

GUIDANCE NOTES

GD04-2023



CHINA CLASSIFICATION SOCIETY

GUIDELINES FOR OFFSHORE TELESCOPING GANGWAY

2023

Effective from 1 March 2023

Beijing

Contents

Chapter 1 General	3
Section 1 General Provisions	3
Section 2 Definitions	4
Section 3 Accepted Standards	5
Section 4 Product Drawing Review	6
Section 5 Product Inspections and Class Notations	7
Section 6 Product Certification Requirements	8
Chapter 2 Gangway Structure	9
Section 1 General Provisions	9
Section 2 Materials and Anti-corrosion	9
Section 3 Structure Layout	9
Section 4 Design Loads and Conditions	10
Section 5 Strength Check	12
Section 6 Welding and NDT	13
Chapter 3 Machinery Installations and Systems	15
Section 1 General Provisions	15
Section 2 Gangway Drive Mechanism	15
Section 3 Hydraulic System	16
Section 4 Pneumatic System	17
Section 5 Motion Compensation System	17
Chapter 4 Electrical Installations	18
Section 1 General Provisions	18
Section 2 Power Supply System	18
Section 3 Lighting System	19
Chapter 5 Safety System	20
Section 1 General Provisions	20
Section 2 System Protection	21
Section 3 Failure Mode and Effects Analysis	22
Chapter 6 Tests	23
Section 1 General Provisions	23
Section 2 Function and Performance Tests	23
Section 3 Inspection after Gangway Test	25
Section 4 Certificates	25
Chapter 7 Installation and Commissioning of Gangways on Ships or Offshore Installations	26
Section 1 General Provisions	26
Section 2 Inspection and Test	27

Chapter 8 Survey of Class Notations for Gangway	31
Section 1 General Provisions	31

Chapter 1 General

Section 1 General Provisions

1.1.1 General requirements

1.1.1.1 The Guidelines provide a basis for the design, manufacture, installation, test and survey of offshore telescoping gangways (hereinafter referred to as gangways).

1.1.1.2 The Guidelines present entire requirements comprising product inspections, surveys during installation on ship/offshore installations and surveys related to class notations.

1.1.1.3 In addition to the requirements in the Guidelines, the gangways shall also meet the applicable requirements in the corresponding specifications of its supporting facilities and the relevant regulations of the flag state and coastal state maritime authorities.

1.1.2 Scope of application

1.1.2.1 The Guidelines apply to telescoping gangways temporarily or permanently installed on ships or offshore installations.

1.1.3 Equivalent and exemption

1.1.3.1 Alternative provisions inconsistent with the requirements in the Guidelines may be accepted as substitutions for the corresponding requirements herein, provided that they are demonstrated through documentary evidence to attain at least an equivalent level of safety, and are agreed by China Classification Society (CCS).

1.1.3.2 Any gangway which embodies structure and features of a novel kind may be exempted from any requirement of the CCS rules if the application of which might seriously impede the incorporation of its features or its service, subject to the agreement of CCS.

1.1.4 Risk assessment

1.1.4.1 If the ship owner, designing institute, manufacturer or other organization wishes to apply the risk assessment technique in design, construction or operation of the gangway, the risk control plan and measures used in the risk assessment may be substituted for the whole or part(s) of the Guidelines, subject to the satisfactory review of the risk assessment documents by CCS.

1.1.5 Type of gangway

1.1.5.1 Depending on operation requirements, gangways can be classified into the following types:
Type 1: Long-term coupling, unrestricted flow of people, with at least one end non-permanently fixed for easy disconnection

Type 2: Short-term coupling, generally no more than 24 hours, restricted flow of people, with at least one end non-permanently fixed for easy disconnection.

1.1.5.2 For other types of gangways or coupling methods, such as hovering, the applicable provisions of the Guidelines may be followed, subject to the approval of CCS.

Section 2 Definitions

1.2.1 Definitions

1.2.1.1 The terms used in the Guidelines are defined as follows:

- (1) Offshore telescoping gangway: a temporary or permanent gangway installed on the ships or offshore installations for the safe movement of personnel or goods. The gangway can compensate for the relative motion between the ship and the offshore installations, between offshore installations or between ships through an active or a passive compensation system. The gangway usually includes a base, a gangway structure and a motion compensation system.
- (2) Motion compensation system: a device or system that compensates for the relative motion between the ship and the offshore installations, between offshore installations or between ships when the gangway is in a connected state.
- (3) Active motion compensation: the use of system equipment through external power supply to actively reduce or eliminate (compensate) the effect of relative motion between the ship and the offshore installations, between offshore installations or between ships on the gangway structure.
- (4) Passive motion compensation: with features that allow the gangway to accommodate the relative motion between the ship and the offshore installations, between offshore installations or between ships without using any external system or equipment.
- (5) Gangway handrail height: the vertical height from the highest point of the personnel standing plane to the upper surface of the gangway handrail when the gangway is in a horizontal position.
- (6) Gangway net width: the width of the gangway from the left toe board to the right toe board or from the inner surface of the left handrail to the inner surface of the right handrail, whichever is the smallest. If the gangway width varies along the length direction, the minimum width is taken as the net width.
- (7) Gangway nominal length: the distance from the middle pin (horizontal axis of luffing motion) at the connection end of the ship or offshore installations carrying the gangway to the support center at the connection end of the target ship or offshore installations when the gangway is horizontal and in the middle position of the telescoping range.
- (8) Gangway extension length: the distance from the middle pin (horizontal axis of luffing motion) at the connection end of the ship or offshore installations carrying the gangway to the support center at the connection end of the target ship or offshore installations when the gangway is extended to its mechanical limit.
- (9) Gangway walkway plane: the flat path for people walking.
- (10) Emergency situation: the failure of the gangway's own components/systems or over-travel.
- (11) Landing area: the area where personnel can stand after getting off the gangway at the free end of the gangway.
- (12) Safe position: the position where the gangway operates within the specified operating area.

1.2.2 Design conditions

1.2.2.1 Based on the conditions or states under which the gangway is operated or activities are performed during its operation or transit, the Guidelines define its design conditions into the following five types:

- (1) Normal operating conditions: the conditions under which the gangway is used for the safe movement of personnel or goods;
- (2) Transit conditions: the conditions under which the gangway is moving or sailing with ships or offshore installations after it is fully retracted and fixed;
- (3) Deployment/retraction conditions: the conditions under which the gangway deploys from its stowed position to the normal operating position through slewing, luffing, telescoping and landing motions/retracts from the normal operating position to the fixing bracket;
- (4) Emergency disconnection conditions: the conditions under which the gangway is emergency-lifted after over-traveling and reaching its mechanical limit;
- (5) Accident conditions: the conditions under which accidents may be caused by accidental loads on the gangway, such as:
 - Collision;
 - Falling objects;
 - Fire;
 - Explosions.

Section 3 Accepted Standards

1.3.1 General requirements

1.3.1.1 In addition to meeting the requirements in the Guidelines, CCS accepts the design, manufacture, installation, inspection and test of gangways in accordance with applicable parts of international standards, national standards and industry standards.

1.3.1.2 Alternative standards can be used in place of those accepted in the Guidelines, provided that they are demonstrated to attain at least an equivalent level of safety, and are agreed upon by CCS.

