Regulations on Structural Safety for Wind Turbines and ClassNK Certification Services

【Website public version】

01 March 2026
NIPPON KAIJI KYOKAI

Attention and Revision history

<Attention>

- This paper is created and released for the purpose of providing an overview of the services offered by ClassNK, as well as an outline of its service provision policies and underlying principles.
- Please check the latest version on the website because the contents of this paper will be update.
- Any unauthorized secondary use of this paper, in whole or in part—including but not limited to reproduction, copying, reprinting, redistribution, modification, adaptation, editing, alteration, translation, or other forms of reuse—is strictly prohibited without prior permission.
  - In case that such unauthorized use is discovered, a warning will be issued, and legal action may be taken in cases of serious or malicious infringement.
- If you wish to reproduce this paper or provide a link to a reproduced copy, please contact us in advance using the contact details provided below.

NIPPON KAIJI KYOKAI
Renewable Energy Department
TEL: +81-3-5226-2032、E-mail: re@classnk.or.jp

<Revision history>

Revision	Released date	Changes
0	01 March 2026	Newly Created and Released

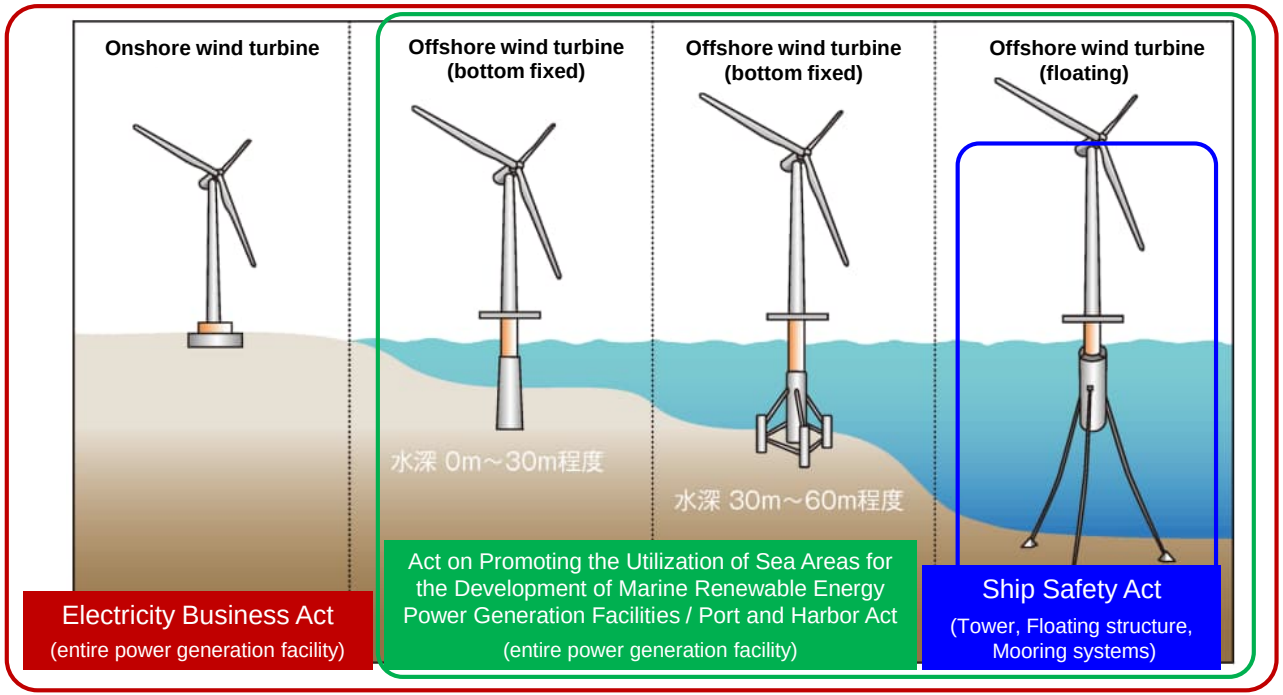
Table of Contents

1. Laws and Regulations for Structural Safety of Wind Turbines

1. Laws and Regulations for Structural Safety of Wind Turbines

<Outlines of laws and regulations applied to the safety of wind farm>

- Wind turbine and entire power generation facility：Electricity Business Act
- Offshore wind turbine (bottom fixed and floating) : Port and Harbor Act
- Floating structure and Mooring systems (floating) : Ship Safety Act



