps (if installed), and the starting positions of motors for these pumps.
- (2) For power supply to the following equipment, 6h:
- ① Signal equipment required in Section 3 of Chapter 8 of the Guidelines;
 - ② All radio communication equipment required in emergency situations;
 - ③ All internal communication equipment required in emergency situations;
 - ④ Fire detection and alarm systems, manual alarm buttons and devices;
 - ⑤ One of the fire pumps (if powered by emergency generators).

6.1.4 Supplementary Requirements for Unattended Marine Fisheries Installations

6.1.4.1 Unattended marine fisheries installations shall be equipped with main power supply according to actual needs, to ensure that the necessary equipment for maintaining the normal operation of the installations is powered without relying on emergency power supply.

6.1.5 Electrical Equipment Related to Aquaculture

6.1.5.1 In addition to meeting the relevant specifications of CCS, electrical installations related to aquaculture shall also comply with provisions of *Aquaculture Electric Equipment Safety Requirement* (SC/T 6050).

Chapter 7 Fire Protection and Explosion Prevention

Section 1 General Provisions

7.1.1 Application

7.1.1.1 Unless otherwise specified, this Chapter applies to the fire protection and explosion prevention of marine fisheries installations operating in the waters under the jurisdiction of the People's Republic of China.

7.1.1.2 In addition to meeting the requirements of this Chapter, the fire protection and explosion prevention of marine fisheries installations shall also fulfill the relevant requirements of the competent authority of the water area.

7.1.1.3 For marine fisheries installations operating outside the waters under the jurisdiction of the People's Republic of China, the fire protection and explosion prevention shall comply with the applicable requirements for cargo ships in Chapter II-2 of the IMO *International Convention for the Safety of Life at Sea*.

7.1.1.4 In addition to the provisions of this section, the marine fisheries unit shall meet the applicable requirements of Part 7 in CCS *Rules for Classification of Mobile Offshore Units* (2023). The floating fisheries installation shall meet the applicable requirements of Part 8 in CCS *Rules for Classification of Offshore Floating Installation* (2023). The fixed fisheries platform shall comply with the applicable provisions of Part 6 in CCS *Rules for Classification and Construction of Fixed Offshore Units* or Part 9 in *Rules for Construction and Surveys of Fixed Units in Shallow Sea*.

7.1.1.5 The fire protection and explosion prevention of unattended fishery fisheries installations shall comply with the requirements of Section 6 of this Chapter.

7.1.2 Miscellaneous

7.1.2.1 For spaces exposed to explosion risks, such as the battery rooms and paint rooms, the division of hazardous zones, design requirements for entrances and exits between zones, equipment used in hazardous zones, and detection of flammable gases shall comply with the applicable requirements of Chapter 7 - 9 of Part 7 in CCS *Rules for Classification of Mobile Offshore Units* (2023).

7.1.2.2 For places with dust explosion hazards such as feed rooms, the fire prevention and explosion prevention shall comply with relevant national or industry standards.

7.1.2.3 If the marine fisheries installations are equipped with helicopter decks, they shall comply with the applicable requirements of Part 7 and Section 4, Chapter 5 of Part 9 in CCS *Rules for Classification of Mobile Offshore Units*.

7.1.3 Fire Drill

7.1.3.1 All personnel on marine fisheries installations shall participate in a fire drill at least once a month. If more than 25% of the personnel have not participated in a fire drill on the marine fisheries installations in the previous month after personnel change, a drill shall be conducted within 24 hours after the personnel change.

7.1.3.2 Equipment used in the fire drill shall be immediately returned to its original position and restored to a ready-to-use state. Any faults and defects found during the fire drill shall be eliminated as soon as possible.

7.1.3.3 Drills and exercises shall be organized in accordance with the applicable requirements of the *Recommendations on Training of Personnel on Offshore Mobile Units*, as adopted by Resolution IMO A 891 (21).

7.1.3.4 A logbook or duty record shall be kept for the marine fisheries installations, to record the date, participants, and content of the fire drill for future reference.

7.1.3.5 For the unattended marine fisheries installations, the fire drills shall be carried out as required by the owner, and personnel boarding the unit shall be proficient in operating the fire-fighting equipment.

Section 2 Fire Detection

7.2.1 General Requirements

7.2.1.1 Unless otherwise specified in this section, the marine fisheries installations shall be equipped with fire detection systems and shall meet the applicable requirements of Chapter 4 of Part 7 in CCS Rules for Classification of Mobile Offshore Units (2023).

7.2.2 Fire Detection System for Periodically Unattended Machinery Spaces

7.2.2.1 If marine fisheries installations are provided with periodic unattended machinery spaces, a fire detection system that meets the requirements of 7.2.1.1 of this section shall be installed in the spaces, and it shall meet the applicable requirements of Chapter 3 of Part 7 in CCS Rules for Classification of Sea-going Steel Ships (2023).

7.2.2.2 The design and arrangement of the fire detection system in periodically unattended machinery spaces shall be able to quickly detect signs of fire in case of a fire in any part of the space and under the required ventilation changes during the normal machine operation and within the temperature range of the environment.

7.2.2.3 Except for places with restricted height and special suitability, fire detection systems using only temperature detectors are prohibited.

7.2.2.4 The fire detection system shall be able to emit audible and visual alarm signals, which shall be different from the alarm signals of non-fire systems. These alarm signals shall be set in sufficient locations, to ensure that the bridge and responsible marine engineers can hear and see these signals. If the bridge or control station is unattended, an alarm shall be sent in the space of the duty crew.

7.2.2.5 After the installation, the fire detection system shall be tested under the conditions of machine operation and ventilation changes.

Section 3 Containment of Fire

7.3.1 General Requirements

7.3.1.1 Unless otherwise specified in this section, the marine fisheries installations shall meet the applicable requirements of Chapter 5 of Part 7 in CCS Rules for Classification of Mobile Offshore Units (2023).

7.3.2 Fire-resistant Partition of Bulkheads and Decks

7.3.2.1 Table 7.3.2.1 (1) and Table 7.3.2.1 (2) apply to the bulkheads and decks separating adjacent spaces. In order to determine the appropriate fire-resistant integrity standards for the separation between adjacent spaces, these spaces are classified into the following categories ((1) to (10)) according to their fire hazard levels. The titles of each category are only examples but not limitations. The number in parentheses before each category refers to the corresponding 'column' or 'row' number in the table.

(1) Control station refers to the location where the radio equipment or main navigation equipment of marine fisheries installations is installed, or the location where fire alarm indicators or fire control equipment or dynamic positioning control systems are centralized, or the location where fire extinguishing systems are mounted. For the column-stabilized marine fisheries installations, the centralized ballast control station shall be considered as a control station;

(2) Corridor refers to the corridor and lobby;

(3) The living quarters refer to places used as public spaces, residential compartments, offices, medical rooms, projection rooms, game rooms, entertainment rooms, barber shops, and similar

spaces;

(4) The passageway refers to internal stairways, elevators, escalators (excluding those fully located inside machinery spaces), and their ring fences. Passageways with ring fences only on one deck shall be considered as part of the space not separated by fire doors;

(5) Spaces with a lower risk of fire refer to the cabinets, storage rooms, workshops, drying rooms, and laundry rooms where flammable materials are not stored;

(6) Class-A machinery spaces refer to places equipped with the following equipment and the enclosure bulkhead passages leading to these places:

① Internal combustion engines used as main propulsion units;

② Internal combustion engines with a total output power of no less than 375kW and used as non-main propulsion unit;

③ Any fuel oil boiler or other fuel oil device, or any fuel oil equipment outside the boiler, such as incinerators;

(7) Other machinery spaces refer to places other than Class-A machinery spaces, including places equipped with propulsion machinery, boilers and other combustion equipment, fuel oil devices, steam engines and internal combustion engines, generators and main motors, fueling stations, refrigeration machines, anti-rolling devices, ventilation fans, and air conditioners, and the enclosure bulkhead passages leading to these places;

(8) Service spaces with a higher risk of fire refer to the cabinets, storage rooms, and workshops where flammable materials are stored, kitchens, dining rooms, paint rooms with cooking equipment, workshops that are not part of machinery spaces, and feed rooms exposed to a risk of dust explosion;

(9) Open deck refers to the deck area that is open and has been exposed to little or no risk of fire hazards. If the enclosed promenade deck falls under such category, the enclosed promenade deck shall be exposed to no significant fire hazards, and shall only be equipped with the deck furniture. In addition, this type of space shall also support the natural ventilation through fixed openings;

(10) Washrooms and similar spaces refer to public sanitation facilities such as bathrooms, showers, washrooms, as well as isolated diet preparation rooms without cooking equipment. Sanitary facilities used for and accessible only from a particular space shall be considered as part of the space.

7.3.2.2 Unless there are continuous Class-B ceilings or linings on both sides of the bulkhead, all bulkheads forming Class-B partition shall extend from deck to deck, and extend to the house side or other boundary, in which case the bulkhead may terminate at the continuous ceiling or lining. In the corridor bulkhead, only the vents on the doors and below the doors of the bedrooms, public space, offices, and sanitary areas can be set, and they can only be arranged in the lower half of the door. If these vents are located above or below doors, the total net area of any one or all vents shall not exceed 0.05m². If the vent is set on the door, a grille made of non-combustible material shall be adopted. Such vent shall not be set on the door as the stairway ring-around partition.

7.3.2.3 For the stairway passing through one deck, at least Class-A or Class-B partition and self-closing doors shall be used for protection, to inhibit the rapid spread of flames from one deck to another. The enclosure bulkhead of personnel lift shall be protected by Class-A partition. For stairway and elevator enclosure passing through more than one deck, Class-A partition shall be surrounded and the self-closing doors shall be used for protection at each deck. The bulkheads of the residential zone facing the hazardous area shall be insulated to Grade A-60.

Fire-resistant Integrity of Bulkheads Separating Adjacent Spaces

Table 7.3.2.1

(1)

Space	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Control station ①	A-0 ^a	A-0	A-60	A-0	A-15	A-60	A-15	A-60	*	A-0
Corridor ②		C	B-0	B-0 A-0 ^b	B-0	A-60	A-0	A-0	*	B-0
Accommodation space ③			C	B-0 A-0 ^b	B-0	A-60	A-0	A-0	*	C
Stairway ④				B-0 A-0 ^b	B-0 A-0 ^b	A-60	A-0	A-0	*	B-0 A-0 ^b
Service areas with minor fire hazards ⑤					C	A-60	A-0	A-0	*	B-0
Class-A machinery space ⑥						*	A-0	A-60	*	A-0
Other machinery spaces ⑦							A-0 ^c	A-0	*	A-0
Service areas with major fire hazards ⑧								A-0 ^c	*	A-0
Open deck ⑨									—	*
Washrooms and similar spaces ⑩										C

Fire-resistant Integrity of Decks Separating Adjacent Spaces

Table 7.3.2.1 (2)

Spaces on deck Spaces under deck	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Control station ①	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	*	A-0
Corridor ②	A-0	*	*	A-0	*	A-60	A-0	A-0	*	*
Accommodation space ③	A-60	A-0	*	A-0	*	A-60	A-0	A-0	*	*
Stairway ④	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	*	A-0

Spaces on deck Spaces under deck	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
Service areas with minor fire hazards ⑤	<u>A-15</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>*</u>	<u>A-60</u>	<u>A-0</u>	<u>A-0</u>	<u>*</u>	<u>A-0</u>
Class-A machinery space ⑥	<u>A-60</u>	<u>A-60</u>	<u>A-60</u>	<u>A-60</u>	<u>A-60</u>	<u>*</u>	<u>A-60^d</u>	<u>A-60</u>	<u>*</u>	<u>A-0</u>
Other machinery spaces ⑦	<u>A-15</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>*</u>	<u>A-0</u>	<u>*</u>	<u>A-0</u>
Service areas with major fire hazards ⑧	<u>A-60</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>A-60</u>	<u>A-0</u>	<u>A-0^c</u>	<u>*</u>	<u>A-0</u>
Open deck ⑨	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>*</u>	<u>—</u>	<u>*</u>
Washrooms and similar spaces ⑩	<u>A-0</u>	<u>A-0</u>	<u>*</u>	<u>A-0</u>	<u>*</u>	<u>A-0</u>	<u>A-0</u>	<u>A-0</u>	<u>*</u>	<u>*</u>

Note: Table 7.3.2.1(1) and Table 7.3.2.1(2) apply, depending on the specific situation.

a The bulkheads separating the bridge, chart house, and radio room can be of Class B-0.

b To determine the applicable class, refer to 7.3.2.2 and 7.3.2.3 of this Chapter.

c Spaces falling under the same category and marked with the superscript 'c' require bulkheads or decks of the class indicated in the table only when adjacent spaces have different purposes. For example, bulkheads are not required between adjacent kitchens in Category ③, while Class 'A-0' bulkhead is required if a paint room is adjacent to the kitchen.

d If machinery spaces in Category (7) are exposed to no or only minor fire hazards, the fire-resistant insulation may be omitted.

* The partition shall be constructed with steel or equivalent materials, requiring no compliance with Class-A standards. Except for open decks, if the deck is penetrated for the installation of cables, pipelines, and ventilation ducts, such penetration places shall be sealed, to prevent the passage of flames and smoke. Unless a fixed gas fire-extinguishing system is installed, the partition between the control station (emergency generator) and the open deck may be provided with air entry openings without closing devices.