1.3.1.3 Alternative provisions inconsistent with design standards, as well as exemptions from and changes to design standards shall be stated in the design documents and agreed upon by the owner and CCS.

1.3.1.4 The latest version of the standard on the effective date of the design contract shall be adopted. Otherwise, it shall be clearly stipulated in the contract.

1.3.2 Accepted Standards

1.3.2.1 The main relevant standards for the gangway accepted by CCS are as follows:

- (1) IMO MSC.98(73) International Code for Fire Safety Systems
- (2) IMO A.1023(26) Code for the Construction and Equipment of Mobile Offshore Drilling Units
- (3) IMO A.1045(27) Pilot Transfer Arrangements
- (4) IMO SOLAS International Convention for the Safety of Life at Sea Chapter V

- (5) ISO 5488 Ships and Marine Technology - Accommodation Ladders
- (6) ISO 7061 Ships and Marine Technology - Aluminium Shore Gangways for Seagoing Vessels
- (7) EN 13852-1 Offshore Cranes
- (8) EN 1999-1 Design of Aluminium Structures

Section 4 Product Drawing Review

1.4.1 General requirements

1.4.1.1 The applicant shall submit a formal drawing review application and complete plans and documents to CCS. Plans and documents may be submitted in paper or electronic files (PDF). If paper plans and documents are submitted, the applicant shall generally submit the application form (available for download at <http://www.ccs.org.cn>) and three copies of the plans and documents to the drawing reviewer designated by CCS for review. If one unit is responsible for drawing review and survey, only two copies of the plans and documents need to be submitted. Should the applicant request additional copies to be returned after review, the number of sets submitted must be increased accordingly. If electronic plans and documents are submitted, the applicant may register, apply, and submit drawing materials through the website <https://www.ccs-service.net>. The list of plans and technical documents to be submitted is shown in 1.4.2 of this section.

1.4.1.2 The names of the submitted plans and technical documents may be different from those in 1.4.2 of this section, but the content of the plans and technical documents shall meet the applicable requirements in the Guidelines and relevant CCS rules. The plan approval surveyor, may, if necessary, require the submission of additional plans and technical documents.

1.4.1.3 Plans and technical documents shall be submitted in Chinese or English, and shall clearly express the design, structure, materials, dimensions, functions and performance parameters of the product. If necessary, restrictions or regulations on use shall also be included.

1.4.1.4 The hydraulic and pneumatic system drawings shall indicate the material, size, type, design pressure, design temperature, safety valve setting pressure, etc. of the pipes, control components including valves and accessories. Where a separate calculation is not provided, necessary standard calculations shall also be attached.

1.4.1.5 Whenever significant changes are made to the design, materials, specifications, dimensions, performance and other aspects of the approved plans and technical documents, the modified plans and technical documents shall be resubmitted to CCS for approval or for information. For products approved by CCS, their plans and technical documents do not need to be resubmitted for review if the drawing review specifications and standards have not been modified.

1.4.2 Plans and documents

1.4.2.1 The following plans and documents shall be submitted for approval. CCS may, if necessary, require the submission of additional plans and documents:

- (1) General layout/assembly drawing, including description of main working parameters;

- (2) The structure, size, steel grade, welding consumables and weld specifications of the main structural components, including fixed trusses, telescoping trusses, slewing structures, bases, stairways and storage facilities;
- (3) Strength calculation of main components, and the design basis, working parameters, mass and center of gravity of the components;
- (4) Anti-corrosion control;
- (5) Schematic diagram of hydraulic system;
- (6) Calculations for piping system and equipment of hydraulic system;
- (7) Electrical system diagram;
- (8) Arrangement plan of electrical equipment;
- (9) Schematic diagram of control circuit, fault mode and alarm system.

1.4.2.2 The following plans and documents shall be submitted for information:

- (1) Operation Manual;
- (2) Construction Instructions;
- (3) Arrangement plan of luffing, slewing and telescoping drive mechanisms and technical description of their equipment and components;
- (4) Failure Mode and Effects Analysis (FMEA) report.

1.4.2.3 The reinforcement drawings for the connection between the telescoping gangway base and the ship or offshore installations structure shall be submitted for approval.

Section 5 Product Inspections and Class Notations

1.5.1 General requirements

1.5.1.1 For any gangway intended for use on ships or offshore installations classed by CCS, its manufacturer or operator shall apply to CCS for inspections of products to be classed.

1.5.1.2 The surveyor will issue a marine product certificate if, in his/her judgement, the gangway and related equipment meet the requirements in the Guidelines or relevant CCS rules in surveys and tests carried out before, during and/or after manufacturing.

1.5.1.3 The ship owner of the classed ship or the owner of the classed offshore installations may apply to CCS for a class notation for a telescoping gangway: Telescope Gangway.

1.5.1.4 After review and approval by CCS headquarters and after the attending surveyor completes the installation inspection and test of the gangway and issues the corresponding survey report in accordance with the relevant survey requirements in the Guidelines, the CCS headquarters will grant the gangway a class notation and mark it in the classification certificates of the ships or offshore installations.

1.5.1.5 For gangways used on non-CCS-classed ships or offshore installations, the surveyor may issue a marine product inspection certificate or certificate of compliance after completion of the required product verification surveys and tests. Any documents issued in connection with the survey shall reflect only the conditions at the time of the survey.

Section 6 Product Certification Requirements

1.6.1 General requirements

1.6.1.1 The certification requirements for gangway products and components shall meet the applicable requirements in Appendices 1A, 1C, 2A, and 2C to Chapter 3, Part 1 of the CCS *Rules for Classification of Sea-Going Steel Ships*.

Chapter 2 Gangway Structure

Section 1 General Provisions

2.1.1 General requirements

2.1.1.1 Unless otherwise specified, this Chapter applies to steel welded structure gangways with a design temperature of not lower than -20°C.

2.1.1.2 Gangways constructed from non-steel materials (e.g., aluminum alloy), of special types, or employing novel structural designs require separate consideration and approval from CCS.

Section 2 Materials and Anti-corrosion

2.2.1 General requirements

2.2.1.1 The design temperature of the gangway is defined as the lowest average daily temperature, which is determined based on annual meteorological data. The applicant shall declare to CCS that the design temperature of the gangway is consistent with that of the ships or offshore installations on which the gangway is installed.

2.2.1.2 The steel or aluminum alloy used for the gangway shall have a CCS marine product certificate.

2.2.1.3 Aluminum alloy shall have good seawater corrosion resistance and weldability.

2.2.2 Anti-corrosion

2.2.2.1 The outer surface of the steel structure shall be coated for anti-corrosion purposes. For small and complex components that are difficult to paint, or steel structural components with special requirements, coating can be used for anti-corrosion purposes.

2.2.2.2 Bolts, nuts and related components may be protected by hot dip galvanizing or completely sealed with anti-oxidation oil/grease.

Section 3 Structure Layout

2.3.1 General requirements

2.3.1.1 The gangway shall be arranged in a security zone.

2.3.1.2 It shall be ensured that the target ships or offshore installations have suitable space and local strength for coupling gangways.

2.3.1.3 The gangway passage shall be adequately sized to allow personnel to pass through and evacuate swiftly with any necessary equipment.