Source: NEDO, Renewable Energy Technology White Paper, 2nd Edition (Chapter 3: Wind Power Generation, p. 72, Figure 3-69) : https://www.nedo.go.jp/content/100544818.pdf

1. Laws and Regulations for Structural Safety of Wind Turbines

The major laws applicable to the structure and equipment of wind power generation facilities from a safety perspective are as shown in the table below. 【As of March 2026】

Applicable laws	Scope	Technical standards
Electricity Business Act	Electric facilities installed to generate electricity using wind power as the prime mover	•Ministerial Ordinance Prescribing Technical Standards for Wind Power Generation Facilities (Ordinance of Ministry of International Trade and Industry No. 53 of 1997) •Ministerial Ordinance Prescribing Technical Standards for Electrical Facilities (Ordinance of Ministry of International Trade and Industry No. 52 of 1997)
Port and Harbor Act	Mooring facilities provided for marine renewable energy power generation facilities, etc., as specified in Article 28-2 of the Enforcement Regulations of the Port and Harbor Act (facilities designed taking into account damage and other effects resulting from loads acting from marine renewable energy power generation facilities, etc.).	•Enforcement Regulations of the Port and Harbor Act (Ministry of Transport Ordinance No. 98 of 1951) •Ministerial Order Establishing Technical Standards for Port and Harbor Facilities (Ministry of Land, Infrastructure, Transport and Tourism Ordinance No. 15 of 2007) •Notification Establishing Detailed Provisions of the Technical Standards for Port and Harbor Facilities(Ministry of Land, Infrastructure, Transport and Tourism Notification No. 395 of 2007)
Ship Safety Act	Floating offshore wind power generation facilities (towers, floating structures, and mooring systems) as specified in the notification issued pursuant to Article 1, Paragraph 4 of the Enforcement Regulations of the Ship Safety Act	•Technical Standards for Floating Offshore Wind Power Generation Facilities(No. 194 of the National Maritime Safety Agency, dated April 23, 2012; partially revised by No. 286 of the National Maritime Safety Agency, dated March 3, 2020)

1. Laws and Regulations for Structural Safety of Wind Turbines

Scope and approval format of major laws applicable to the structure and equipment of wind power generation facilities from safety perspective

Scope and approval format	Electricity Business Act	Port and Harbor Act	Ship Safety Act
Onshore wind farm	Applied	N/A	N/A
Offshore wind farm (bottom fixed)	Applied	Applied	N/A
Offshore wind farm (floating)	Applied	Applied	Applied
Approval format	Construction Plan Notification [directly reviewed by Japanese Government] + [Registered Conformity Assessment Body]	Conformity Verification by CDIT, a confirmation agency registered with the Minister of Land, Infrastructure, Transport and Tourism	Classification Survey by ClassNK, a classification society registered with the Minister of Land, Infrastructure, Transport and Tourism

Refer to review results of WFC by ClassNK

- Of the review items applied to the support structures of offshore wind farm and their ancillary equipment, items common to these three laws are jointly reviewed under the wind farm certification with CDIT.
- In practice, the wind farm certification and the conformity assessment based on the Electricity Business Act are operated as an integrated process.

1. Laws and Regulations for Structural Safety of Wind Turbines

Electricity Business Act regulation

- When a person intends to implement a construction project to install or modify wind power generation facilities for business use, the person must notify the competent minister of plan for the construction project. (Article 48)
- When a person installs special electric facilities for business use must be confirmed Order for Conformity to Technical Standards by Registered Conformity Assessment Body. (Article 48)
  - When a person intends to construct wind farm that have an output of 500 kilowatts or more , the person must submit prior notification. (Appended table 2 , Electricity Business Act Enforcement Regulations)
  - Special electric facilities are defined as wind turbine and support structures of wind power generation facilities.
- A person that installs electric facilities for business use must maintain the electric facilities for business use to ensure that they conform to the technical standards established by order of the competent ministry. (Article 39)
  - In case of wind power generation facilities : Technical Standards for wind power generation facilities established by order of the competent ministry. (Ordinance of Ministry of International Trade and Industry No. 53 of 1997)
  - In case of floating offshore wind turbine : support structures of wind power generation facilities (floating structure, mooring system, tower) must be conformed Ship Safety Act due to the following regulations;

<Ministerial Order Establishing Technical Standards for Wind Power Generation Facilities>

(Structure to support the wind turbine)
Article 7. The structure supporting the wind turbine shall be structurally safe against its own weight, loading capacity, snow and wind pressure, and against earthquakes and other vibrations and impacts.