- No special requirements are imposed on the material or integrity of the boundary interface.

Section 4 Fire Control and Firefighting

7.4.1 General Requirements

7.4.1.1 Unless otherwise specified in this section, the fire control and firefighting measures for the marine fisheries unit shall meet the applicable requirements of Chapter 6 of Part 7 in CCS Rules for Classification of Mobile Offshore Units (2023). The fire control and firefighting measures for the floating fisheries installation shall meet the applicable requirements of Chapter 6 of Part 8 in CCS Rules for Classification of Offshore Floating Installation (2023). The fixed fisheries platform shall comply with the applicable provisions of Chapter 4 of Part 6 in CCS Rules for Classification and Construction of Fixed Offshore Units or Chapter 5 of Part 9 in Rules for Construction and Surveys of Fixed Units in Shallow Sea.

7.4.1.2 The marine fisheries installations shall be equipped with fire water extinguishing systems that meet the requirements of Chapter 6 of Part 7 in CCS Rules for Classification of Mobile Offshore Units (2023).

7.4.1.3 Based on a comprehensive safety analysis and after the CCS review, necessary fire systems and firefighting equipment may be installed according to the actual situation.

7.4.2 Fire Pump

7.4.2.1 Sanitary water pump, ballast pump, bilge pump or general-purpose pump, if not normally used for conveying oils, can be also used as a fire pump.

7.4.2.2 The displacement of each fire pump shall be no less than the flow required by the foam fire extinguishing system in the largest space plus 25m³/h.

7.4.3 Configuration of Fire-fighting Equipment

7.4.3.1 Fire hydrants shall be installed on each deck in the living quarters, and at least 3 approved portable fire extinguishers shall be mounted on each deck. The carbon dioxide fire extinguisher is prohibited.

7.4.3.2 Class-A machinery space with fuel equipment shall at least meet the following configuration requirements:

- (1) Three approved portable foam or dry powder fire extinguishers;
- (2) One approved large foam fire extinguisher with a capacity no less than 135L or an equivalent dry powder fire extinguisher;
- (3) One set of approved portable foam spray guns;
- (4) One of the approved fixed pressure water mist fire extinguishing system, fixed high expansion foam fire extinguishing system or fixed gas fire extinguishing system.

7.4.3.3 For Class-A machinery space with boilers for domestic use (capacity: less than 175kW; equivalent to an evaporation rate of 250kg/h), the configuration requirements of 7.4.3.2 (1), (3), and (4) shall be met at least.

7.4.3.4 At least two portable gas fire extinguishers shall be provided in the distribution room and control room, and in smaller spaces, they can be placed near the door. A gas fire extinguishing system that meets the requirements of Section 9 or Section 10, Chapter 6 of Part 7 in CCS Rules for Classification of Mobile Offshore Units (2023) should be installed in the control room separated from the living quarters.

7.4.3.5 In addition to the above spaces, each accessible space exposed to the fire hazard shall be equipped with a portable fire extinguisher, to extinguish initial fires. Each space exposed to significant risks of oil fires shall be equipped with a large movable fire extinguisher and/or a portable foam spray gun. The above fire extinguishing methods shall be configured with redundancy.

Section 5 Escape

7.5.1 Escape Route

7.5.1.1 Unless otherwise specified in this section, at least two escape routes that are far apart from each other and available at all times shall be provided for all spaces or groups, and there shall be no obstacles in the escape routes. The doors on the escape routes of control stations, accommodation spaces, and service spaces shall generally open in the direction of escape, while the doors on vertical emergency escape trunks can be opened to the outside of the trunk, so that the trunk can be used for both escape and access.

7.5.1.2 Spaces not specified below shall be arranged according to 7.5.1.1 of this section. Considering factors such as the space size and property, with the consent of CCS, one escape passage can be exempted.

7.5.1.3 The escape route for the marine fisheries installations shall meet the following requirements:

(1) All accommodation spaces and places frequently used by personnel (except machinery places) shall be equipped with stairways and ladders, to provide escape passages to the open deck and finally to the lifeboat and life raft deck, and shall comply with the following provisions:

① On each deck of the accommodation space, there shall be at least 2 escape passages that are far away from each other for each restricted space or group;

② Under the lowest open deck, the main escape passage shall be a stairway, and the other can be a bulkhead passage or a stairway. Above the lowest open deck, the escape passage shall be a stairway or a door leading to the open deck, or a combination of both;

③ For spaces where personnel only occasionally access, only one escape passage is required, which shall be independent of the watertight door;

④ No closed corridor with a length exceeding 7m shall be constructed. A corridor with closed end refers to the corridor with one escape passage or part of a corridor;

⑤ The term "net width" refers to the distance from the handrail to the bulkhead on the other side or between handrails. The net width of the stairway and corridor used as escape routes shall be at least 700mm, and there shall be handrails on one side. Stairways and corridors with a net width of 1,800mm or more shall be provided with handrails on both sides. The inclination angle of the stairway shall generally be 45°, but shall not exceed 50°, and shall not exceed 60° in narrow spaces. The entrance to the stairway shall be with the same size as the stairway;

⑥ If the radio room is constructed with no direct exit to the open deck, two entrances and exits shall be arranged, one of which can be a window and porthole of sufficient size, or equivalent facilities, for emergency escape.

(2) Each Class-A machinery space shall be provided with 2 escape routes, following any one of the following requirements:

① For 2 steel ladders as far away from each other as possible, leading to a door on the upper part of the machinery space, there shall be a passage from the door to the open deck. One of the steel ladders shall be led from the lower part of the Class-A machinery space (the lowest deck accessible to personnel) to a safe location outside the machinery space, and shall be located within a protected ring fence. The ring fence shall meet the requirements of 7.3.2.1 in Section 3 of this Chapter for Class (4), and shall be provided with a self-closing fire door that meets the same fire-resistant integrity standards inside. The steel ladders shall be installed to prevent heat from entering the ring fence through uninsulated fixed points. The internal dimensions of the ring fence shall be at least 800mm × 800mm, with emergency lighting;

② A steel ladder leads to one door on the upper part of the space, and there is a passage from the door to the open deck. In addition, on the lower part of the space and the place away from the

aforementioned ladder, there is one steel door that can be operated from both sides. Through this door, there is another safety escape passage leading to the open deck.

(3) Each non-Class A machinery space shall be provided with two escape passages that lead to the open deck and finally to the lifeboat and life raft embarkation deck. However, for spaces that are only occasionally accessed and have the maximum walking distance to the door no more than 5m, only one escape passage is required;

(4) The net width of the stairway used as an escape passage in the aforementioned machinery space shall be at least 600mm, and its inclination angle shall not exceed 60°. If a ladder is used as an escape passage, its type and dimension shall comply with the national or industry standards. All inclined ladders/stairways and ladders that comply with 7.5.1.3 (2), installed with open treads, used as part of or leading to an escape passage but not located within a protected ring fence, shall be made of steel. The underside of such inclined ladders/stairways shall be equipped with steel guard plates, to protect evacuees from high temperatures and flames below;

(5) Elevators shall not be considered as required escape passages.

7.5.2 Emergency Escape Breathing Device (EEBD)

7.5.2.1 The number and arrangement of EEBDs for marine fisheries installations shall meet the following requirements:

(1) The placement of EEBD in the Class-A machinery space with internal combustion engines for main propulsion shall comply with the following provisions:

① If the engine control room is located inside the machinery space, one set of EEBDs shall be placed inside;

② One set of EEBDs shall be placed in the workshop. However, if there is an entrance directly led from the workshop to the escape passage, one set of EEBDs is not required;

③ One set of EEBDs shall be placed on each deck or near the escape ladder. The ladder constitutes the second escape passage of the machinery space (the other escape passage is an enclosed escape trunk or a watertight door on the lower part of the space);

④ Alternatively, considering the layout and dimension of the space or the normal staffing, different quantities or placement positions may be determined with the approval of CCS, and at least 2 sets shall be provided.

(2) For Class-A machinery spaces without internal combustion engines for main propulsion, at least one set of EEBDs shall be placed on each deck or near the escape staircase. The ladder constitutes the second escape passage of the machinery space (the other escape passage is an enclosed escape trunk or a watertight door on the lower part of the space);

(3) The quantity and location of EEBDs in other machinery spaces shall be determined according to the specific circumstances.

(4) At least 2 sets of EEBDs shall be equipped in the accommodation space.

(5) At least 2 sets of EEBDs shall be equipped in the unattended Class-A machinery space.

Section 6 Special Requirements for Unattended Fisheries installations

7.6.1 General Requirements

7.6.1.1 Unless otherwise specified in this section, the fire protection of unattended marine fisheries installations shall comply with the applicable requirements of Section 1 - 5 of this Chapter.

7.6.1.2 Effective ventilation measures shall be taken for spaces where flammable gases may accumulate.

7.6.2 Containment of Fire

7.6.2.1 Structural materials shall meet the following requirements:

(1) Unless otherwise specified in this section, floats, superstructures, structural bulkheads, decks, and deckhouses shall be constructed of steel or other equivalent materials.

(2) For the insulation of aluminum alloy components for Class-A or Class-B partitions, except for non-load-bearing structures, the insulation layer shall be able to prevent the temperature of the structural core material from rising more than 200°C above the ambient temperature during any applicable fire exposure time in the standard fire resistance test.

(3) Special attention shall be paid to the insulation requirements for the storage, launching, and boarding areas of lifeboats and life rafts, as well as the aluminum alloy cylinders, pillars, and other components supporting Class-A and Class-B partitions, so as to ensure that:

① For components used to support lifeboat and life raft areas and Class-A partitions, the temperature rise at the end of the 1-h standard fire resistance test shall meet the limits specified in 7.6.2.1 (2) of this section.

② For components used to support Class-B partitions, the temperature rise at the end of the 0.5-h standard fire resistance test shall meet the limits specified in 7.6.2.1 (2) of this section.

(4) The top cover and casing of Class-A machinery spaces shall be composed of steel structure. In case any openings on them, appropriate arrangements and protection shall be made to prevent fire spread. Additionally, the floor of normal passageways in Class-A machinery spaces shall be made of steel.

7.6.2.2 The fire-resistant of bulkheads and decks separating adjacent spaces shall meet the following requirements:

(1) Corridor bulkheads and their doors shall be made of steel or non-combustible materials;

(2) The boundaries of Class-A machinery spaces and kitchens shall be made of steel or equivalent materials, and their doors shall be also made of steel or non-combustible materials; the doors for the bulkheads of Class-A machinery spaces shall be self-closing type.

7.6.2.3 The protection of stairways and elevators in service spaces and control stations shall meet the following requirements:

(1) Elevator trunks and stairways passing through more than one deck shall be surrounded by at least Class B-0 materials and protected by self-closing doors.

(2) All stairways shall be made of steel structure or approved equivalent materials.

7.6.2.4 Construction details shall meet the following requirements as much as possible:

(1) Except for the refrigerated rooms in the cargo or service spaces, the insulation material shall be non-combustible. The damp-proof layer and adhesive used together with the insulation material, as well as the insulation material of piping fittings for the air conditioning refrigeration system, need not to be non-combustible, but shall reach the minimum feasible quantity and their exposed surfaces shall be low flame-spread.

(2) Combustible veneers, insertion strips, decorations, and decorative panels can be added to the surfaces of non-combustible bulkheads, ceilings, and linings installed in service spaces, and such spaces shall be enclosed by non-combustible bulkheads, ceilings, and linings that comply with the requirements of (3), (4), and 7.6.2.5.

(3) The calorific value of combustible materials used for surfaces and linings as specified in (2) above shall not exceed 45MJ/m² per area of the thickness used. This requirement is inapplicable to furniture surfaces fixed to linings or bulkheads.

(4) If combustible panels, insertion strips, decorations, and decorative panels are used in service

spaces, the total volume shall not exceed the volume of decorative panels with the equivalent thickness of 2.5mm on the combined area of enclosure bulkheads, ceilings and linings. Furniture fixed to linings, bulkheads or decks needs not to be included in the calculated total volume of combustible materials.

(5) The gaps on the back of enclosed ceilings, panels, or linings shall be separated by tightly installed draft stoppers with a spacing not exceeding 14m. In the vertical direction, these gaps, including those behind the stairway linings, bulkhead passageways, etc., shall be sealed on each deck.

7.6.2.5 Restrictions on the use of combustible materials

(1) The ring fences of the corridors and stairways, exposed surfaces of ceilings of service spaces and control stations, as well as the surfaces and barrier liners for concealed or inaccessible areas in service spaces and control stations shall be low flame-spread.

(2) Paints, varnishes and other finishing coatings used on exposed surfaces shall not produce excessive smoke and toxic substances.

(3) Deck substrate covering used in service spaces and control stations shall be approved materials that are not easily ignited, produce no smoke and toxic substances, or pose no explosion hazard at high temperatures.

7.6.3 Escape Route

7.6.3.1 The escape route for the unattended marine fisheries installations shall meet the following requirements:

(1) Unless otherwise specified in this article, at least two escape routes that are far apart from each other and available at all times shall be provided for all spaces or groups, and there shall be no obstacles in the escape routes. The doors on the escape routes of control stations and service spaces shall generally open in the direction of escape, while the doors on vertical emergency escape trunks can be opened to the outside of the trunk, so that the trunk can be used for both escape and access;

(2) Each Class-A machinery space shall be provided with at least two escape passages that lead to the open deck and finally to the lifeboat and life raft embarkation deck, which is one of the following methods. However, if a Class-A machinery space is constructed with an escape route to the embarkation deck through a single door or a steel ladder, only one escape route is required.