2.3.2 Stairway and walkway

2.3.2.1 For a Type 1 gangway, the net width of the stairway and walkway shall generally be no less than 900mm, and for a Type 2 gangway, it shall generally be no less than 600mm. Special requirements for the net width, if any, require approval from CCS.

2.3.2.2 The inclination angle of the boarding ladder attached to the cylindrical structure of the

gangway shall generally not exceed 45° and shall under no circumstances exceed 50°.

2.3.2.3 The walkway floor and stairway treads shall be anti-slip, easy to clean, and not prone to liquid accumulation.

2.3.3 Guard rail and handrail

2.3.3.1 For the gangway, guard rails shall be set on both sides of the walkway, and they shall be at least 1 m higher than the walkway.

2.3.3.2 Guard rails shall have at least three courses. The opening below the lowest course of the guard rails shall not exceed 230 mm. The other courses shall be not more than 380 mm apart. If the gangway allows for use by children, the guard rail spacing shall be given special consideration.

2.3.3.3 Handrails shall be installed on both sides of the stairway, and the spacing between handrail posts shall not exceed 1800mm.

Section 4 Design Loads and Conditions

2.4.1 General requirements

2.4.1.1 The following loads need to be considered in the structural design:

- (1) Gravity and functional load;
- (2) Environmental load;
- (3) Gangway installation load.

2.4.1.2 The owner/designing institute shall specify the design conditions and corresponding environmental conditions as the basis for use.

2.4.1.3 In addition to the loads mentioned in 2.4.1.1, other relevant loads shall be considered if necessary.

2.4.1.4 The designing institute shall ensure that the gangway design conditions are consistent with the design conditions and the requirements in the applicable rules and standards of ships or offshore installations. Those inconsistent with the provisions of this section may be accepted as an equivalent, subject to the approval of CCS.

2.4.2 Gravity and functional load

2.4.2.1 Gravity and functional load refer to the loads caused by the weight, use and operation of the gangway under static water conditions, generally consisting of the following loads:

- (1) Dead weight of gangway;
- (2) Live Load;
- (3) Vertical load generated by operation;
- (4) Horizontal load generated by operation;
- (5) Inertial load generated by the motion of ships/offshore installations.

2.4.2.2 For gangway design, the uniformly distributed live load under normal operating conditions shall generally not be less than 4500N/m², and the concentrated live load under the emergency disconnection conditions shall not be less than 6000N at the end of a Type 1 gangway or less than

3500N at the end of a Type 2 gangway.

2.4.2.3 The vertical load and inertia force generated by operation shall be determined based on the maximum acceleration of a given machine and the maximum possible deceleration of a given brake. Usually this type of inertial force occurs when the luffing motion starts and stops (for example, during the deployment/retraction of the gangway).

2.4.2.4 The horizontal load and inertia force generated by operation shall be determined based on the maximum acceleration of a given machine and the maximum possible deceleration of a given brake. Usually this type of inertial force occurs when the slewing motion starts and stops (for example, during the deployment/retraction of the gangway). The inertial forces resulting from the angular acceleration/deceleration of rotating mechanism components shall be taken into account when their impact is significant.

2.4.3 Environmental load

2.4.3.1 The design wind speed for normal operation of the gangway shall not be lower than 20m/s. The design wind speed when the gangway is deployed/retracted shall be higher than that during normal operation, and 36m/s is recommended. The wind speed under transit conditions shall not be lower than 51.5m/s. The wind load shall be calculated according to the requirements in Article 2.2.2, Section 2, Chapter 2, Part 2 of the *CCS Rules for Classification of Mobile Offshore Units*.

2.4.3.2 If necessary, consideration shall be given to the possibility of resonance occurring when the frequency of the alternating force induced by the von Karman vortex street approaches the natural frequency of the structure. The calculation shall meet the requirements in Section 6, Chapter 2, Part 2 of the *CCS Rules for Classification of Mobile Offshore Units*.

2.4.3.3 The designing institute shall decide whether to consider green sea loads and ice/snow loads based on the type of ships or offshore installations and the actual location of the gangway.

2.4.4 Design conditions

2.4.4.1 For the strength analysis of the gangway, consideration shall be given at least to normal operating conditions, transit conditions, deployment/retraction conditions and emergency disconnection conditions. If necessary, special consideration shall be given to accident conditions. The combination of these conditions is shown in Table 2.4.4.1.

Combination of Design Conditions

Table 2.4.4.1

	Normal operating conditions	Transit conditions	Deployment/retraction conditions	Emergency disconnection conditions	Accident conditions
Dead weight	100%	100%	100%	100%	100%
Live load	100%			100%	
Vertical load generated by operation	100% ^①		100%	100%	
Horizontal load generated by operation	100% ^①		100%	100%	
Inertial load generated by the motion of ships/offshore installations		100%			
Environmental load	100%	100%	100%	100%	100%
Accidental load					100%

Note: ① Only applicable to gangways using active compensation under normal operating conditions.

Section 5 Strength Check

2.5.1 General requirements

2.5.1.1 The structural strength check shall meet the following failure criteria:

- (1) Yield failure criteria;
- (2) Buckling failure criteria;
- (3) Fatigue failure criteria.

2.5.2 Yield failure criteria

2.5.2.1 The allowable stress value of the main structural components of the gangway involved in the structural analysis shall be determined according to the following provisions $[\sigma]$:

$$[\sigma] = \sigma_s / S \quad \text{N/mm}^2$$

Where, σ_s - yield strength of material, in N/mm²;

S - safety factor, taken according to Table 2.5.2.1.

Safety Factor

Table 2.5.2.1

Normal operating conditions	Transit conditions	Deployment/retraction conditions	Emergency disconnection conditions	Accident conditions
1.5	1.33	1.33	1.15	1.0

2.5.2.2 Other requirements for yield failure verification shall meet the applicable requirements in Section 4, Chapter 3, Part 2 of the *CCS Rules for Classification of Mobile Offshore Units*.

2.5.3 Buckling failure criteria

2.5.3.1 For components that are only subjected to compressive stress, the permissible stress for stability $[\sigma_{st}]$ can be calculated as follows:

$$[\sigma_{st}] = \sigma_{cr} / S$$

Where, σ_{cr} - critical compressive stress of the component, N/mm². The critical compressive stress of various compression components can be obtained according to Appendix 1 of the CCS *Rules for Lifting Appliances of Ships and Offshore Installations*;
 S - safety factor, taken according to Table 2.5.2.1.

2.5.3.2 The stability of components that are subjected to both pressure and bending shall be verified according to the following stress criteria:

$$\frac{\sigma_m}{\sigma_s} + \frac{\sigma_c}{\sigma_{cr}} \leq \frac{1}{S}$$

Where, σ_m - bending stress on the component, in N/mm²;
 σ_c - compressive stress on the component, in N/mm²;
 σ_s - yield strength of material, in N/mm²;
 σ_{cr} - critical compressive stress of the component, in N/mm²;
 S - safety factor, taken according to Table 2.5.2.1.

2.5.3.3 For other requirements for buckling failure verification, please refer to Section 4, Chapter 3, Part 2 of the CCS *Rules for Classification of Mobile Offshore Units* and the applicable requirements in the CCS *Rules for Lifting Appliances of Ships and Offshore Installations*.