<Interpretation of Technical Standards for Wind Power Generation Facilities>

(Ministerial Ordinance Article 7) Article 16
(2) The structure supporting the wind turbine (limited to those structures subject to the provisions of Article 2, Paragraph 1 of the Ship Safety Act) shall conform to the provisions of the same paragraph.

Source: METI website / Laws and Regulations | Electricity Safety: https://www.meti.go.jp/policy/safety_security/industrial_safety/law/index.html

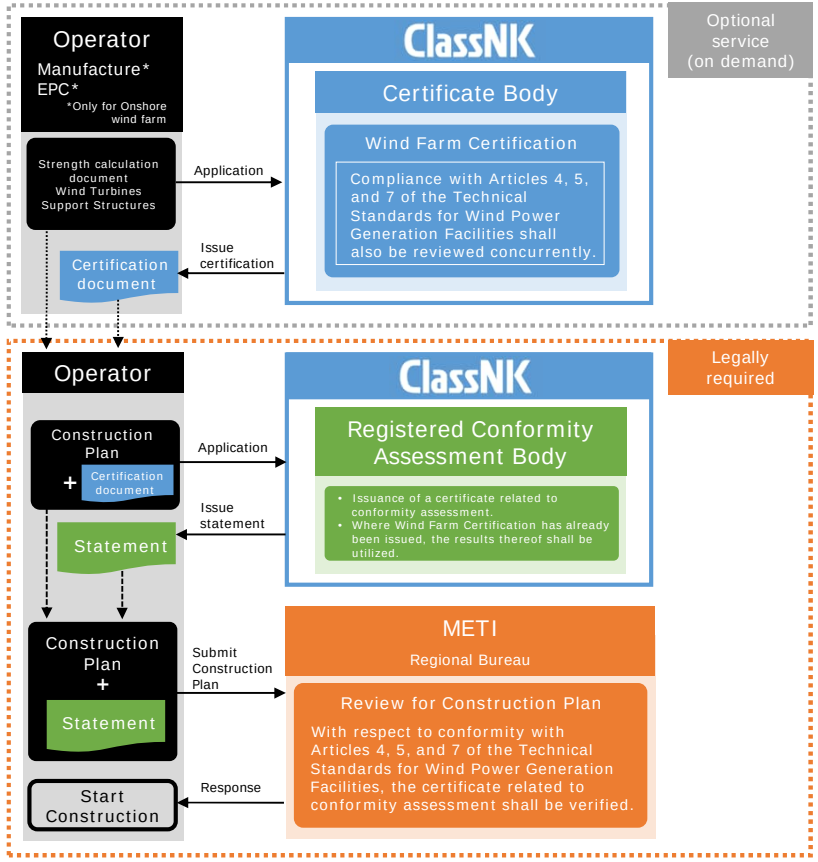
1. Laws and Regulations for Structural Safety of Wind Turbines

Prior confirmation by a Registered Conformity Assessment Body

- ClassNK was registered by the Minister of Economy, Trade and Industry as a “Conformity Assessment Body” effective March 31, 2023, and commenced its operations as a “Registered Conformity Assessment Body” on April 5, 2023.
- The scope of its services covers onshore, offshore (bottom fixed), and offshore (floating) wind power facilities, in accordance with the operational regulations submitted by ClassNK.