① Two steel stairs that are far away from each other leads from the lowest floor to a safe position outside the space;

② One steel ladder leads to one door on the upper part of the space, and there is a passage from the door to the open deck. In addition, on the lower part of the space and the place away from the aforementioned ladder, there is one steel door that can be operated from both sides. Through this door, there is another safety escape passage leading to the open deck;

(3) Each non-Class A machinery space shall be provided with two escape passages that lead to the open deck and finally to the lifeboat and life raft embarkation deck. However, for spaces that are only occasionally accessed and have the maximum walking distance to the door no more than 5m, only one escape passage is required;

(4) No closed corridor with a length exceeding 7m shall be constructed;

(5) The net width of the stairway used as an escape passage in the aforementioned machinery space shall be at least 600mm, and its inclination angle shall not exceed 60°. If a ladder is used as an escape passage, its type and dimension shall comply with the national or industry standards. All inclined ladders/stairways and ladders that comply with 7.6.3.1 (2), installed with open treads, used as part of or leading to an escape passage but not located within a protected ring fence, shall be made of steel. The underside of such inclined ladders/stairways shall be equipped with steel guard plates, to protect evacuees from high temperatures and flames below;

(6) Elevators shall not be considered as the required escape passages.

7.6.4 Emergency Escape Breathing Device (EEBD)

7.6.4.1 Class-A machinery space shall be equipped with no less than 2 EEBDs.

Chapter 8 Safety Equipment

Section 1 Life-saving Appliances and Equipment

8.1.1 General Requirements

8.1.1.1 This Chapter is applicable to marine fisheries installations operating in the waters under the jurisdiction of the People's Republic of China. For the fisheries installations operating outside the waters under the jurisdiction of the People's Republic of China, the performance, configuration, and arrangement of life-saving appliance shall comply with the relevant regulations of the IMO *International Convention for the Safety of Life at Sea* and/or the competent authorities of the countries concerned.

8.1.1.2 The terms concerning life-saving appliance used in this Chapter shall be subject to the definitions in Section 1, Chapter 3 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*.

8.1.1.3 The maintenance, inspection, performance, training, and drills of life-saving appliance shall comply with the applicable regulations of Chapter 3 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships* and its appendix.

8.1.1.4 The storage and release of life-saving appliance shall comply with the applicable regulations of Chapter 3 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*.

8.1.2 Configuration Requirements for Lifeboats, Rescue Boats, and Life Rafts

8.1.2.1 The marine fisheries installations 200nmi or more from the coast shall be equipped in accordance with the provisions in Table 8.1.2.1 or higher.

Configuration of Life-saving Equipment in Marine Fisheries Installations 200nmi or More from the Coast ^① (%) Table 8.1.2.1

<u>Lifeboat</u>	<u>Inflatable life raft</u>	<u>Additional life raft (storage spacing > 100m) ^②</u>	<u>Rescue boat</u>
<u>100</u>	<u>100 (transferred port-side to port-side)</u>	<u>1 or 2 (not included in total capacity)</u>	<u>1</u>
	<u>100 per side</u>		

Note: ① The maximum allowable boarding persons on the marine fisheries installations is used as the basis for configuration approval.

② If the distance from the very front or rear end of the installation to the nearest end of the lifeboat or life raft storage location exceeds 100m, in addition to the life rafts mentioned above, one life raft shall be equipped within a reasonable and feasible range, preferably placed as close to the front or rear. Alternatively, two life rafts may be equipped, with one placed as close to the front and the other as close to the rear. The life raft can be securely fastened in a way that can be detached manually, requiring no approved launching device. The storage location of the life raft shall be equipped with:

(a) At least 2 life jackets and at least 2 life suits;

(b) Sufficient lighting for the water area where the storage and launching positions are located. If the portable lighting is used, brackets shall be provided for positioning on both sides of the installation.

8.1.2.2 For the marine fisheries installations more than 20nmi but less than 200nmi from the coast, the rescue boats may be omitted, and lifeboats and life rafts shall be equipped in accordance with the provisions in Table 8.1.2.1 or higher.

8.1.2.3 For the marine fisheries installations within 20nmi from the coast, lifeboats and rescue boats are not required, and life rafts shall be equipped in accordance with the provisions in Table 8.1.2.3 or higher. During the personnel boarding on the installation, guard vessels shall be moored alongside the installation for supervision, with certain rescue/assistance capabilities, and all guard

vessels shall be able to accommodate the total number of personnel boarding on the installation. In addition, the vessels shall have sufficient maneuverability and operability in waves, allowing to rescue personnel from the water and assemble life rafts.

Configuration of Life-saving Equipment in Marine Fisheries Installations No More Than 20nm from the Coast^① (%) Table 8.1.2.3

<u>Inflatable life raft</u>	<u>Additional life rafts (storage spacing > 100m)</u>
<u>100 per side</u>	<u>1 or 2 (not included in total capacity)</u>

Note: ① The requirements in the table shall be consistent with Table 8.1.2.1.

8.1.3 Configuration Requirements for Life Jackets

8.1.3.1 On marine fisheries installations, each person shall be equipped with a life jacket that meets the requirements of 3.6.7, Section 6, Chapter 3 of Part 3 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*.

8.1.3.2 Each life jacket shall be equipped with a life jacket light.

8.1.4 Configuration Requirements for Life Suits

8.1.4.1 For marine fisheries installations operating in non-warm climate areas¹, each person shall be equipped with a life suit that meets the requirements of 3.6.8, Section 6, Chapter 3 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*. In addition, a sufficient number of life suits shall be provided for use at lifeboats and life rafts.

8.1.5 Configuration Requirements for Lifebuoys

8.1.5.1 For the fixed fisheries platform, at least 6 lifebuoys that meet the requirements of 3.6.6, Section 6, Chapter 3 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships* shall be provided, and they shall be easily accessible from open areas.

8.1.5.2 For marine fisheries installations and floating fisheries installation, the lifebuoys shall be provided in accordance with the provisions in Table 8.1.5.2 or higher.

Configuration of Lifebuoys for Marine Fisheries Installations and Floating Fisheries Installation Table 8.1.5.2

<u>Length (m)</u>	<u>Number of lifebuoys</u>
<u>$L < 100$</u>	<u>8</u>
<u>$100 \leq L < 150$</u>	<u>10</u>
<u>$150 \leq L < 200$</u>	<u>12</u>
<u>$L \geq 200$</u>	<u>14</u>

8.1.5.3 At least one buoyant lifeline shall be installed on two lifebuoys that are far away from each other, and the length of the lifeline shall be at least 1.5 times the distance from the storage deck to the light load waterline, or 30m, whichever is greater.

6.6.2.1 At least a half of the total lifebuoys shall be provided with self-igniting lights, and at least 2 lifebuoys shall be provided with the function of self-activating smoke signals. Lifebuoys with self-igniting lights and those with self-igniting lights and self-activating smoke signals shall be evenly distributed around accessible marine fisheries installations, and they shall not be the ones equipped with lifelines according to the provisions of 8.1.5.3. Lifebuoys with self-igniting lights and self-activating smoke signals shall be placed outside the hazardous area.

¹ See IMO *Guidelines for Thermal Protection Assessment* (MSC/Circ.1046).

8.1.6 Configuration Requirements for Line-throwing Appliance

8.1.6.1 At least one line-throwing appliance shall be equipped, and each appliance shall:

- (1) Be able to accurately throw out the rope;
- (2) Include no less than 4 throwing bodies, each of which can throw out the rope at least 230m in the calm weather;
- (3) Include no less than 4 gunlines, each of which has a breaking force of no less than 2kN;
- (4) Be provided with a brief instruction manual or illustrations explaining the use of the line-throwing appliance.

8.1.6.2 Pistol-fired rockets, or components consisting of rockets and gunlines, shall be installed in waterproof casings. In addition, pistol-fired rockets, gunlines, rockets, and igniters shall be stored in weatherproof containers.

8.1.7 Configuration Requirements for Distress Fireworks Signals

8.1.7.1 Six approved rocket parachute flare signals shall be provided.

8.1.8 Configuration Requirements for Radio Life-saving Appliance

8.1.8.1 Life boats shall be equipped with a VHF radio telephone and a search and rescue positioning system. In addition, at least one search and rescue positioning system shall be available on marine fisheries installations, and shall be stored in such way that it can be quickly placed in any lifeboat and life raft.

8.1.9 Configuration requirements for life-saving appliance on unattended marine fisheries installations

8.1.9.1 For unattended marine fisheries installations, the following provisions shall be followed for the configuration of life-saving appliance:

- (1) At least one life raft shall be provided, with a capacity sufficient to accommodate the maximum allowable number of personnel on the installation, and the total capacity of life rafts shall be no less than 12 persons.
- (2) At least 6 lifebuoys shall be provided, and they shall meet the requirements of 8.1.5.3 and 8.1.5.4 in this section.
- (3) Life jackets shall be provided according to the maximum allowable boarding persons, or a life jacket shall be carried by each person working on the unattended marine fisheries installations.
- (4) In the non-warm climate areas, life suits shall be provided according to the maximum allowable boarding persons, or a life suit shall be carried by each person working on the unattended marine fisheries installations.
- (5) During the personnel boarding, guard vessels shall be moored alongside the installation for supervision, and shall meet the requirements of 8.1.2.3.
- (6) At least one approved line-throwing appliance and six rocket parachute flare signals shall be provided.

Section 2 Communication Equipment

8.2.1 General Requirements

8.2.1.1 This section is applicable to marine fisheries installations operating in the waters under the jurisdiction of the People's Republic of China. For marine fisheries installations operating outside the waters under the jurisdiction of the People's Republic of China, their communication equipment shall comply with the applicable requirements of the *International Convention for the Safety of Life at Sea*.

8.2.1.2 The performance of communication equipment shall comply with the relevant provisions of Chapter 4 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*.

8.2.1.3 The marine fisheries installations shall be equipped with at least one VHF radio telephone (fixed-mount or portable).

8.2.1.4 For the unattended marine fisheries installations, no communication system may be equipped. Personnel boarding the unattended marine fisheries installations shall carry reliable portable radio communication equipment.

Section 3 Signal Equipment

8.3.1 General Requirements

8.3.1.1 The marine fisheries installations shall be equipped with the signal equipment such as the navigation aiding lights and acoustic signals. Self-propelled marine fisheries installations operating in the waters under the jurisdiction of the People's Republic of China shall, in addition to meeting the requirements of this section, be also equipped with signal equipment as required by Chapter 8 of Part 4 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*. Self-propelled marine fisheries installations operating outside the waters under the jurisdiction of the People's Republic of China shall be also equipped with signal equipment as required by the *International Convention for the Safety of Life at Sea* and Chapter 13 of Part 4 in the *Technical Regulations for Statutory Survey of International Sea-going Ships*.

8.3.1.2 The specific requirements from the competent authority, if any, shall prevail.

8.3.2 Navigation Aiding Light

8.3.2.1 Navigation aiding light shall be synchronous luminescent lamp with white light at night. The structure and installation locations of the lights shall be such to ensure that the ships approaching the navigation aiding light from any direction can see the light from at least one location.

8.3.2.2 The light shall be set within a range of 6m - 30m above the design high tide level, its flashing shall be characterized by Morse signal "U", with the maximum period of 15s, and the luminous intensity of 1,400cd, supporting the synchronous operation. The outgoing beam shall be vertically distributed in such way that the beam can be seen from the place near the marine fisheries installations to the maximum range of the light.

8.3.3 Acoustic Signal

8.3.3.1 The structure and location of the acoustic signal shall be arranged to ensure that the signal can be heard by ships approaching from any direction.

8.3.3.2 The acoustic signal shall be installed within a range of 6m - 30m above the design high tide level, with a hearing range of at least 2nmi. The sound rhythm shall be characterized by Morse signal "U", with a period of 30s. The minimum duration of a short sound shall be 0.75s.

8.3.3.3 When the visibility is less than or equal to 2nmi, the acoustic signals shall be activated, and those for the unattended marine fisheries installations shall be activated automatically.

8.3.3.4 Manual acoustic signals and other sounders shall be equipped for use in case of acoustic signal failure (applicable to manned installations).

Chapter 9 Pollution Prevention Structures and Equipment

Section 1 General Provisions

9.1.1 General Requirements

9.1.1.1 For marine fisheries installations, the requirements of the flag country and the competent authority of the aquaculture area shall be met first, to prevent the oil pollution, domestic sewage pollution, garbage pollution, and air pollution.

9.1.1.2 For the floating fisheries installation and the fixed fisheries platform, the requirements of the competent authority of the aquaculture area shall be met first, to prevent the oil pollution, domestic sewage pollution, garbage pollution, and air pollution.

9.1.1.3 Sick fish, dead fish, and other fish in the aquaculture area shall not be directly discarded in the area, and shall be collected and handled by specially-assigned personnel by taking into account the most serious possible situation.

9.1.2 Requirements for Pollution Prevention of Marine Fisheries Installations

9.1.2.1 Units navigating and operating within the waters under the jurisdiction of the People's Republic of China shall comply with the relevant requirements of Part 5 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Ships*, to prevent the oil pollution, pollution from domestic sewage, garbage pollution, air pollution, and pollution from harmful anti-fouling systems.