2.5.4 Fatigue failure criteria

2.5.4.1 Fatigue failure verification shall meet the applicable requirements in the CCS *Technical Guidelines for Fatigue Strength Assessment of Marine Engineering Structures*.

2.5.4.2 The fatigue strength safety factor shall not be less than 2.0.

Section 6 Welding and NDT

2.6.1 General requirements

2.6.1.1 Prior to the commencement of construction, the factory shall obtain approval for the proposed welding procedure, and the Welding Procedure Specification may only be used after approval by CCS. See Chapter 3, Part 3 of the CCS *Rules for Materials and Welding* for specific requirements.

2.6.1.2 Only welders who have passed the training and assessment and hold a Welder Qualification Certificate issued or recognized by CCS are permitted for welding within the scope of their certificates.

2.6.1.3 NDT personnel shall hold the Qualification Certificate for NDT Personnel issued or recognized by CCS and may only perform NDT that corresponds to the type and level specified on the certificate.

2.6.1.4 The selected welding consumables shall comply with the relevant requirements in Chapter

2, Part 3 of the *CCS Rules for Materials and Welding* and be subjected to approval by CCS.

2.6.2 Welding

2.6.2.1 The Welding Procedure Specification approved by CCS shall be followed for the welding conditions, pre-welding preparation, preheating and interpass temperature, welding, PWHT and defect repair of the gangway steel structure welding.

2.6.2.2 For the pre-welding preparation and welding of the gangway aluminum alloy structure, refer to Section 2, Chapter 11, Part 3 of the *CCS Rules for Materials and Welding*.

2.6.3 Welding inspection

2.6.3.1 All weld surfaces shall be visually inspected. The weld edge shall smoothly transition to the base material, and the weld dimensions shall meet the requirements of the design drawings.

2.6.3.2 The type and scope of NDT depends on the type of welded structural joints, as shown in Table 2.6.3.2.

Scope of NDT for Welded Structures^① (%)

Table 2.6.3.2

Joint type	Visual inspection	Method		
		RT ^②	UT ^②	MT ^②
Butt joint	100	10~20	100	100
Cross/T-shaped joint, full penetration	100	-	100	100
Cross/T-shaped joint, fillet/deep penetration welding	100	-	-	100

Note: ① NDT of aluminum alloy welded structures shall be subjected to approval by CCS.

② RT, UT and MT represent radiographic testing, ultrasonic testing and magnetic particle testing respectively.

2.6.3.3 The acceptance criteria for weld inspection shall meet the requirements in 4.4.5, Section 4, Chapter 4, Part 1 of the *CCS Rules for Classification of Mobile Offshore Units*.

Chapter 3 Machinery Installations and Systems

Section 1 General Provisions

3.1.1 General requirements

3.1.1.1 In addition to meeting the requirements in this Chapter, machinery installations and systems shall also comply with the applicable provisions in Chapter 4 of the CCS *Rules for Lifting Appliances of Ships and Offshore Installations* and Part 4 of the CCS *Rules for Classification of Mobile Offshore Units*. The certification of main parts and components of machinery installations and their systems shall comply with the provisions in Section 6, Chapter 1 of the Guidelines.

3.1.2 Plans and documents

3.1.2.1 The plans and documents corresponding to this Chapter in 1.4.2 of Chapter 1 shall be submitted to CCS for approval.

Section 2 Gangway Drive Mechanism

3.2.1 General requirements

3.2.1.1 The gangway drive mechanism includes the mechanical equipment required to realize luffing, slewing, telescoping and emergency retraction. It shall meet the performance requirements under various sea states and design load cases to ensure the safe transportation of personnel.

3.2.2 Luffing mechanism

3.2.2.1 The main component of the luffing mechanism is the luffing cylinder. The force of the luffing mechanism under various conditions shall be calculated according to the CCS Product Inspection Guidelines H-02 *Hydraulic Cylinder* or relevant standards accepted in the Guidelines, and a suitable luffing cylinder shall be selected based on the force and stroke to meet the luffing requirements.

3.2.2.2 Other non-hydraulic driven luffing mechanisms require approval from CCS before their use.

3.2.3 Slewing mechanism

3.2.3.1 The slewing mechanism includes the electric/hydraulic motor, reduction gearbox, drive gear and internal gear slewing bearing. The forces and power requirements for the slewing mechanism under various conditions shall be calculated in accordance with Chapter 10, Part 3 of the CCS *Rules for Classification of Sea-Going Steel Ships* or standards accepted in the Guidelines. The appropriate electric/hydraulic motor, reduction gearbox, drive gear and internal gear slewing bearing shall be selected based on the calculation results to meet the slewing requirements.

3.2.4 Telescoping mechanism

3.2.4.1 The telescoping mechanism shall be able to meet the strength requirements under various loads. The telescoping mechanism includes the hydraulic motor, reduction gearbox, gears, guide wheels, tracks, racks and wheels. The forces and power requirements for the telescoping

mechanism under various conditions shall be calculated in accordance with Section 3, Chapter 6, Part 4 of the *CCS Rules for Classification of Mobile Offshore Units*, Chapter 10, Part 3 of the *CCS Rules for Classification of Sea-Going Steel Ships* or standards accepted in the Guidelines. The appropriate electric/hydraulic motor, reduction gearbox, drive gear and rack shall be selected based on the calculation results, and a proven rack and pinion drive configuration shall be used to meet the telescoping requirements.

3.2.4.2 Other non-hydraulic driven telescoping mechanisms require approval from CCS before their use.

Section 3 Hydraulic System

3.3.1 General requirements

3.3.1.1 The hydraulic system and its layout shall meet the applicable requirements in Chapters 2, 4, 6 and 13, Part 3 of the *CCS Rules for Classification of Sea-Going Steel Ships*, and CCS Product Inspection Guidelines H-01 *Hydraulic Power Unit*. The relevant standards accepted in the Guidelines can be used as equivalent standards.

3.3.1.2 The materials used in the hydraulic system shall comply with the relevant provisions of the *CCS Rules for Materials and Welding*.

3.3.1.3 The certification requirements and product inspections of the hydraulic system and its components shall comply with relevant provisions in Chapter 1 of the Guidelines and in Chapter 3, Part 1 of the *CCS Rules for Classification of Mobile Offshore Units*.

3.3.1.4 In the design of the hydraulic system circuit, all possible fault types (including control power failure) shall be considered. The selection, installation and commissioning of hydraulic system components shall prioritize maximum personnel safety even in the event of failure, while also minimizing equipment damage (fail-safe criteria). All components shall be designed to operate without exceeding the maximum working pressure of the system or the rated pressure of a particular component.

3.3.1.5 The system shall be able to withstand the impact of impact pressure and pulsating pressure.

3.3.1.6 Measures shall be taken to prevent surface temperatures of the hydraulic system or other mechanical equipment connected to the hydraulic system from causing harm to personnel.

3.3.1.7 Measures shall be taken to prevent the hydraulic system or other mechanical equipment connected to the hydraulic system from polluting the surrounding environment due to accidental leakage of hydraulic oil or lubricating oil.

3.3.2 Hydraulic cylinder

3.3.2.1 The material of the load-carrying hydraulic cylinder (luffing cylinder) shall comply with the applicable provisions in Part 1 of the *CCS Rules for Materials and Welding*. The design, drawing review, manufacture, inspection and test shall comply with the provisions in 6.2.2, Section 2, Chapter 6, Part 4 of the *CCS Rules for Classification of Mobile Offshore Units* and the applicable requirements in the CCS Product Inspection Guidelines H-02 *Hydraulic Cylinder*.