【ClassNK Policy】

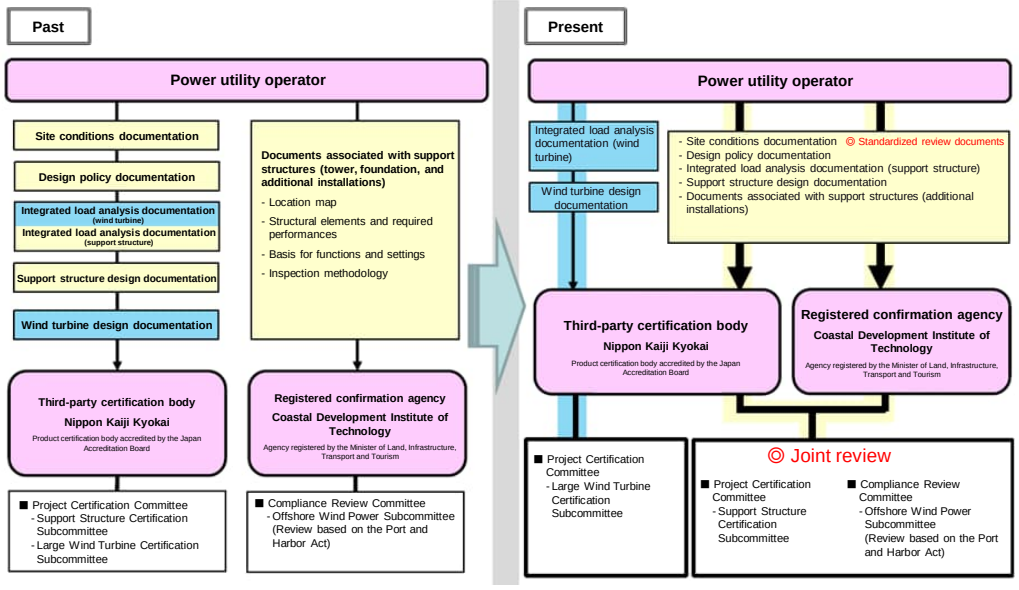
- A scheme shall be adopted whereby Wind Farm Certification is conducted as a preliminary step prior to conformity assessment.
  - The review may commence even if all documents required for the construction plan notification and its attachments (as stipulated in Appendix Table 3 of the Ordinance for Enforcement of the Electricity Business Act) have not yet been fully prepared.
  - A system shall be established to respond to a wide range of needs, not only from power producers but also from wind turbine manufacturers, EPC contractors, and other stakeholders.(Applicable to onshore wind power plants only.)
- It is also possible to apply directly to a Conformity Assessment Body without obtaining Wind Farm Certification ; however, the following conditions must be satisfied:
  - The applicant shall be limited to the power producer.
  - At the time of application, all documents to be attached to the construction plan notification (as stipulated in Appendix Table 3 of the Ordinance for Enforcement of the Electricity Business Act) shall be fully prepared.
  - All documents submitted at the time of application shall be in Japanese only.



Port and Harbor Act compliance

Unified review system overview

○ Standardizing the review documents for offshore wind farm support structures and submitting the same documents to both organizations reduces the burden on power utility operators.
○ Unifying the process through a joint review shortens the review duration.



- With regard to regulations under the Port and Harbor Act, these matters fall outside the scope of ClassNK's responsibilities; therefore, no overview explanation is provided in this document.
- The Subcommittee on Support Structure Certification – Offshore (bottom fixed) Section / Offshore (floating) Section described on pages 41 and 56 of this document is planned to be held jointly with CDIT.

Note: In case of a dispute over translation, Japanese text shall prevail

Source of the figure: Joint press release issued on March 31, 2021, by the Coastal Development Institute of Technology and ClassNK (Nippon Kaiji Kyokai).

Ship Safety Act regulation

Ship Safety Act

Article 2 Ships shall be outfitted pursuant to the provisions of ordinances of the Ministry of Land, Infrastructure, Transport and Tourism (ordinances of the Ministry of Land, Infrastructure, Transport and Tourism and ordinances of the Ministry of Agriculture, Forestry and Fisheries only with regard to fishing vessels) with regard to the following matters:

(i) Hull
(ii) to (xiii) (omitted)

Order for Enforcement of the Ship Safety Act (Ministry of Transport Ordinance No. 41 of 1963, as partially amended by Ministry of Land, Infrastructure, Transport and Tourism Ordinance No. 41 of 2022)

Article 1, Paragraph 4In this Ordinance, the term “special ship” means a nuclear-powered ship (as defined in Article 2 of the Regulations Concerning Special Nuclear-Powered Ships (Ministry of Transport Ordinance No. 84 of 1967); hereinafter the same shall apply), a submarine, a hydrofoil craft, an air-cushion vehicle, a surface effect ship (as defined in Article 21-2 of the Order for Enforcement of the Act on Preventing Collision at Sea (Ministry of Transport Ordinance No. 19 of 1977); hereinafter the same shall apply), a seabed resource drilling ship, a semi-submersible or self-elevating ship, a ship equipped with diving apparatus (limited to those carrying personnel therein; hereinafter the same shall apply), and any other ship having special structures or equipment as specified by public notice.