9.1.2.2 In addition to meeting the requirements of 9.1.2.1, units navigating and operating outside the waters under the jurisdiction of the People's Republic of China shall comply with the relevant requirements of Part 5 in *Technical Regulations for Statutory Survey of International Sea-going Ships*, to prevent the oil pollution, pollution from domestic sewage, garbage pollution, air pollution, and pollution from harmful anti-fouling systems.

9.1.3 Floating Fisheries Unit and Fixed Fisheries Platform

9.1.3.1 Facilities operating within the waters under the jurisdiction of the People's Republic of China shall comply with the relevant requirements of Part 5 in the *Technical Regulations for Statutory Survey of Domestic Sea-going Facilities*, to prevent the oil pollution, pollution from domestic sewage, garbage pollution, and air pollution.

9.1.3.2 Facilities operating within the waters under the jurisdiction of the People's Republic of China shall meet the requirements for air pollution prevention and the applicable requirements of the *Air Pollution Prevention and Control Law of the People's Republic of China*.

9.1.3.3 For facilities operating within the waters under the jurisdiction of the People's Republic of China, the discharge requirements for the oily sewage, domestic sewage, garbage, toxic liquid substances, and waste shall be subject to the *Discharge Standard for Water Pollutants from Ships* (GB3552-2018) in addition to meeting the requirements of 9.1.3.1.

Chapter 10 Ship-type Marine Fisheries Installations

Section 1 General Provisions

10.1.1 General Requirements

10.1.1.1 This Chapter provides the basis for the classification survey and certification of ship-type marine fisheries installations.

10.1.1.2 Unless otherwise specified, the survey types and periods, survey items and scope of the ship-type marine fisheries installations shall generally meet the applicable requirements of CCS *Rules for Classification of Mobile Offshore Units* (2023) or CCS *Rules for Classification of Offshore Floating Installation* (2023), depending on the purposes of the mobile and floating types.

10.1.1.3 For major ship alteration, the relevant requirements of CCS *Implementation Guidelines for Major Ship Alterations* shall be also met.

10.1.1.4 In addition to the requirements of this Chapter and the safety equipment and pollution prevention requirements, including the stability, fire protection, life-saving, communication, and navigation requirements for the ship-type marine fisheries installations, the relevant regulations of the competent authority of flag country shall be fulfilled.

10.1.1.5 The materials and welding of ship-type marine fisheries installations shall meet the requirements of CCS *Rules for Materials and Welding* and the applicable requirements of Chapter 1 of Part 2 in CCS *Rules for Classification of Sea-going Steel Ships* (2023). The materials (including coatings) used shall not affect the health of personnel and aquaculture products.

10.1.1.6 For the structural components of the ship-type marine fisheries installations, such as bottom plates, side shells, bulkheads and perimeters of fishery holds, reasonable and effective measures shall be taken to prevent corrosion damage to the structure, and appropriate corrosion weight grows shall be considered according to specific locations and environmental conditions. Sacrificial anodes or impressed current cathodic protection, combined with coatings, are recommended for corrosion protection. For the perimeter of the enclosed fishery hold, it is recommended to refer to the *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks and Double-Sided Spaces of Cargo Ships for All Vessel Types* (PSPC; IMO MSC.215(82) Resolution) for coating. For the perimeter of the free-flooding fishery hold, refer to the coating requirements for side shells.

10.1.1.7 The layout and scantlings of main structural members in barge-type marine fisheries installations shall meet the applicable requirements of CCS *Rules for Classification of Sea-going Steel Ships* (2023), depending on the structural forms. The outfitting and position mooring system, mechanical devices and systems, electrical installations, fire protection, safety equipment, and pollution prevention structures and equipment shall meet the applicable requirements of Chapter 4 - 9 of the Guidelines. If it is designed as a barge-type marine fisheries unit, the structural analysis and verification, as well as stability, shall also comply with the applicable provisions for surface-type units in CCS *Rules for Classification of Mobile Offshore Units* (2023). If it is designed as a barge-type floating fisheries installation, the structural analysis and verification, as well as the stability, shall also comply with the applicable provisions for the barge-type floating installations in CCS *Rules for Classification of Offshore Floating Installation* (2023). The design, structural analysis, verification, and stability calculation of outfitting and position mooring systems in the nearshore barge-type marine fisheries installations may be considered on a case-by-case basis with the consent of CCS.

10.1.1.8 The aquaculture vessel supports the self-propulsion function, and its turbine and electrical equipment meet the relevant applicable requirements of Parts 3, 4, 7 and 10 in the *Rules for Classification of Sea-going Steel Ships* (2023), and can be assigned with the class notation for autonomous propulsion (self-propelled).

10.1.2 Scope of Application

10.1.2.1 The ship-type marine fisheries installations in this Chapter include two types: the ship-type and barge-type, as defined in Chapter 1.

10.1.2.2 This Chapter is applicable to the design and construction of aquaculture vessels with self-propulsion capabilities within designated sea areas. The barge-type marine fisheries installations shall meet the requirements of 10.1.1.7.

10.1.2.3 This Chapter is applicable to aquaculture vessels with shell plating, single-layer or multi-layer decks, double bottoms, single or double hulls, and watertight or free-flooding fishery holds. The typical mid-ship section structural forms with closed fishery holds are as shown in Figure 10.1.2.3 (1) and Figure 10.1.2.3 (2) and those with of fishery holds with free-flooding fishery holds (where the seawater can flow through the sea opening freely) are as shown in Figure 10.1.2.3 (3) and Figure 10.1.2.3 (4). The new structure of the aquaculture vessel shall be specially considered.

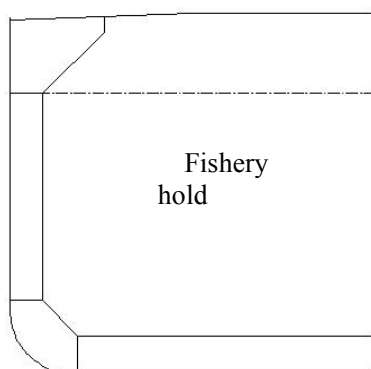


Figure 10.1.2.3 (1)

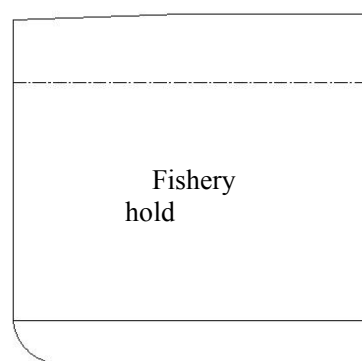


Figure 10.1.2.3 (2)

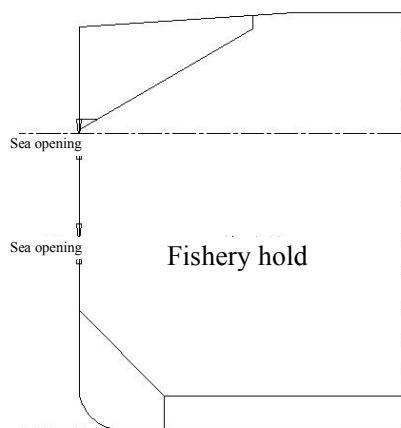


Figure 10.1.2.3 (3)

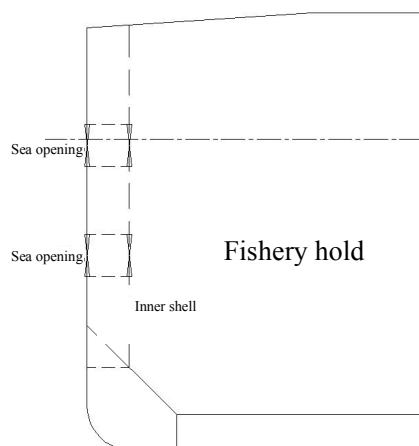


Figure 10.1.2.3 (4)

10.1.2.4 The structural strength and stability of the aquaculture vessel shall meet the requirements of environmental conditions in the design area for ship navigation, requiring no survival conditions. The limitations of the breeding conditions generally shall not exceed the environmental conditions of the corresponding navigation area. The limitations of the breeding conditions shall be specified in the operation manual. Once these conditions are exceeded, the aquaculture vessel shall be switched to the navigation conditions. The environmental conditions of the aquaculture service area shall be monitored at all times. When it is possible to exceed the design environmental conditions, appropriate measures shall be taken, to avoid risks and ensure the safety of the aquaculture vessel.

10.1.2.5 The owner/designer shall provide data on the environmental conditions of the aquaculture vessel in the service area. The environmental conditions shall be determined through the statistical analysis based on reliable and sufficient measured data. If the limiting conditions of the breeding conditions are significantly lower than the designed environmental conditions of the navigation zone, with the consent of CCS, the structural analysis, verification, and stability under the breeding conditions can be exempted from calculation.

10.1.2.6 The selection and configuration requirements of facilities and equipment related to aquaculture, explosion-proof requirements, compressed air system, feed delivery system, dead fish recovery system, open discharge system, and enclosed spaces for feed storage in the aquaculture vessel shall also meet the relevant requirements of Chapter 5 of the Guidelines.

10.1.2.7 After the approval of the application from relevant parties, the aquaculture vessel may be assigned with the class notations other than those specified in the Guidelines, and it shall comply with the requirements of CCS *Rules for Classification of Sea-going Steel Ships* (2023).

10.1.3 Definitions

10.1.3.1 Aquaculture vessel: The ship-type structure (boat-shaped, displacement-type), equipped with the fishery holds formed by the bulkheads and/or side plates. It is a self-propelled marine fisheries unit, also called a ship-type marine fisheries unit.

10.1.3.2 Barge-type marine fisheries unit: The ship type structure (boat-shaped, displacement-type), equipped with the fishery holds formed by the bulkheads and/or side plates. It, supporting no self-propulsion function, is a marine fisheries unit for aquaculture in the specified water area.

10.1.3.3 Navigation conditions: The working conditions of the aquaculture vessel when navigating from one area to another within the designated navigation area.

10.1.3.4 Breeding condition (positioning aquaculture): The condition where the aquaculture vessel is kept in a predetermined position or range for positioning aquaculture.

10.1.3.5 Limiting condition for breeding conditions: The environmental condition, under which the aquaculture vessel is positioned in the designated service area and within the proper design limit during the aquaculture operations. It is proposed by the owner/the designer, reviewed by CCS, and documented in the operation manual.

10.1.4 Drawings and Documents

10.1.4.1 In addition to the drawing materials specified in CCS *Rules for Classification of Sea-going Steel Ships* (2023), the following drawing materials shall be also submitted for CCS approval or future reference:

- (1) Finite element strength calculation (for future reference);
- (2) Fatigue intensity calculation (for future reference);
- (3) Sloshing strength calculation (for future reference);
- (4) Layout of position mooring system or anchoring and mooring system;
- (5) Details of mooring or anchoring components and equipment;
- (6) Mooring or anchoring analysis and calculation book (for future reference);
- (7) Operation manual (for future reference).

10.1.4.2 For the aquaculture vessel with the free-flooding fishery holds, the following drawings need to be supplemented:

- (1) Layout of side sea holes;

(2) Hydrodynamic characteristics model test report (for future reference);

(3) Hydrodynamic load analysis report (for future reference).

10.1.4.3 CCS may require an increase in the scope of the drawing materials submitted, if necessary.

Section 2 Structure

10.2.1 Aquaculture Vessel with Enclosed Fishery Holds

10.2.1.1 General requirements

(1) This article is applicable to the structural design of aquaculture vessels equipped with enclosed fishery holds (all fishery holds isolated from seawater).

(2) In addition to the direct calculation requirements of 10.2.1.4, the local strength of mooring attachment points (if any) and supporting structures of lifting facilities (if any) shall be also considered.

(3) The structural strength calculation under sloshing loads and the evaluation of sloshing loads and structural dimensions of fishery holds shall meet the applicable requirements of CCS *Guidelines for Evaluation of Sloshing Loads and Scantling of Main Structural Members of Liquid Tanks*.

10.2.1.2 Scantlings of structural members

(1) The overall structural arrangement and dimensions of the entire vessel shall meet the applicable requirements of Chapter 1, Chapter 2, Chapter 5, and Chapter 6 of Part 2 in CCS *Rules for Classification of Sea-going Steel Ships* (2023).

(2) Ships navigating in restricted service areas are subject to the relevant provisions of Chapter 2 of Part 10 in CCS *Rules for Classification of Sea-going Steel Ships* (2023).

10.2.1.3 Longitudinal strength

(1) The longitudinal strength shall meet the applicable requirements of Section 2, Chapter 2 of Part 2 in CCS *Rules for Classification of Sea-going Steel Ships* (2023), and the wave loads under breeding conditions can be calculated directly.

10.2.1.4 Direct calculation

(1) Under the navigation conditions, for ships with a length of 150m and above, the structural finite element strength analysis and verification shall be carried out in accordance with the applicable requirements of Part 2 of CCS *Rules for Classification of Sea-going Steel Ships* (2023).

(2) For the breeding condition, the structural finite element strength analysis and verification shall be carried out in accordance with the applicable requirements of Chapter 3 of Part 2 in CCS *Rules for Classification of Mobile Offshore Units* (2023) and according to the limitations of the aquaculture vessel.