Hydraulic cylinders shall have the CCS product certificate.

3.3.3 Accumulator

3.3.3.1 The design, drawing review, manufacture, inspection and test of accumulators shall meet the applicable requirements in Appendix 4 Pressure Vessel Strength Calculation to Chapter 6, Part 3 of the *CCS Rules for Classification of Sea-Going Steel Ships* or standards accepted in the Guidelines. Accumulators shall have the CCS product certificate.

3.3.4 Flexible hose

3.3.4.1 Flexible hoses shall meet the applicable requirements in Appendix 2 to Chapter 2, Part 3 of the *CCS Rules for Classification of Sea-Going Steel Ships*. Flexible hoses shall have the CCS product certificate.

3.3.5 Hydraulic test

3.3.5.1 The hydraulic system shall be hydraulically tested in accordance with the applicable requirements in Section 7, Chapter 2, Part 3 of the *CCS Rules for Classification of Sea-Going Steel Ships*.

Section 4 Pneumatic System

3.4.1 General requirements

3.4.1.1 The pneumatic system shall meet the applicable requirements for compressed air systems in Section 17, Chapter 3, Part 4 of the *CCS Rules for Classification of Mobile Offshore Units*.

Section 5 Motion Compensation System

3.5.1 General requirements

3.5.1.1 No single fault shall result in a hazard, and any failure or fault shall trigger an alarm at the control station.

3.5.2 Motion compensation system

3.5.2.1 It can achieve 6-dimensional motion compensation through three systems: luffing, slewing, and telescoping, and it provides both active and passive compensation capabilities, both before and after the coupling of the gangway.

3.5.2.2 The motion compensation system shall enable real-time monitoring and data fusion of both the motions of ships or offshore installations and the marine environment. For the gangway motion compensation system, it shall generally include:

- (1) Real-time monitoring of marine environmental parameters;
- (2) Real-time monitoring of multi-degree-of-freedom motion of ships or offshore installations;
- (3) Real-time monitoring of relative position of ships or offshore installations;
- (4) Real-time monitoring of gangway attitude;
- (5) Identification and real-time processing analysis of monitoring data;
- (6) Multi-channel data fusion.

Chapter 4 Electrical Installations

Section 1 General Provisions

4.1.1 General requirements

4.1.1.1 In addition to meeting the requirements in this Chapter, electrical installations shall also comply with the applicable provisions in Part 5 of the CCS *Rules for Classification of Mobile Offshore Units*.

4.1.2 Environmental and operating conditions

4.1.2.1 The gangway electrical installations shall be capable of operating at the design temperature specified in 2.2.1.1.

4.1.2.2 The operating voltage and frequency of the gangway electrical installations shall meet the applicable requirements in 1.2.2, Section 2, Chapter 1, Part 5 of the CCS *Rules for Classification of Mobile Offshore Units*.

4.1.3 Selection of electrical installations

4.1.3.1 The design of electrical installations shall comply with relevant standards and rules.

4.1.3.2 Electrical installations and cables installed in hazardous areas shall meet the applicable requirements in 1.4.2, Section 4, Chapter 1, Part 5 of the CCS *Rules for Classification of Mobile Offshore Units*.

Section 2 Power Supply System

4.2.1 General requirements

Note: A citation is made from 5.11 in DNV *Certification Standard of Offshore Gangways for Personnel Transfer*.

4.2.1.1 The gangway shall be equipped with two power supplies. In addition to the main power supply, the second power supply shall be either the emergency power supply from the ship or offshore installations, or battery provided for the gangway.

4.2.1.2 In the event of main power loss, the second power supply for the gangway shall be capable of meeting the power requirements for the following equipment:

- (1) 18h emergency lighting for the walkway of the gangway;
- (2) Emergency control system for restoring the gangway to a safe position;
- (3) Gangway alarm system and protection related to personnel safety.

Note: A citation is made from 6.10.10 in DNV *Certification Standard of Offshore Gangways for Personnel Transfer*.

4.2.1.3 The batteries provided for the gangway shall meet the applicable requirements in Section 10, Chapter 2, Part 5 of the CCS *Rules for Classification of Mobile Offshore Units*.

Section 3 Lighting System

4.3.1 General requirements

4.3.1.1 In addition to meeting the requirements in this section, the lighting system shall also meet the applicable requirements in Section 7, Chapter 2, Part 4 of the *CCS Rules for Classification of Sea-Going Steel Ships*.

4.3.1.2 The average illumination of the lighting set up in the stairways and walkways of the gangway shall not be less than 100 lux, and the illumination of the lighting set up at the entrances and exits at both ends shall not be less than 300 lux.

Chapter 5 Safety System

Section 1 General Provisions

5.1.1 General requirements

5.1.1.1 In addition to meeting the requirements in this Chapter, the gangway safety system shall also meet the applicable requirements in 4.3, Chapter 4 of the *CCS Rules for Lifting Appliances of Ships and Offshore Installations*.

5.1.1.2 CCS can accept an equivalent alternative scheme with the same safety functions.

5.1.2 Mooring arrangements

5.1.2.1 When the gangway is out of service, it shall be securely fastened to the kickstand using safety methods such as lashing to maintain it in an "out-of-service" state.

5.1.2.2 For the strength of the securing device, the motions of ships or offshore installations and the influence of winds and gusts shall also be taken into account in addition to factors related to the gangway itself.

5.1.3 Control room

5.1.3.1 The control room shall meet the following requirements:

- (1) A comfortable working environment shall be provided inside it;
- (2) Its windows shall be equipped with wipers and heating devices to prevent icing.

5.1.4 Control by operators

5.1.4.1 In an emergency, the operator shall be able to manually override the gangway automatic safety system.

5.1.4.2 A Type 2 gangway can only be manually overridden by the operator in the control room.

5.1.5 Single fault

5.1.5.1 When the gangway is in the raised position, the gangway support and suspension system shall not cause the top of the gangway to fall suddenly due to any fault.

5.1.5.2 The gangway motion compensation system and the telescoping, slewing and luffing systems shall also not be affected by any fault.

5.1.6 Disconnection system

5.1.6.1 At the connection between the top of the gangway and the landing platform (also known as the landing area, supporting structure), an appropriate disconnection system shall be provided to facilitate the disconnection of the gangway from the landing area.

5.1.6.2 The separation force of the disconnection system shall not exceed 30% of the horizontal resultant load.

5.1.6.3 The disconnection device can be activated automatically in an emergency (either by the operator or by an automatic protection system). This function shall not be affected by main power loss.

5.1.7 Automatic protection system

5.1.7.1 When the gangway control system detects a preset automatic disconnection condition (such as overload, overtravel, or disconnection from the landing area), the gangway shall automatically provide an audible and visual alarm to the user before automatically disconnecting, lifting, retracting, and/or slewing to a predetermined safe position. The automatic protection system shall be configured to allow anyone crossing the gangway to reach a security zone before any movement in the X, Y and Z directions begins when an audible and visual alarm is triggered.

5.1.7.2 To enable movement to a safe position when necessary, the gangway must be equipped with an emergency slewing function. After this emergency slewing operation, the gangway shall be reset to restore it to normal working state. This function shall not be affected by main power loss.

5.1.7.3 For gangways in permanent manned operation, such a protection system is not required.

5.1.8 Manual protection system

5.1.8.1 The gangway is equipped with a manual protection system that allows the operator to disconnect the gangway in an emergency. During operation, the system shall automatically initiate an audible and visual alarm to the user, followed by separating, lifting, retracting, and slewing the gangway to a predefined safe position, while ensuring the safety of any personnel on the gangway.

5.1.8.2 The manual protection system shall be operable under all conditions, including main power loss and failure of the main control system. All other functions can be overridden during manual operation.

Section 2 System Protection

5.2.1 Automatic lateral overload protection

5.2.1.1 An automatic lateral overload protection device shall be installed on the slewing mechanism.

5.2.2 Automatic vertical overload protection

5.2.2.1 An automatic vertical overload protection device shall be installed on the luffing mechanism of the gangway of a cantilever beam structure.

5.2.3 Automatic axial overload protection

5.2.3.1 An automatic axial overload protection device shall be installed on the telescoping mechanism (along the length of the gangway).

5.2.4 Overtravel protection

5.2.4.1 Overtravel of the gangway may result in stresses exceeding the structural strength of the gangway and pose operational hazards. Therefore, all motions of the gangway must be kept within a safe range, either through limiting devices (or limiting alarms) or physical means.

5.2.4.2 The limiting device shall be fail-safe and can be accurately triggered to guide the gangway into a predetermined safe state even in the event of a fault (power failure, etc.). After the limiting device is triggered, there shall be a display and alarm in the gangway operation room. In addition, the reverse motion of the gangway shall not be restricted. If more than one action can cause

overtravel, all limiting devices designed to prevent overtravel shall be activated simultaneously. The installation of a manual override system, which can be actively triggered and its action maintained, shall be permitted. A manual override system that can actively trigger and maintain actions may be installed, and relevant display and alarm shall be provided.

5.2.5 Emergency stop device

5.2.5.1 As a fault in the gangway control system may result in unintended motion of the gangway or other unforeseen risks, the system must be equipped with a manual emergency stop function that can shut down and stop the gangway. This function shall support immediate disconnection of the power supply to the machine actuator or separation of the mechanical connection between the component and the actuator, ensuring that the gangway ceases operation promptly.

5.2.5.2 Regardless of any fault in the gangway control system, the emergency stop device shall maintain its function.

5.2.5.3 The emergency stop button shall be conveniently located at the control station for immediate use.

5.2.6 Blind spot

5.2.6.1 Imaging equipment shall be installed in the blind spots of the gangway operator.

5.2.7 Communication equipment

5.2.7.1 The gangway operator and other personnel related to the gangway operation shall be provided with two-way communication equipment.

5.2.7.2 Fixed two-way communication equipment shall be provided between the gangway control room and the navigation bridge/DP control station of the ships or offshore installations.

5.2.8 Disconnection from the landing area

5.2.8.1 The gangway shall automatically enter a safe state if its top becomes disconnected from the landing area.

5.2.8.2 The disconnection of the gangway from the landing area shall not cause the top of the gangway to fall suddenly. This function shall not be affected by main power loss.

5.2.9 Power loss protection

5.2.9.1 Power loss may cause the gangway to stop in an unfavorable and unsafe position.

5.2.9.2 Power loss shall not render the gangway inoperable. In the event of main power loss, an alarm shall sound in the control room, other control rooms and the ship integrated automation system (IAS).

5.2.9.3 The gangway shall be connected to an independent emergency power supply.

Section 3 Failure Mode and Effects Analysis

5.3.1 General requirements

5.3.1.1 FMEA shall be carried out for a gangway in accordance with the relevant provisions of the CCS *Guidelines for Application of Failure Mode and Effects Analysis* to prove its safety and reliability.

Chapter 6 Tests

Section 1 General Provisions

6.1.1 General requirements

6.1.1.1 In addition to meeting the requirements in this Chapter, the function and performance tests of the completed gangway shall also meet the applicable requirements in Chapter 7 of the CCS *Rules for Lifting Appliances of Ships and Offshore Installations*.

6.1.1.2 The function and performance tests and delivery inspection of the gangway shall be carried out in accordance with the CCS-approved test program.

Section 2 Function and Performance Tests

6.2.1 Installation and inspection of complete machine

6.2.1.1 Installation and inspection of mechanical equipment:

(1) The installation and inspection of mechanical equipment for gangway luffing, telescoping and slewing mechanisms shall not only meet the applicable requirements in Section 2, Chapter 1, Part 4 of the CCS *Rules for Classification of Mobile Offshore Units*, but also meet the requirements in assembly process specifications, drawings and technical conditions of mechanical equipment approved by CCS;

(2) During the assembly process, inspections shall be carried out at the specified process nodes.

6.2.1.2 Installation and inspection of hydraulic system:

(1) The installation and inspection of hydraulic system shall meet the applicable requirements in Sections 6, 7, Chapter 2 and Section 12, Chapter 3, Part 4 of the CCS *Rules for Classification of Mobile Offshore Units*, as well as the requirements of drawings and relevant installation processes approved by CCS;

(2) Hydraulic tests shall be carried out on the hydraulic system at a test pressure 1.5 times the design pressure.

6.2.1.3 Installation and inspection of electrical installations:

(1) The installation and inspection of electrical installations shall meet the applicable requirements in Section 3, Chapter 1, Part 5 of the CCS *Rules for Classification of Mobile Offshore Units*;

(2) The insulation resistance of the output circuit between all insulated electrodes and the ground shall be measured in accordance with the requirements in 3.3.7.5, Section 3, Chapter 3, Part 4 of the CCS *Rules for Classification of Sea-Going Steel Ships*. Where feasible, the insulation resistance between electrodes shall be measured;

(3) When deemed necessary by the surveyor, the switchgear shall be tested under loading conditions to verify its fitness-for-purpose;

(4) The electrical installations and control systems shall be tested in accordance with the CCS-approved test program.

6.2.2 Test of monitoring and control system

6.2.2.1 Prior to the test of the safety equipment and control system, all safety protection devices shall be verified or adjusted to ensure they are safe and reliable.

6.2.2.2 The test and test results of the gangway control, monitoring and alarm system shall meet the requirements of the approved drawings and relevant process documents.

6.2.2.3 It shall be verified that the control and monitoring system can operate normally under normal loads. During relevant tests, faults or boundary conditions shall be simulated as realistically as practically possible.

6.2.3 Test of I/O signal

6.2.3.1 I/O signals shall be tested in accordance with the *Gangway Control and Monitoring System Test Report* (including I/O signals) and *Software Quality Plan* to verify their compliance.

6.2.4 Test of telescoping mechanism

6.2.4.1 The gangway telescoping mechanism shall be tested to verify compliance with design requirements. The test shall include but is not limited to:

- (1) Telescoping limit test at horizontal position;
- (2) Telescoping limit test at maximum luffing angle;
- (3) Telescoping limit test at minimum luffing angle.

6.2.5 Test of luffing mechanism

6.2.5.1 The control system of the luffing mechanism shall be tested to verify compliance with design requirements. The test shall include but is not limited to:

- (1) Luffing limit test at retracted position;
- (2) Luffing limit test at maximum telescoping stroke position.