(3) Fatigue strength verification shall be carried out for ships with a length of 150m and above, and the proportion of navigation conditions and breeding conditions shall be determined by the designer according to their usage needs.

10.2.2 Aquaculture Vessel with Free-Flooding Fishery Holds

10.2.2.1 General requirements

(1) This article is applicable to the structural design of aquaculture vessels equipped with free-flooding fishery holds (one or more fishery holds to seawater).

(2) In addition to the direct calculation requirements of 10.2.2.4, the local strength of mooring

attachment points (if any) and supporting structures of lifting facilities (if any) shall also be considered.

(3) The size and arrangement of sea openings on free-flooding aquaculture vessels shall be appropriate, to ensure the effectiveness of the ship hull girder.

10.2.2.2 Design load

(1) The designer shall stipulate the design conditions serving as the basis for classification and the corresponding ambient conditions.

(2) During the navigation conditions, considering the sea openings set in the side structures, wave loads shall be predicted or calculated through model tests.

(3) During the breeding conditions, the following design loads shall be considered:

① In addition to environmental loads (wind loads, wave loads and current loads), loads from the weight, usage and operations (if any) of the aquaculture vessel shall be also considered. The deck load shall be no less than the pressure value specified in Section 5, Chapter 2 of Part 2 in *CCS Rules for Classification of Mobile Offshore Units* (2023). In case of water on deck and the deck load exceeding the specified value, the load shall be selected according to the maximum possible pressure.

② The limitations on aquaculture vessels shall be determined according to the sea conditions in the service area, and the short-term forecasting of wave load and strength calculation for hull structure shall be conducted accordingly. The wave load applied to the aquaculture vessel is selected as follows: first, the envelope line is drawn for the maximum predicted values of wave loads under each operating condition, and then a margin of at least 10% is taken, which is 1.1 times the predicted wave load.

10.2.2.3 Scantlings of structural members

(1) The navigation conditions shall meet the following requirements:

① Unless otherwise specified, the structure arrangement and dimensions of the entire ship shall comply with the applicable requirements for ship hull structure in Chapter 1 and Chapter 2 of Part 2 in *CCS Rules for Classification of Sea-going Steel Ships* (2023). If necessary, the main supporting components can be adjusted according to the results directly calculated.

② Aquaculture vessels navigating in restricted service areas are subject to the relevant provisions of Chapter 2 of Part 10 in *CCS Rules for Classification of Sea-going Steel Ships* (2023).

③ The watertight boundary bulkhead on the side of the ship and adjacent to the open seas shall meet the requirements for deep compartments in Section 13, Chapter 2, Part 2 of the *CCS Rules for Classification of Sea-going Steel Ships* (2023). Considering the seawater load characteristics of the free-flooding fishery holds, it may be necessary to increase the dimensions of components.

④ The non-watertight outer plate of the fishery hold area shall at least meet the requirements for Thickness t_1 and the minimum thickness of the outer plate in Section 3, Chapter 2 of Part 2 in the *CCS Rules for Classification of Sea-going Steel Ships* (2023).

⑤ According to 10.2.2.4 (2) ①, a structural finite element strength analysis shall be conducted on the fishery hold area. The geometric catastrophe areas (such as side openings) shall have sufficient structural strength to withstand sudden stress changes and stress concentration at the edges of the openings. The added side tank (if any) shall transition smoothly with the surrounding structures.

(2) The breeding conditions shall meet the following requirements:

① If the draught under the breeding conditions is larger than that under the navigation conditions, the outer plate of the watertight boundary shall meet the requirements for the outer plate of

Section 3, Chapter 2 of Part 2 in *CCS Rules for Classification of Sea-going Steel Ships*" (2023); The transverse bulkhead of the fishery hold, which always bears equal pressure on both sides, can be evaluated in terms of structural dimensions according to the requirements for general watertight bulkheads. If necessary, the dimensions of the components can be adjusted according to the calculated results and actual environmental conditions.

② The dimensions of the hull structure shall be determined according to the load distribution under all expected operating conditions using the direct calculation method, as specified in 10.2.2.4 (2) ②.

10.2.2.4 Strength verification

(1) Longitudinal strength

① Under navigation conditions, the longitudinal strength shall comply with the applicable requirements of Section 2, Chapter 2 of Part 2 in the *CCS Rules for Classification of Sea-going Steel Ships* (2023), and the wave loads shall meet the requirements of 10.2.2.2 (2); The allowable still water bending moment and still water shearing force of the ship hull girder along the ship length at each cross section are provided by the designer, and the influence of the sea opening for the side structure on the surrounding stress distribution is taken into account.

② Under the breeding conditions, the longitudinal strength shall meet the requirements of *CCS Rules for Classification of Sea-going Steel Ships* (2023), and the wave load shall meet the requirements of 10.2.2.2 (3) ②. The allowable still water bending moment and still water shearing force of the ship hull girder along the ship length at each cross section are provided by the designer, and the influence of the sea opening for the side structure on the surrounding stress distribution is taken into account.

(2) Direct calculation

① During the navigation conditions, the finite element strength analysis and verification shall be conducted (the finite element model shall cover all sections of the fishery holds). If the ship length is greater than 250m or CCS deems it necessary, direct calculation of the structural strength shall be carried out for the entire ship. The direct calculation method shall meet the relevant requirements for direct calculation of structural strength in Chapter 2 of *CCS Rules for Classification of Sea-going Steel Ships* (2023), and the influence of the sea opening for the side structure shall be taken into account for the wave load. The operating conditions shall include but not be limited to the most serious loading conditions for ballast and full loads. [For the local area around the sea opening of the side structure, a fine grid analysis shall be conducted.](#)

② During the breeding conditions, the finite element strength analysis and verification shall be conducted using the design loads required in 10.2.2.2 (3), and local refined grid structural strength analysis shall be performed for high stress areas and typical side opening areas. Under the combination conditions, the typical calculation conditions of the control loads of the ship hull girder shall be considered, as follows:

- a. The maximum hogging bending moment;
- b. The maximum sagging bending moment;
- c. The maximum shear force;
- d. The maximum torque bending moment;
- e. The maximum acceleration.

[③ During the fatigue strength verification, the navigation and breeding conditions shall be considered, of which the time proportion for navigation conditions and breeding conditions shall be determined by the designer according to their usage needs.](#)

(3) Sloshing calculation

- ① The structural strength calculation under sloshing loads and the evaluation of sloshing loads and structural dimensions of fishery holds shall meet the applicable requirements of CCS *Guidelines for Evaluation of Sloshing Loads and Scantlings of Main Structural Members of Liquid Tanks*, and the sloshing load can be obtained through the model test.
- ② If effective anti-sloshing measures are taken and appropriate test, theoretical basis and usage experience are provided, they can be accepted as alternatives and equivalent methods to ① upon the consent of CCS.

10.2.2.5 Model test

Side structures are constructed with sea openings. The inflow/outflow velocity or time period of the openings (including fish interception devices) have certain influence on ship motion parameters and loads. Considering that, necessary model tests shall be conducted to determine the following factors:

- ① Under the navigation conditions, the influence of hydrodynamic loads (including sloshing loads), the influence of longitudinal strength loads calculated, and the influence on ship motion parameters shall be determined.
- ② Under breeding conditions, the influence of hydrodynamic loads (including sloshing), total longitudinal strength loads calculated, and the mooring force of the anchoring system on the ship-type marine fisheries installations (hull) shall be determined.

Section 3 Outfitting and Positioning System

10.3.1 General Requirements

10.3.1.1 In addition to meeting the requirements for outfitting of Chapter 3 of Part 2 in the CCS *Rules for Classification of Sea-going Steel Ships* (2023), the aquaculture vessel shall be also equipped with the positioning systems according to the limitations of its expected breeding conditions.

10.3.3.2 The design and construction of the positioning systems (such as anchor windlasses, anchors, anchor chains, shackles, and related connecting devices) for the aquaculture vessel shall be carried out in accordance with recognized standards for ship anchoring equipment (such as *Sea-going Vessels - Windlasses and Anchor Capstans* (GB/T 4447-2008), and *Mooring Chain* (GB/T 20848-2017)) with the consent of CCS.

10.3.3.3 The positioning systems of the aquaculture vessel shall be easy to release and can be used for individual positioning methods such as anchoring and mooring, or for a combination of various methods.

10.3.3.4 During the design of the positioning systems, various combinations of external loads such as wind, waves, and currents, as well as water depth and seabed soil conditions shall be considered.

10.3.3.5 The strength of the positioning systems and the components and equipment used (such as anchors, anchor chains, mooring ropes, mooring bollards, anchor windlasses, winches, and guide apparatus) of the aquaculture vessel, as well as the supporting structure of the hull, shall be determined to ensure that the aquaculture vessel maintains its predetermined position or range under various external load conditions imposed by limitations of the breeding conditions.

10.3.3.6 When anchoring equipment is used as the positioning systems, dedicated monitoring devices shall be installed, to control the anchor dragging risk in the aquaculture vessel.

10.3.3.7 The navigation conditions shall meet the following requirements:

(1) Temporary anchoring equipment shall meet the requirements of Chapter 3 of Part 2 in the CCS

Rules for Classification of Sea-going Steel Ships (2023).

(2) Ships in restricted service areas are subject to the relevant provisions of Chapter 2 of Part 10 in CCS Rules for Classification of Sea-going Steel Ships (2023).

(3) In the anchor moored positioning systems of the aquaculture vessel, if the requirements of temporary anchoring equipment are met, they can replace the temporary anchoring equipment specified in this section.

10.3.3.8 The positioning system of the aquaculture vessel shall be analyzed according to the relevant provisions of Chapter 8 of Part 8 in CCS Rules for Classification of Mobile Offshore Units (2023) and in combination with the constraints of the breeding conditions. If it is designed as a single anchor chain, the safety factor of the mooring cable shall be specially considered.

10.3.3.9 If the limitations of the breeding conditions do not exceed the environmental conditions of temporary anchoring equipment specified in Chapter 3 of Part 2 in CCS Rules for Classification of Sea-going Steel Ships (2023), the temporary anchoring equipment can be used as a positioning system with the consent of CCS.

10.3.3.10 The aquaculture vessel shall be equipped with boarding and disembarking facilities or provided with other measures, to ensure the personnel safety. A lifebuoy with self-igniting light and buoyant life line shall be provided near the boarding and disembarking location for immediate use.

10.3.3.11 Anti-slip measures shall be taken into account for the floor surfaces of the fishery hold platforms, working areas, walkways, ladder surfaces, and other places where personnel frequently pass through, to ensure the personnel safety. The personnel walkways in the aquaculture area shall be equipped with reliable safety guardrails and skirting boards or equivalent facilities. The height of the guardrails shall be no less than 1m, and the risk of slipping and falling into the sea shall be taken into account.

10.3.3.12 A steel hatch cover, if installed, with the hatch cover area of the fishery hold greater than 2.5m², shall not be regarded as a conventional small hatch cover. The structural strength and weather tightness requirements of the hatch cover shall be considered under the following principles:

(1) The structural strength of the hatch cover shall be equivalent to that of the deck where it is located;

(2) During the structure check, the vertical open-air design load, specified in 2.20.2.2 (1), Section 20, Chapter 2 of Part 2 in CCS Rules for Classification of Sea-going Steel Ships (2023) shall be considered;

(3) The plates and stiffeners of the hatch cover structure shall be checked according to the relevant requirements of 2.20.2.3, Section 20, Chapter 2 of Part 2 in CCS Rules for Classification of Sea-going Steel Ships (2023);

(4) The steel weather-tight hatch cover, if used, shall meet the requirements for fastening devices in 2.20.2.9 of CCS Rules for Classification of Sea-going Steel Ships (2023).

Section 4 Subdivision and Stability

10.4.1 Subdivision and Stability

10.4.1.1 The navigation conditions shall meet the following requirements:

(1) Subdivision and stability shall meet the requirements of Chapter 1 of Part 2 in the CCS Rules for Classification of Sea-going Steel Ships (2023).

(2) Ships in restricted service areas are subject to the relevant provisions of Chapter 2 of Part 10 in CCS Rules for Classification of Sea-going Steel Ships (2023).

(3) The fishery hold with side sea opening is not included in the buoyancy calculation.

10.4.1.2 The breeding conditions shall meet the following requirements based on the limitations of the aquaculture vessel:

(1) The intact stability in the floating state shall comply with the relevant provisions for surface-type units in Part 3 of *CCS Rules for Classification of Mobile Offshore Units* (2023).

(2) The damage stability in the floating state shall comply with the relevant provisions for surface-type units in Part 3 of *CCS Rules for Classification of Mobile Offshore Units* (2023).

(3) The fishery hold with side sea opening (if any) is not included in the buoyancy calculation.

10.4.1.3 According to the design requirements, if the aquaculture vessel is under special aquaculture conditions, the corresponding technical certificate and calculation or model test data shall be submit to ensure the safety operation of the ship, and shall be approved by CCS.

Section 5 Gas Turbine Installation and System

10.5.1 General Requirements

10.5.1.1 The gas turbine installation and system shall meet the requirements of Part 3 and Part 5 in the *CCS Rules for Classification of Sea-going Steel Ships* (2023).

10.5.1.2 The gas turbine installation and system of the ship in restricted service area shall meet the relevant provisions of Chapters 3 and 5 of Part 10 in *CCS Rules for Classification of Sea-going Steel Ships* (2023).