6.2.5.2 Test of overload protection device for luffing mechanism

6.2.6 Test of slewing mechanism

6.2.6.1 The slewing capability of the slewing mechanism shall be tested to verify compliance with design requirements. The test shall include but is not limited to:

- (1) Capability to complete the slewing action at the maximum and minimum telescoping lengths selected based on the telescoping action.

6.2.7 Test of disconnection system

6.2.7.1 The automatic release function of the disconnection system shall be tested under the design load (vertical and horizontal loads including wind loads and their combinations) to verify compliance with design requirements.

6.2.8 Test of emergency lifting system

6.2.8.2 The emergency lifting system shall be tested (normal power supply, power loss) to verify compliance with design requirements.

6.2.9 Test of emergency stop system

6.2.9.1 Before the emergency stop system is started, it shall be confirmed that the emergency stop circuit and emergency stop switch are in normal working state, and the emergency stop system

shall be tested to verify compliance with the design requirements.

6.2.10 Load test

6.2.10.1 Gangway load test:

(1) Type 1 gangway: The gangway is extended to the maximum operating length and supported at both ends. The test load shall be 1.25 times the live load, but not less than 500kg. The test load is evenly distributed along the gangway. The total structural deflection of the gangway shall not exceed $L/200$. The load test shall not cause permanent deformation of the gangway.

(2) Type 2 gangway: For a gangway supported in the z-axis direction at both ends, when it is extended to the maximum operating length, a test load shall be applied in the middle of the gangway. The test load shall be 1.25 times the live load, but not less than 300kg.

If a Type 2 gangway is designed to carry more than 3 people, the distribution of test loads along the gangway shall be determined on a case-by-case basis. The load test shall not cause permanent deformation of the gangway.

6.2.11 Test of gangway compensation system

6.2.11.1 The gangway motion compensation system (active and passive compensation) shall be tested to verify functional compliance with the design requirements.

Section 3 Inspection after Gangway Test

6.3.1 General requirements

6.3.1.1 Upon completion of all test items for the gangway, a comprehensive inspection of the gangway shall be carried out for any damage or deformation to components as a result of the load tests. If deemed necessary by the surveyor, any questionable components or systems shall be disassembled for inspection or NDT.

6.3.1.2 After the test is completed, the disconnected overload protection system shall be reconnected. Safety valves and/or electrical circuit breakers shall be restored to their original settings.

Section 4 Certificates

6.4.1 General requirements

6.4.1.1 Upon completion of all inspection and test items for the gangway, and after review and verification of all inspection, test data, and factory documents, a marine product certificate or certificate of compliance for the gangway will be issued to the building applicant.

Chapter 7 Installation and Commissioning of Gangways on Ships or Offshore Installations

Section 1 General Provisions

7.1.1 General requirements

7.1.1.1 This Chapter stipulates the installation and commissioning of gangways on ships or offshore installations and applies to ships or offshore installations with gangway class notations. This Chapter may serve as a reference for ships or offshore installations that do not apply for class notations.

7.1.2 Requirements for dynamic positioning system

7.1.2.1 The dynamic positioning system of the ships or offshore installations shall meet the applicable requirements in Chapter 11, Part 8 of the *CCS Rules for Classification of Sea-Going Steel Ships*.

7.1.2.2 If applicable, the interface for the output equipment of the dynamic positioning system on the ships or offshore installations can be connected to the interface for the input equipment of the gangway control system. Data shall be shared between the dynamic positioning system and the gangway control system.

7.1.3 Requirements for ships or offshore installations

7.1.3.1 The requirements for the motion and acceleration of ships or offshore installations are as follows:

(1) Under the most severe sea state, the motion and local acceleration of ships or offshore installations at the center of gravity of the gangway shall be provided for both the connection phase and the personnel transfer phase. Unless the applicant can prove the validity of other values obtained based on direct analysis, the motion and acceleration of ships or offshore installations shall be considered in accordance with the applicable rules for ships or offshore installations.

(2) During the transfer phase, the acceleration of the gangway shall be considered in accordance with the applicable rules for ships or offshore installations.

7.1.3.2 The foundation structure of the gangways on ships or offshore installations shall meet the requirements of CCS-approved drawings.

7.1.3.3 When the gangway in use has a significant inclination angle, stability verification shall be carried out in accordance with applicable rules or standards accepted by CCS.

7.1.4 Power supply

7.1.4.1 When ships or offshore installations supply power to the gangway, the simultaneous operation of the following systems and equipment shall be ensured:

- (1) Gangway (at maximum rated load and speed);
- (2) Basic facilities of ships or offshore installations;
- (3) Dynamic positioning system of ships or offshore installations.

7.1.4.2 The availability of power supply shall be analyzed through FMEA.

Section 2 Inspection and Test

7.2.1 General requirements

7.2.1.1 After a gangway is installed on the ship or offshore installations and before it is put into use for the first time, function tests and load tests shall be carried out on the gangway to confirm its compliance with design requirements and its suitability for its intended purpose.

7.2.1.2 The gangway shall be fully tested for function and performance in accordance with the relevant requirements in Chapter 6 of the Guidelines.

7.2.2 Design review

7.2.2.1 The following plans and documents related to the gangway shall be submitted to CCS for approval:

- (1) Plans and documents of the gangway base;
- (2) Reinforcement drawings for the connection between the gangway base and the ship or offshore installations structure;
- (3) Diagram of hollow cylinder (also known as samson post);
- (4) Diagram of landing cone;
- (5) Reinforcement drawings for the connection between the kickstand and the ship or offshore installations structure;
- (6) Diagram of slewing chassis (slewing platform);
- (7) Installation drawing of slewing device;
- (8) Schematic diagram of hydraulic system;
- (9) Diagram of electrical system;
- (10) Diagram and function description of control, detection and alarm system;
- (11) Arrangement plan of electrical equipment;
- (12) Arrangement plan of control room/station.

7.2.2.2 The following plans and documents related to the gangway shall be submitted to CCS for information:

- (1) Environmental conditions;
- (2) Maximum significant wave height and peak period;
- (3) Maximum wind speed;
- (4) Minimum and maximum ambient temperatures;
- (5) Motion and acceleration of ships or offshore installations under the most severe sea state;
- (6) FMEA report.

7.2.3 Survey during gangway installation

7.2.3.1 In accordance with the plans and documents approved and available for information in 7.2.2, the following items (including but not limited to) during gangway installation shall be surveyed and tested:

- (1) Check the welding of the base, hollow cylinder, kickstand and hull structure, and perform NDT according to the requirements in Table 2.6.3.2 of the Guidelines to verify compliance with specified requirements;
- (2) Check the installation of the slewing chassis and hollow cylinder to verify compliance with the relevant approved drawings;
- (3) Carry out hydraulic test and tightness test on the hydraulic system to verify compliance with specified requirements;
- (4) Conduct insulation resistance measurement and power-on test on the power supply line to verify compliance with specified requirements.

7.2.4 Joint commissioning survey of gangway

7.2.4.1 Before a gangway is installed on the ship or offshore installations and put into use for the first time, the following items shall be debugged and tested in accordance with the test program or test procedure requirements approved by CCS:

- (1) The data shared between the dynamic positioning system and the gangway control system on board the ships or offshore installations shall be debugged in accordance with the provisions in Table 7.2.5.1 of this section.

- (2) No-load operation test

- ① Starting test of power system;
- ② Slewing, luffing and telescoping action tests;
- ③ Emergency stop test;
- ④ Limit test.

- (3) Luffing test

Check whether the luffing time of the gangway from the minimum mechanical angle to the maximum mechanical angle meets the design requirements. The luffing time error shall be controlled within $\pm 6s$, and the oil pressure shall be within the normal range.

- (4) Slewing test

Check and record the slewing speed and oil pressure when the gangway turns right and left. The slewing speed error shall be controlled within $\pm 10\%$.

- (5) Telescoping test

Check and record the speed and oil pressure when the gangway extends from the minimum working length to the maximum working length. The speed error shall be controlled within $\pm 5\%$.

- (6) Post-test inspection

- ① After completing the no-load operation tests of the slewing, telescoping and luffing mechanisms, check the temperature rise of each mechanical moving part to confirm that the temperature rise of the slewing mechanism and hydraulic oil meets the design requirements;
- ② Check the operation of the hydraulic components, electric motor, hydraulic motor, and

electrical components to confirm that they are in good technical conditions.

7.2.4.2 After the gangway is installed, function tests and load tests shall be carried out on ships or offshore installations in accordance with the CCS-approved test program.

7.2.4.3 Function tests shall be carried out in various modes respectively.

7.2.5 Data sharing and commissioning

7.2.5.1 The dynamic positioning (DP) system on the ships or offshore installations shares data with the gangway control system, and its commissioning method (if applicable) is as follows:

Data Sharing Between DP System and Gangway Control System and Technical Requirements

Table 7.2.5.1

S/N	Real-time monitoring items/data fusion processing	Parameter	Technical requirements
1	Marine environment	Wind speed, wind direction, current speed, current direction and wave period characteristics	Ships or offshore installations have real-time marine environment monitoring information. The gangway control system obtains real-time marine environment information by sharing data with ships or offshore installations and uses it as a key input parameter for the short-term motion forecast model of the ships or offshore installations.
2	Multi-degree-of-freedom for ships or offshore installations	Multi-degree-of-freedom position, velocity and acceleration	The gangway motion sensor and the DP system of the ships or offshore installations work together to complete the real-time monitoring of the parameters in the left column and obtain real-time data information. Data are input to the gangway motion forecast model.
3	Relative position of ships or offshore installations	Relative three-dimensional distance, relative spatial position, induced velocity and acceleration	The relative three-dimensional distance between ships or offshore installations and the relative spatial position between the overlap points at both ends of the gangway, as well as their induced velocity and acceleration, are output in a real-time manner by the motion sensor and position sensor of the gangway. Combined with the output information basis of the DP system of the ships or offshore installations, the parameter values in the left column are obtained using a mathematical model to complete the real-time monitoring of the relative position of ships or offshore installations, providing direct input conditions for the motion compensation control of the

S/N	Real-time monitoring items/data fusion processing	Parameter	Technical requirements
			gangway.
4	Gangway attitude	Length, angle, and altitude, as well as the real-time six-degrees-of-freedom coordinates of the overlap points at the gangway ends	The attitude, telescoping position, rotation angle, and angular acceleration of the gangway are monitored to provide both accurate input information to the motion compensation control system of the gangway and quantitative safety indicators for the personnel transfer under normal operating conditions.
5	Identification, processing and analysis of monitoring data	Data accuracy and quality	Based on the characteristics of various monitoring data and their sensors, corresponding data identification and modification strategies are developed for the accuracy and quality of different signal data. Additionally, a real-time data monitoring and processing scheme is developed to meet the requirements for gangway motion control.
6	Multi-channel data fusion	Data summarization and conversion	The data monitored from multiple channels are sorted, summarized, converted and fused by computer to obtain data directly used for the control of the gangway compensation system and the safety of personnel and materials.

7.2.5.2 The CCS surveyor shall check the consistency between the output data of the dynamic positioning (DP) system of ships or offshore installations and the received data of the gangway control system according to the parameters and technical requirements for identification, processing and analysis of monitoring data and for multi-channel data fusion given in Table 7.2.5.1. If necessary, the manufacturer's full-time software technicians will conduct debugging until all requirements are met.

Chapter 8 Survey of Class Notations for Gangway

Section 1 General Provisions

8.1.1 General requirements

8.1.1.1 The requirements in this Chapter apply to gangways that have been granted class notations in accordance with applicable requirements in Section 5, Chapter 1 of the Guidelines.

8.1.1.2 For gangways on ships or offshore installations transitioning to CCS class, plans and documents shall be submitted for review in accordance with the applicable requirements in Section 4, Chapter 1 of the Guidelines. The gangway structure, mechanical, electrical and other equipment and systems shall be surveyed in accordance with the requirements for special surveys in 8.1.4 of this Chapter.

8.1.2 Annual surveys

8.1.2.1 Annual surveys shall include at least the following items:

- (1) Visual inspection of the gangway structure for defects such as cracks, distortion and corrosion, and NDT if necessary;
- (2) Visual inspection of supporting structures for defects such as cracks, distortion and corrosion, and NDT if necessary;
- (3) Inspection of the operating status of the slewing system to confirm that the slewing bearing and lubrication, bolts and their pretightening forces are in normal conditions;
- (4) Inspection of the operating status of telescoping system (including sliding surface) to confirm that it is in normal operating condition; visual inspection of the operating status of luffing system including hydraulic cylinder components to confirm that they are in normal operating conditions;
- (5) Function test;
- (6) Operation test of safety system and alarm system;
- (7) Inspection of the hydraulic system for leakage and confirmation of the opening pressure of the safety valve;
- (8) Condition inspection of electrical system;
- (9) Inspection of fire extinguishing system (sprinkler), if applicable.

8.1.3 Intermediate surveys

8.1.3.1 Intermediate surveys of the gangway shall follow the requirements for annual surveys.

8.1.4 Special surveys

8.1.4.1 In addition to the annual survey items listed above, special surveys shall also include the following items. The surveyor may add further items at his/her discretion if deemed necessary;

- (1) Load test on the gangway in accordance with the requirements in 6.2.10 Load test of the Guidelines.
- (2) Condition inspection and confirmation of the hydraulic cylinder fixed shaft, shaft pin and shaft sleeve. If necessary, disassemble them for inspection.

(3) Inspection of the slewing bearing by opening it, and magnetic particle testing on the inner fillets, raceways and bolts of the bearing. Opening it for inspection is not required if the bearing meets the following conditions:

- ① Approved fixtures (retainers) are installed or;
- ② The slewing bearing has been specially modified, and NDT has been carried out by a NDT company approved by CCS to check for cracks.

(4) Inspection of anchor bolts:

- ① First, dismantle and inspect 20% of the anchor bolts in the area where the gangway is most stressed. If serious defects are found, dismantle and inspect additional 20% of the anchor bolts. If defects are found again, dismantle and inspect all bolts;
- ② If 20% of the anchor bolts inspected for the first time are in good condition, mark them, and inspect the remaining 80% during the next special survey;
- ③ When installing new anchor bolts, tighten them to the pretightening forces specified in the Gangway Operation Manual or approved drawings.