10.5.1.3 Powdered feed shall be mixed in an enclosed space, and shall be provided with appropriate measures to prevent dust dispersion. Devices or equipment in enclosed spaces with explosive dust shall meet the corresponding explosion-proof requirements.

Section 6 Electrical Installations and Automation System

10.6.1 General Requirements

10.6.1.1 Electric installation and automation system shall meet the requirements of Part 4 and Part 7 in the *CCS Rules for Classification of Sea-going Steel Ships* (2023).

10.6.1.2 Electric installation of the ship in restricted service area is subject to the relevant provisions of Chapter 4 of Part 10 in *CCS Rules for Classification of Sea-going Steel Ships* (2023).

10.6.1.3 The workstation of the aquaculture monitoring system shall be equipped with an UPS, with a capacity that sustains power supply for at least 30min.

Section 7 Fire Protection

10.7.1 General Requirements

10.7.1.1 Fire protection shall meet the relevant requirements of Chapter 6 in *CCS Rules for Classification of Sea-going Steel Ships* (2023).

10.7.1.2 Fire protection for ships in restricted service areas are subject to the relevant provisions of Chapter 6 of Part 10 in *CCS Rules for Classification of Sea-going Steel Ships* (2023).

10.7.1.3 Explosion-proof electrical equipment shall be used in hazardous areas with explosive materials, and appropriate measures shall be taken to prevent mechanical equipment from becoming an ignition source. The fire protection measures adopted shall be inspected by CCS.

Section 8 Safety Equipment and Pollution Prevention

10.8.1 General Requirements

10.8.1.1 The life-saving, communication, navigation equipment, and pollution prevention on aquaculture vessels shall meet the requirements of this section. Other regulations imposed by the competent authority of flag country, if any, shall prevail.

10.8.1.2 Sick fish, dead fish, and other fish in the aquaculture area shall not be directly discarded in the area, and shall be collected according to the most serious possible situation, and handled by specially-assigned personnel.

10.8.1.3 For aquaculture vessels engaged in international shipping, the following requirements shall be met:

(1) The relevant requirements for cargo ships in Chapters II-1, III, IV, and V of the IMO *International Convention for the Safety of Life at Sea*. If passengers are more than 12, the relevant requirements for passenger ships in the convention shall be met. If there are more than 12 aquaculture workers on board ², the relevant technical provisions of the IMO *Safety Rules for Special Purpose Vessels* shall be followed (in such case, the aquaculture workers can be regarded as special personnel).

(2) The requirements of the IMO *Convention for the Prevention of Pollution from Ships*. Special requirements in the port waters where the vessel is operating, if any, shall be also met.

10.8.1.4 Chinese aquaculture vessels shall meet the relevant technical requirements of Chapter 10 of Part 5 in the China MSA *Technical Regulations for Offshore Mobile Units* (2023).

² It refers to the personnel engaged in aquaculture on board.

Appendix 1 Certification Requirements for Fishery Aquaculture Products with Class Notations

Certification Requirements for Fishery Aquaculture Products (Fishery Equipment) with Class Notations Schedule 1-1

S/N	Product Name	Document type		Approval model				Plan approval	Remarks
		C/E	W	DA	TA-B	TA-A	WA	PA	
1	Feed processing unit								
1.1	Belt conveyor	X	—	—	O	—	—	X	
1.2	Level indicator in feed room	X	—	—	O	—	—	X	If the certification requirements for purchased equipment cannot be met, a complete type test shall be conducted with the products
1.3	Electric remote control valve								Refer to certification requirements for mobile unit/floating installation valves
1.4	Feeding system	X	—	—	O	—	—	—	
1.5	Bale plucker	X	—	—	O	—	—	—	
1.6	Bale breaker	X	—	—	O	—	—	—	
2	Fish feed feeding unit								
2.1	Control station	X	—	—	—	—	—	—	
2.2	Feeder	X	—	—	O	—	—	X	
2.3	Feed spreader	X	—	—	O	—	—	X	
2.4	Temperature and humidity control system	X	—	—	O	—	O	X	
2.5	Air compressor	X	—	X	—	—	—	—	
2.6	Feed distributor	X	—	—	O	—	—	X	
2.7	Bait tank	X	—	—	—	—	—	—	
2.8	Feeding fan	X	—	—	O	—	—	X	
2.9	Dryer	X	—	—	—	—	—	—	
2.10	Bait mixing device	X	—	—	O	—	—	O	
3	Cleaning unit								

S/N	Product Name	Document type		Approval model				Plan approval	Remarks
		C/E	W	DA	TA-B	TA-A	WA	PA	
3.1	Underwater net washing machine	X	—	—	O	—	—	—	Type approval certificate shall be provided with W
3.2	Control station for net washing machine	X	—	—	—	—	—	—	
3.3	High-pressure pump station	X	—	—	X	O	—	—	
3.4	High-pressure spray hose	X	=	=	=	=	=	X	
3.5	Accessories for high-pressure spray hose (unions, valves, elbows, etc.)	X	=	=	=	=	=	X	
3.6	Umbilical cable	X	=	=	=	=	=	X	
4	Dead fish recovery device								
4.1	Fish collection machine/pump	X	—	—	O	—	—	X	Type approval certificate shall be provided with W
5	Monitoring system								
5.1	Underwater monitoring device	—	X	—	X	—	—	—	Type approval certificate shall be provided with W
5.2	Environmental monitoring device	—	X	—	X	—	—	—	Type approval certificate shall be provided with W
5.3	Motion monitoring device	=	X	=	X	=	=	=	Type approval certificate shall be provided with W
5.4	Fish density monitoring device	—	X	—	X	—	—	—	Type approval certificate shall be provided with W
5.5	Closed-circuit television/camera unit	—	X	—	X	—	—	—	Type approval certificate shall be provided with W
5.6	Wastewater and freshwater treatment control and monitoring unit	X	—	—	X	O	—	—	

S/N	Product Name	Document type		Approval model				Plan approval	Remarks
		C/E	W	DA	TA-B	TA-A	WA	PA	
5.7	Underwater lighting system	—	X	—	O	—	—	X	
6	Catching device								
6.1	Fish lifting machine	X	—	O	O	O	—	—	
6.2	Distributor	X	—	O	O	O	—	—	
<u>6.3</u>	<u>Fish pump</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>—</u>	
<u>6.4</u>	<u>Fish-water separator</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>O</u>	<u>—</u>	<u>—</u>	<u>—</u>	
<u>6.5</u>	<u>Other units</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>O</u>	<u>—</u>	<u>—</u>	<u>—</u>	
7	Track travel unit	X	—	—	—	—	X	—	
8	Netting	X	—	—	—	—	X	—	
9	Float	X	—	—	—	—	X	—	
10	Sinker	—	X	—	—	—	—	—	
11	Winch (including the net winch, tension winch, umbilical winch, equipment deployment winch, etc.)	X	—	O	O	O	—	—	
12	Flood light	—	X	—	X	—	—	—	Type approval certificate shall be provided with W
13	Fishing net winch rope	X	—	—	—	—	X	—	
14	Echo sounder	X	—	—	X	O	—	—	
<u>15</u>	<u>Water exchange system</u>								
<u>15.1</u>	<u>Seawater pump</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>—</u>	
<u>16</u>	<u>Aeration system</u>								
<u>16.1</u>	<u>Oxygenerator</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>O</u>	<u>—</u>	<u>—</u>	<u>X</u>	<u>In case of the explosion-proof equipment, it shall be TA-B approved</u>
<u>16.2</u>	<u>Oxygen cone</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>O</u>	<u>—</u>	<u>—</u>	<u>X</u>	<u>In case of the explosion-proof equipment, it shall be TA-B approved</u>
<u>16.3</u>	<u>Booster pump</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>X</u>	<u>—</u>	<u>—</u>	<u>X</u>	

S/N	Product Name	Document type		Approval model				Plan approval	Remarks
		C/E	W	DA	TA-B	TA-A	WA	PA	
16.4	Oxygen cylinder	X	=	=	O	=	=	X	
16.5	Deployment winch	X	=	=	=	=	=	=	
16.6	Aeration device	X	=	=	O	=	=	X	In case of the explosion-proof equipment, it shall be TA-B approved
17	Fishhold lighting system	X	=	=	O	=	=	X	
18	Centralized control aquaculture system	X	=	=	O	=	=	X	

Note: In terms of marine fisheries installations, for which no class notation of "Fishery Equipment" is applied, at least manufacturer certificate shall be provided.

In terms of marine fisheries installations, for which the class notation of "Fishery Equipment" is applied, the field survey project team shall refer to the above product certification requirements.

Symbol description: 1) C - Marine product certificate; E - Equivalent certificate; W - Manufacturer certificate; X - Applicable; O - Optional.

2) DA - Design approval; TA-B - Type approval B; TA-A - Type approval A; WA - Factory approval.

3) Factory approval for components refers to the approval for blank manufacturers.

Appendix 2 Special System and Equipment for Fishery Aquaculture

Section 1 General Provisions

2.1.1 General Requirements

2.1.1.1 This appendix is applicable to marine fisheries installations equipped with special fishery systems and equipment.

2.1.1.2 The special fishery system and equipment in this appendix shall meet the corresponding technical requirements, and also comply with the applicable parts of international standards, national standards, and industry standards. In case of any inconsistency between the standards and the requirements of this appendix, the latter shall prevail.

2.1.1.3 The specific requirements from the competent authority, if any, shall prevail.

Section 2 Main Systems and Equipment

2.2.1 Feed Feeding System

2.2.1.1 This system mainly consists of the feeding system, power system, distribution system, spraying system, etc.

2.2.1.2 The feeding system usually supports compressed air or wind feeding mode.

2.2.1.3 The pipelines of the feeding system shall be properly fixed and protected, to prevent vibration during the operation or sudden startup of the system, which may cause feed leakage and personnel injury.

2.2.1.4 The internal connecting cables of the feed feeding mechanical device shall be protected by a metal hose or other equivalent measures.

2.2.1.5 The electrical control device of the feed feeding system shall be well grounded, with protective measures such as the shell protection and explosion protection.

2.2.1.6 If the feed feeding system runs in the centralized control mode, the system shall be able to meet various functional requirements, such as the timing, fixed point, fixed quantity, and fixed route feeding.

2.2.1.7 The feed feeding unit shall be free from large fluctuations in terms of the feed amount or material jamming under continuous feeding conditions.

2.2.1.8 The flow rate and direction after the material passes through the fishing net shall be considered for feed delivery.

2.2.2 High-pressure Cleaning System (netting cleaning)

2.2.2.1 If the high-pressure cleaning system is permanently fixed on the marine fisheries installations, the following requirements shall be met:

(1) The system mainly consists of the high-pressure cleaning water pump, underwater net washing machine, remote control device, etc.

(2) The high-pressure cleaning system supports the side and bottom netting cleaning, reducing netting adhesion, and thus improving the water permeability.

(3) The high-pressure water delivery pipeline of the high-pressure cleaning system shall be properly fixed and protected, to prevent leakage and personnel injury.

(4) The high-pressure cleaning system can be used for the centralized remote control, allowing to

control the running direction of the netting cleaning machine, as well as the flow and velocity of the cleaning water.

(5) The high-pressure cleaning system is provided with a video monitoring system, which can be used to transmit the cleaning image to the central control screen in real time through the camera, allowing the user to view the net cleaning status and effect.

(6) The length of the high- and low-pressure hoses and cables shall be determined by taking into account the convenience of netting cleaning operations, so as to minimize the work intensity of personnel.

2.2.3 Catching System

2.2.3.1 The catching system is mainly used to collect fish with the fishing nets or fish pumps.

2.2.3.2 The catching system shall meet the requirements of normal operating conditions, to ensure that the catches fish are alive.

2.2.3.3 The relevant pipelines of the catching system shall meet the requirements of tightness and undergo the tightness test.

2.2.4 Dead Fish Treatment and Recovery System

2.2.4.1 The dead fish treatment and recovery system supports the fishing net recovery mode and the fish collector/pump recovery mode.

2.2.4.2 The dead fish treatment and recovery system shall not cause environmental pollution.

2.2.4.3 The dead fish treatment and recovery system shall have no impact on normal aquaculture.

2.2.4.4 The dead fish treatment and recovery system shall be able to intermittently recover fish according to the real-time living conditions of the fish and the aquaculture water quality.

2.2.5 Monitoring System

2.2.5.1 Underwater Monitoring System

(1) It can be used to monitor real-time data such as the water temperature, salinity, pH value, water velocity, and dissolved oxygen concentration at different locations underwater.

(2) The underwater monitoring device shall be used to ensure a certain level of underwater stability, prevent the tilting and collision of the measuring system due to the effect of ocean currents, which may cause damage to the equipment.

2.2.5.2 Environmental Monitoring System

(1) It is used to monitor meteorological conditions and transmit various meteorological observation data in real time, such as the wind speed, wind direction, temperature, pressure, humidity, as well as wave height and frequency;

(2) The environmental monitoring system shall be used to transmit meteorological data in real-time to the centralized aquaculture control system.

2.2.5.3 Aquatic Life Identification System

(1) The system can be used to monitor the quantity and distribution of fish in the water of aquaculture net cage;

(2) The system shall be equipped with binocular vision cameras to count the types and sizes of fish schools within the visible range;

(3) The system shall be used to monitor the entire growth process of fish in the monitored area, so as to direct the aquaculture production.

2.2.6 Netting Lifting, Tensioning and Local Reinforcement

2.2.6.1 The netting can be lifted and tensioned by lifting winches and tensioning winches.

2.2.6.2 The hoisting rope and tensioning rope on the winch are provided with effective protective measures.

2.2.6.3 For the netting with coating protection, the double-layer nets are set on the top and bottom, four corners, and near the high and low tide lines, strengthening the netting locally and reducing the damage caused by waves and currents.

2.2.6.4 Measures shall be taken to prevent the wear of netting and structures (if applicable).

2.2.7 Aeration System

2.2.7.1 The aeration system shall be able to adjust the oxygenation intensity according to factors such as population density and fish species.

2.2.7.2 The piping system of the aeration system shall be kept dry and clean, to prevent blockage. The end of the oxygen supply port shall be fixed securely.

2.2.7.3 The aeration system shall not pollute the aquaculture water quality.

2.2.7.4 The aeration system, equipped with a real-time oxygen content monitoring device, allows to automatically supplement oxygen when the oxygen concentration in the water is below a certain level.

2.2.7.5 The gas pipeline of the aeration system for aquaculture vessels with enclosed fishery holds shall be set separately and equipped with independent aerators and gas cylinders, and shall not be connected to other pipelines for control and instrument air. In addition, measures shall be taken to prevent seawater from being sucked back.

2.2.7.6 The aeration system for aquaculture vessels with enclosed fishery holds shall be also provided with a separate pipeline isolated from the oxygen production module for system commissioning and emergency oxygenation with the compressed air. In addition, an emergency oxygenation system shall be provided.

2.2.7.7 The area near the oxygenator of the aquaculture vessel with enclosed fishery holds shall be equipped with oxygen and nitrogen concentration monitoring and alarm devices.

2.2.8 Underwater Lighting System (if applicable)

2.2.8.1 The underwater lighting equipment shall have corrosion resistance to seawater.

2.2.8.2 The lighting fixtures shall support functions such as brightness adjustment, with the protection class of no lower than IP56, and the shell material shall comply with relevant specifications.

2.2.9 Fry Entry System (if applicable)

2.2.9.1 The aquaculture vessel may be equipped with a suitable fry entry system as needed. If there is a fry entry pipeline is provided, the pipeline shall be tested for tightness, to prevent seawater from leaking into other areas.

2.2.9.2 It is recommended to equip the fry entry system with a fry measuring device.

Appendix 3 Recommended Practices for Netting Effect Analysis and Testing

Section 1 General Provisions

3.1.1 General Requirements

3.1.1.1 Netting is an important component of marine fisheries installations. Its presence has a significant impact on the motion and force of the floating body of marine fisheries installations. Meanwhile, the force and integrity of the netting in water are also crucial for the proper operation of fisheries devices. These factors shall be fully and reasonably considered during the design.

3.1.1.2 Numerical simulation and physical model tests are important means for analyzing the performance of marine fisheries installations, the integrity of netting, and the characteristics of surrounding flow fields. This appendix specifies the main technical requirements for the impact test of netting on the performance of marine fisheries installations, the hydrodynamic characteristics analysis of netting, and the methods of physical model test, as well as the reference literature for specific implementation.

Section 2 Test on Influence of Netting on Fisheries Installations Performance

3.2.1 Column-stabilized Fisheries Installations

3.2.1.1 For column-stabilized fisheries installations, it is recommended to test the additional mass, natural period, damping and other fundamental physical quantities of the fisheries installations, the motion response in six degrees of freedom (surging, heaving, swaying, yawing, rolling, and pitching) and the mooring force of the cable under the wind, wave, and current loads, as well as the inclination angle of the fisheries installations under the water flow.

3.2.1.2 The free attenuation test of the physical model of the fisheries installations and the horizontal stiffness test of the mooring system shall be conducted under still water conditions. The motion history curve of the fisheries installations can be collected using a motion measurement instrument. Based on the test results, the additional mass coefficient, natural period, and damping coefficient in each degree of freedom of the fisheries installations can be calculated, and the force-displacement characteristic curve of the mooring system can be analyzed.

3.2.1.3 During the response amplitude operator (RAO) test of the motion response for the fisheries installations, the motion history curve can be collected using a motion measurement instrument, and the maximum values of motion and corresponding wave periods in different degrees of freedom can be analyzed.

3.2.1.4 During the hydrodynamic characteristics test of the fisheries installations under wind, wave, and current loads, the mooring force and netting force can be measured using an underwater tension sensor, and the motion response of the installations under wave action and the maximum inclination angle of the installations under water flow can be measured using a motion measurement instrument. [The changes in wave and flow fields around the fisheries installations can be measured using a current meter and wave height meter. Based on the test results, the low-flow area and the attenuation amplitude of wave height inside the fisheries installations can be analyzed.](#)

3.2.2 Combined-type Fisheries Installations

3.2.2.1 For combined-type fisheries installations, it is recommended to test the additional mass, natural period, damping and other fundamental physical quantities of the fisheries installations, the motion response in six degrees of freedom (surging, heaving, swaying, yawing, rolling, and pitching) and the mooring force of the cable under the wind, wave, and current loads, as well as the connection force between combined floating bodies (including the tension and pressure).

3.2.2.2 The free attenuation test of the physical model of the fisheries installations and the

horizontal stiffness test of the mooring system shall be conducted under still water conditions. The motion history curve of the fisheries installations can be collected using a motion measurement instrument. Based on the test results, the additional mass coefficient, natural period, and damping coefficient in each degree of freedom of the fisheries installations can be calculated, and the force-displacement characteristic curve of the mooring system be analyzed.

3.2.2.3 During the response amplitude operator (RAO) test of the motion response for the fisheries installations, the motion history curve can be collected using a motion measurement instrument, and the maximum values of motion and corresponding wave periods in different degrees of freedom can be analyzed.

3.2.2.4 During the hydrodynamic characteristic test of fisheries installations under wind, waves, and currents, the underwater tension/pressure sensors can be used to measure the connection force (connection force/pressure) between floating bodies, the mooring force of cables, and the netting force. The motion measurement instrument can be used to measure the motion response of the fisheries installations, and the optical measurement and analysis methods can be used to measure the motion deformation of the netting. The changes in wave field and flow field around the fisheries installations can be measured using the current meter and wave height meter. Based on the test results, the flow velocity and attenuation amplitude of wave height downstream of the fisheries installations and in each frame can be analyzed. For the specific steps of optical measurement and analysis method, refer to Reference [1], Section 5 in this appendix.

3.2.2.5 During the wave field characteristic test for the combined-type fisheries installations, the wave height meter can be installed at different positions (on the windward side, inside the floating frame, and on the back wave side) of the fisheries installations, to measure the wave field at different positions. Based on the measurement results, the wave surface elevation on the windward side of the combined-type fisheries installations, the wave field response inside the frame, the wave transmission coefficient of the installations, and the wave duration phase difference at different positions can be analyzed. For the specific methods, refer to Reference [4], Section 5 of this appendix.

3.2.2.6 During the hydrodynamic characteristic tests of fisheries installations under irregular waves, the Hilbert-Huang transform method can be used to analyze the time-frequency domain of the nonlinear motion and mooring force response of the fisheries installations, and to analyze the inherent vibration modes of the hydrodynamic response of the fisheries installations. For the specific method of the time-frequency domain analysis for the nonlinear response of fisheries installations, refer to Reference (21) in Section 5 of this appendix.

3.2.3 Fixed Fisheries Platform

3.2.3.1 For the fixed fisheries platform, it is recommended to measure the force on fisheries installations and the motion deformation of netting under wave and current loads.

3.2.3.2 During the hydrodynamic characteristic test on fisheries installations under wave and current actions, the six-component force sensors and underwater tension sensors can be used to measure the force on the installations and netting, and optical measurement and analysis methods can be used to measure the motion deformation of netting. The changes in wave field and flow field around the fisheries installations can be measured using the current meter and wave height meter. Based on the test results, the low-flow area and the attenuation amplitude of wave height inside the fisheries installations can be analyzed.

Section 3 Analysis on Hydrodynamic Characteristics of Netting

3.3.1 Test Contents

3.3.1.1 It is recommended to test the hydrodynamic coefficients of netting, the force and motion deformation of netting under wave and current actions, the tension distribution of net lines, and the flow field distribution characteristics around the netting.

3.3.1.2 In actual engineering, if biological adhesion occurs in the netting, it is recommended to test the influence of biological adhesion on the netting force and the surrounding flow field.

3.3.2 Hydrodynamic Coefficient of Netting

3.3.2.1 The hydrodynamic coefficient of the netting is a key indicator for calculating the netting force. After the hydrodynamic coefficient of the netting is obtained, the netting force on any area can be calculated using the empirical formulas such as the Morrison equation. Physical model test is the most reliable method to obtain the hydrodynamic coefficient of the netting.

3.3.2.2 During the physical model test, the flexible netting shall be stretched and fixed on a rigid support frame, to form a rigid planar netting model, and to ensure no deformation under the action of water flow. The data of the current force on the netting model can be collected using a force balance, and the force on the netting can be obtained by subtracting the total force on the netting and frame from the force on the empty frame. By using the least squares method and combining with the Morrison equation, the current force at different flow velocities obtained from the test can be nonlinearly fitted, so as to calculate the hydrodynamic coefficient of the netting. [For the specific methods of physical model test for the hydrodynamic coefficient of the netting, refer to Reference \(2\), Section 5 in this appendix.](#)

3.3.2.3 For the fiber netting commonly used in fisheries installations (nylon nets, polyethylene nets, polyethylene nets with ultra-high molecular weight, etc.), in addition to the physical model test method, the following formula can be also used to estimate the Resistance coefficient C_d and Lift coefficient C_l in the Morrison equation. [For the specific empirical formula of the hydrodynamic coefficient of the netting, refer to Reference \(3\), Section 5 in this appendix.](#)

$$C_d = 0.04 + (-0.04 + S_n - 1.24S_n^2 + 13.7S_n^3) \cos \alpha'$$

$$C_l = (0.57S_n - 3.54S_n^2 + 10.1S_n^3) \sin(2\alpha')$$

Where: $\alpha' = 90 - \alpha$ (degrees), α is the attack angle of the netting, that is, the angle between the netting and the water flow direction on the horizontal plane, as shown in the following top view:

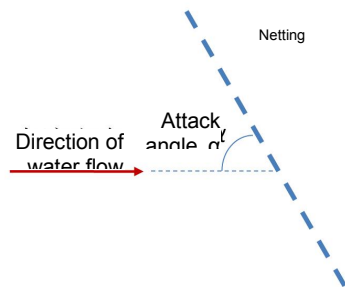


Figure 3.2.3 (1) Attack Angle of the Netting

S_n represents the netting density, which is the ratio of the projection area of the physical netting to the outline area, that is, the area of the black net line in the figure below divided by the netting area a^2 . The applicable range of this formula is that the netting density S_n is within 0.35.

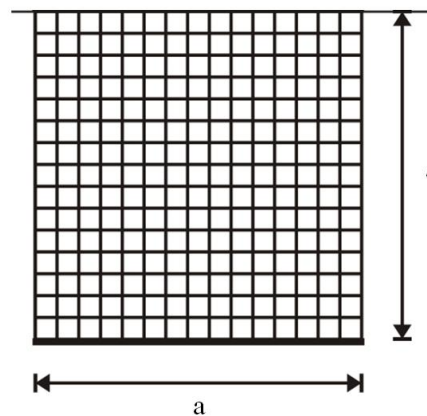


Figure 3.2.3 (2) Netting Density

3.3.2.4 For fiber netting with coatings as well as new netting types such as the polyethylene netting with the ultra-high molecular weight, metal netting, and PET netting, it is recommended to use physical model test method to calculate the hydrodynamic coefficient.

3.3.3 Netting Force, Motion Deformation, and Tension of Net Line

3.3.3.1 The force on the netting directly affects the motion response and mooring force of the fisheries installation. The motion deformation of the netting affects the survival status of the cultured fishes inside the net cage. The tension of the netting is a key indicator for measuring the load on the netting and judging whether it ruptures.

3.3.3.2 For flexible netting structures like fiber netting, it is recommended to use the concentrated mass model to calculate the force, motion deformation, and tension of the net line, so as to provide a basis for the structural design and strength verification of the net cage. [For the specific practices of the concentrated mass model, refer to Reference \(1\), Section 5 in this appendix. The general principles of concentrated mass model for analysis are as follows:](#)

(1) Simplify the netting into a series of concentrated mass points, which are located at the two ends of the mesh bars (end nodes) and the middle position (middle nodes), and connect the concentrated mass points with massless springs.

(2) By solving the differential motion equations at each concentrated mass point, obtain the displacement of each mass point, and finally calculate the netting motion and deformation. The differential motion equations of the concentrated mass points can be constructed based on Newton's second law and solved using the Runge-Kutta method.

3.3.3.3 For the metal netting, it is recommended to calculate the stress and strain and obtain the structural strength of the netting, using a finite element model. A general finite element software can be used to build the geometric model of the netting structure. It is recommended to take the tube elements as the basic units of the netting model. Based on the Morrison equation and numerical integration method, the finite element method can be used to analyze the stress and strain of the netting under wave loads and water flow loads, so as to simulate the stress and strain of the netting under wave and water flow actions. [For the specific methods of the finite element model for the netting, refer to References \(5\) and \(6\), Section 5 of this appendix.](#)

3.3.4 Effect of Netting on Flow Field

3.3.4.1 The flow of water in fisheries installations is closely related to the growth of fish. The magnitude of the flow velocity determines the speed of water exchange in the fisheries installations, which has a significant impact on the oxygen content and water quality environment in the net cage. Therefore, the influence of netting on the flow field in the installations is non-negligible.

3.3.4.2 During the calculation of the flow field around the netting, it is recommended to use a porous medium with the same size as the netting, similar shape and certain thickness for numerical simulation. The fluid motion around the netting under water flow can be expressed by the continuity equation and momentum equation (i.e., Navier-Stokes equation), and the governing equation of the mathematical model can be solved using the finite volume method, so as to achieve the numerical simulation of the flow field around the netting. [For the specific methods of numerical simulation for the porous media, refer to References \(2\), \(7\), \(8\), \(9\) and \(13\), Section 5 of this appendix.](#)

3.3.5 Effect of Netting on Wave Field

3.3.5.1 [The wave field inside the fisheries installation directly affects the growth of fish. Fish will actively dive to avoid the impact of waves, which increases the chance of contact between fish and the backing screen, threatening the health of fish. Moreover, the extreme waves slamming the fisheries installation may cause the overtopping, leading to fish escape. Therefore, the effect of netting on wave fields shall be considered.](#)

3.3.5.2 [During the calculation of the wave field around the netting, it is recommended to use a porous medium with the same size as the netting, similar shape, and certain thickness for numerical simulation. The fluid motion around the netting under wave can be expressed by the continuity equation and momentum equation \(i.e., Navier-Stokes equation\), and the governing equation of the mathematical model can be solved using the finite volume method, so as to achieve the numerical simulation of the wave field around the netting.](#)

3.3.6 Effects of Biological Adhesion

3.3.6.1 Fisheries installations are prone to severe biological adhesion, which increases the force on the net cages, thereby threatening the stability of the net cage structure and reducing the service life of mooring ropes. On the other hand, it may cause rapid clogging of the mesh, affecting the water exchange rate inside the net cage, resulting in poor water quality and influencing the survival rate of breeding materials.

3.3.6.2 The force on the netting can increase by more than 10 times due to the attachments. It is recommended to fully consider the influence of attachments on the structural strength during the structural design, and to clean or replace the netting in a timely manner during the actual production.

3.3.6.3 For the netting with different attachments in different sea areas, it is recommended to first conduct the netting hanging test for the field sampling, so as to determine the attachment types and adhesion degrees on the netting. Then, the force and flow field characteristics of netting under the influence of biological adhesion are analyzed through the physical model test and numerical simulations. [For the specific methods of analyzing the hydrodynamic characteristics of netting under biological adhesion, refer to References \(2\), \(10\), \(11\), \(12\) and \(14\), Section 5 of this appendix.](#)

Section 4 Physical Model Test Method

3.4.1 Model Similarity Criteria for Netting in Physical Model Test

3.4.1.1 The netting model is the key to testing the force, deformation, and flow field around the netting. During the net cage modeling, reliable model similarity criteria shall be selected for the design of the net cage model and model test.

3.4.1.2 In terms of the reliable model similarity criteria for fisheries installations, both the water flow effect and the wave load effect shall be considered.

3.4.1.3 The similarity conditions of the netting model generally include the geometric similarity, dynamic similarity, weight similarity, and stiffness similarity. During the physical model test, it is recommended to use the gravity similarity based variable scale netting model similarity criteria for

the netting modeling. The large-scale ratio is defined by the similarity criteria for model scaling as the main scale ratio, and a set of small-scale ratios are required. The contour dimensions of the netting are designed according to the large-scale ratio, while the diameter of the net line and the mesh length are scaled using the small-scale ratio.

3.4.1.4 The main dynamic factors for the force on the netting include the water flow resistance and the weight of the netting in water, and the force on the netting is related to the vertical projection area of the netting along the flow direction. Under the precondition of ensuring that the net line projection area of the netting in the model is equal, the geometric similarity ratio for changing the net line diameter and mesh size also satisfies the gravity similarity condition. As long as the test is in the automatic simulation zone, the dynamic similarity condition can be satisfied.

3.4.1.5 After the scaling down of the mesh size with a small scale ratio, the weight and buoyancy of the netting in water will change, that is, the weight of the netting fails to satisfy the similarity condition. If the actual netting and the model netting have different materials, the weight difference caused by the material shall be also considered. In other words, it is necessary to make a mass correction for the netting model. During the actual correction for the mass of the netting model, the method of net line mixing or directly adding counterweights or increasing buoyancy may be considered for balance.

3.4.1.6 The stiffness of the netting model mainly refers to its flexibility, which is directly related to the material of the netting and the diameter of the net line. In order to ensure the similarity of the netting model's projection area, the net line diameter is scaled down with a small scale ratio. In conclusion, the projection area and stiffness conditions cannot be satisfied simultaneously. As an approximate treatment method, the net line can be partially cut off, to meet the stiffness similarity conditions of the netting model. [For the specific methods of the similarity criterion for installation models, refer to References \(1\) and \(15\), Section 5 of this appendix.](#)

[3.4.2 Test Method for Biological Adhesion Meshes](#)

[3.4.2.1 Field samples can be collected through the netting hanging method, or artificial materials can be used to simulate attachments for the model test design.](#)

[3.4.2.2 If artificial materials are used to simulate the attachments, attention shall be paid to the influence of variables such as the attachment type, netting density, distribution uniformity of attachment, and attachment mass on the hydrodynamic characteristics of the netting. For the specific methods of simulating attachments with artificial materials, refer to the Reference \(12\), Section 5 in this appendix.](#)

3.4.3 Measurement Methods for Netting Motion And Deformation

3.4.3.1 During the physical model test, the netting motion and deformation can be measured using the light-emitting diode (LED) tracking method.

3.4.3.2 Several light sources of LEDs can be arranged along the periphery of the netting as tracking points. The motion of the tracking points under the wave and water flow can be captured using a high-speed industrial camera, and the image scanning processing method can be used to visualize the tracking points, thereby obtaining the motion trajectory of the tracking points and the instantaneous contour area of the netting. By comparing this area with the original projected area, the estimated volume loss can be obtained. [For the specific methods of netting motion and deformation measurement, refer to Reference \(1\), Section 5 of this appendix.](#)

3.4.4 Measurement Methods for Flow Field around the Netting

3.4.4.1 Particle image velocimetry (PIV) and acoustic doppler velocimeter (ADV) methods can be used to measure the flow field around the netting:

(1) PIV is a transient, multi-point, non-contact laser fluid mechanics velocity measurement method. The PIV method relies on the tracer particles scattered in the flow field, to indirectly measure the transient velocity distribution of the flow field by measuring the displacement of the

tracer particles within a known short interval. The tracer particles shall have a specific gravity similar to water, adequate flow following performance, and high light scattering efficiency, to accurately reflect the motion state of the flow field;

(2) The acoustic doppler velocimeter (ADV) is an instrument for measuring the velocity at fixed points, which can be used to measure the flow velocity values at several characteristic points around the netting.

3.4.4.2 For the flow velocity distribution on a certain section around the netting, it is recommended to use PIV for testing. During the model test, it is recommended to set at least one typical section to measure the flow field around the netting.

3.4.4.3 For the measurement of the flow velocity at a certain characteristic point around the netting, it is recommended to use the single-point flow velocity meters such as ADV. For a single piece of netting, it is recommended to set at least one measuring point on the backflow side of the netting. For the net cage model, it is recommended to set at least one measuring point inside the cage and on the backflow side of the cage, respectively. [For specific methods of measuring the flow field around the netting, refer to References \(2\), \(16\), \(17\), \(18\) and \(19\), Section 5 of this appendix.](#)

[3.4.5 Measurement Methods for Wave Field around the Netting](#)

[3.4.5.1 The wave height meter can be used to measure the wave height of the wave field around the netting. The wave height meter, an instrument for measuring wave height at fixed points, can be used to measure the wave height values at several characteristic positions around the netting.](#)

[3.4.5.2 Several wave height meters can be arranged around the netting in the test, to monitor the real-time changes in the wave height. For a single piece of netting, it is recommended to set at least one measuring point on the windward side and the back wave side, respectively. For the installation model, it is recommended to set at least 2 measuring points on the windward side of the installation, and at least 1 measuring point inside the installation and on the back wave side, respectively. For the specific methods of measuring the wave field around the netting, refer to References \(8\) and \(20\), Section 5 of this appendix.](#)

Section 5 References

During the analysis and test study on hydrodynamic effects of netting, the following papers can be referred to:

- (1) Zhao Yunpeng. Numerical Simulation Study on Hydrodynamic Characteristics of Deep-water Gravity Net Cages [D]. Dalian University of Technology, 2007.
- (2) Bi Chunwei. Research on Internal and Surrounding Wave Flow Field Characteristics of Marine Aquaculture Net Cages [D]. Dalian University of Technology, 2016.
- (3) Aarsnes J, Rudi H, Løland G. Current forces on cage, net deflection [C]. Engineering for offshore fish farming Proceedings of a conference organised by the Institution of Civil Engineers, Glasgow, UK, 17-18 October 1990, 1990. Thomas Telford.
- (4) Ma C, Zhao Y P, Xu Z J, et al. Experimental investigation on the wave performance with the interference of floating aquaculture cages in single and tandem arrangements [J]. Ocean Engineering, 2022, 262: 112255.
- (5) Liu Hangfei, Chen Changping, and Zheng Yanna. Study of the Numerical Simulation of Characteristics of Different Flow Resistances on a Metal Chain-link Net for Aquaculture Under Currents [J]. Fishery Modernization, 2017, 44: 73-79.
- (6) Zhao Y, Chen Q, Bi C. Numerical investigation of nonlinear wave loads on a trestle-netting enclosure aquaculture facility[J]. Ocean Engineering, 2022, 257: 111610.

- (7)Bi C-W, Zhao Y-P, Dong G-H, Xu T-J, Gui F-K. Numerical simulation of the interaction between flow and flexible nets [J]. *Journal of Fluids and Structures*, 2014, 45: 180-201.
- (8)Bi C W, Zhao Y P, Dong G H, et al. Experimental and numerical investigation on the damping effect of net cages in waves[J]. *Journal of Fluids and Structures*, 2015,55:122-138.
- (9)Liu H F, Bi C W, Xu Z, et al. Numerical study on the flow environment for a novel design of net cage with a shielding device[J]. *Ocean Engineering*, 2022, 243:110345.
- (10)Bi C W, Zhao Y P, Dong G H, Wu Z M, Zhang Y, Xu T J. Drag on and flow through the hydroid-fouled nets in currents [J]. *Ocean Engineering*, 2018, 161: 195-204.
- (11)Bi C-W, Zhao Y-P, Dong G-H. Numerical study on the hydrodynamic characteristics of biofouled full-scale net cage [J]. *China Ocean Engineering*, 2015, 29: 401-414.
- (12) Lai Yan. The Experimental Study on Hydrodynamic Characteristics of Hard-fouled Nets [D]. Dalian University of Technology, 2021.
- (13)Zhao Y, Liu H, Bi C, et al. Numerical study on the flow field inside and around a semi-submersible aquaculture platform[J]. *Applied Ocean Research*, 2021,115:102824.
- (14)Bi C W, Chen Q P, Zhao Y P, et al. Experimental investigation on the hydrodynamic performance of plane nets fouled by hydroids in waves[J]. *Ocean Engineering*, 2020,213.
- (15)Zhao Y, Bi C, Chen C, et al. Experimental study on flow velocity and mooring loads for multiple net cages in steady current[J]. *Aquacultural Engineering*, 2015,67:24-31.
- (16)Chun-Wei Bi, Yun-Peng Zhao, Guo-Hai Dong, Tiao-JianXu, Fu-Kun Gui. Experimental investigation of the reduction in flow velocity downstream from a fishing net [J].*Aquacultural Engineering*, 2013, 57: 71-81.
- (17)Yun-Peng Zhao, Chun-Wei Bi, Guo-Hai Dong, Fu-Kun Gui, Yong Cui, Tiao-JianXu. Numerical simulation of the flow field inside and around gravity cages [J]. *Aquacultural Engineering*, 2013, 52: 1-13.
- (18)Liu H, Bi C, Xu Z, et al. Hydrodynamic assessment of a semi-submersible aquaculture platform in uniform fluid environment[J]. *Ocean Engineering*, 2021,237:109656.
- (19)Bi C, Zhao Y, Dong G. Experimental study on the effects of farmed fish on the hydrodynamic characteristics of the net cage[J]. *Aquaculture*, 2020,524:735239.
- (20)Zhao, Y.P., Bi, C.W., Liu, Y.X., Dong, G.H., Gui, F.K., 2014. Numerical Simulation of Interaction Between Waves and Net Panel Using Porous Media Model. *Engineering Applications of Computational Fluid Mechanics*. 8(1), 116-126.
- (21)Ma C, Xie S D, Bi C W, Zhao Y P, Nonlinear dynamic analysis of aquaculture platforms in irregular waves based on Hilbert–Huang transform [J]. *Journal of Fluids and Structures*, 2023, 117: 103831.