Public Notice Establishing Vessels with Special Structures or Equipment under Article 1, Paragraph 4 of the Ordinance for Enforcement of the Ship Safety Act

Ships with special structures or equipment as established in the Public Notice under Article 1, Paragraph 4 of the Ordinance for Enforcement of the Ship Safety Act are as follows:

(i) to (iii) (omitted)
(iv) Floating offshore wind power facilities (Ministry of Transport Notification No. 56 of 1980, as partially amended by Ministry of Land, Infrastructure, Transport and Tourism Notification No. 183, dated June 19, 2019.)

Technical Standards for Floating Offshore Wind Power Facilities
Kokkaian No. 194 dated April 23, 2012
Partially Amended Kokkaian No. 286 dated March 3, 2020

Technical standards establishing the requirements for structures and facilities based on the Ship Safety Act

<Source>
Ministry of Land, Infrastructure, Transport and Tourism website: Promoting the use of floating offshore wind power facilities - Establishing technical standards for ensuring safety - https://www.mlit.go.jp/maritime/maritime_fr6_000006.html

Ship Safety Act regulation

Ship Safety Act
Article 8 Under Article 25-47 applied mutatis mutandis pursuant to Article 23-69 and Article 25-72, ship out of passenger ship (the capacity is over 12 people ; hereinafter the same as) that have been surveyed by ClassNK ,“Classification Society authorized by the Minister of Land, Infrastructure, Transport and Tourism” (hereinafter the “Classification Society”), and that have registered as classification are regarded as having undergone inspection about what is listed in the Article 2 Cause 1 each number, such as load line / radio telegraph, and to have passed such by the maritime authorities excluding inspection established by order of the Minister of Land, Infrastructure, Transport, and Tourism during having effective certification.

- ClassNK is a “Classification Society authorized by the Minister of Land, Infrastructure, Transport and Tourism” as prescribed in Article 8 of the Ship Safety Act.
- Floating offshore wind power facilities that have been surveyed by ClassNK, a “Classification Society authorized by the Minister of Land, Infrastructure, Transport and Tourism,” and that have registered as classification are regarded as having undergone inspection and to have passed such by the maritime authorities*.
- For convenience, the inspections conducted by NK for this floating offshore wind power facility are referred to as “Class Surveys”.

*maritime authorities : the headquarter of Transport Bureau or Maritime Bureau dealing with ship register

2. Certification Services Provided by ClassNK

Type certification

Large wind turbine type certification

Conducts evaluations based on various technical standards related to wind turbines, such as design conformity assessments and type testing assessments using test units, and ultimately issues a type certificate.

Small wind turbine type certification

Evaluates the conformity of small wind turbines to the requirements in international and domestic standards (performance and safety) and issues a type certificate.

Wind Farm Certification

Wind Farm Certification

Certification service for wind farm. Confirm and certify that wind turbines and their support structures are designed to satisfy the environmental conditions of the site where the wind farm is to be constructed, as well as the requirements stipulated under the Electricity Business Act, and that they are structurally safe.

Wind turbine support structure technical evaluation

[Technical / Design]

A certification service that conducts third-party reviews and evaluations against the requirements defined for wind farm certification carried out as a preliminary step to obtaining permits and approvals under domestic laws and regulations, for technologies related to wind turbine support structures not covered by existing international standards or guidelines.

[Material / Product]

A certification service that conducts third-party reviews and evaluations against the requirements for permits and approvals under domestic laws and regulations, for materials and products used in wind turbine support structures.

Wind turbine certification [Large wind turbines]

Design conformity assessment

- Assesses whether the wind turbine is designed and documented according to the design assumptions, specific standards, and other technical requirements

Prototype certification

- Design evaluation specialized in verifying safety when constructing test units

Type testing

- Verifies the output performance and performs an experimental safety verification through the actual operation of the test unit

Manufacturing evaluation

- Assesses whether the wind turbine is manufactured according to the design documents verified during the design evaluation

Wind Turbine Certification Body Certificate (Japan Accreditation Board)

Type certification

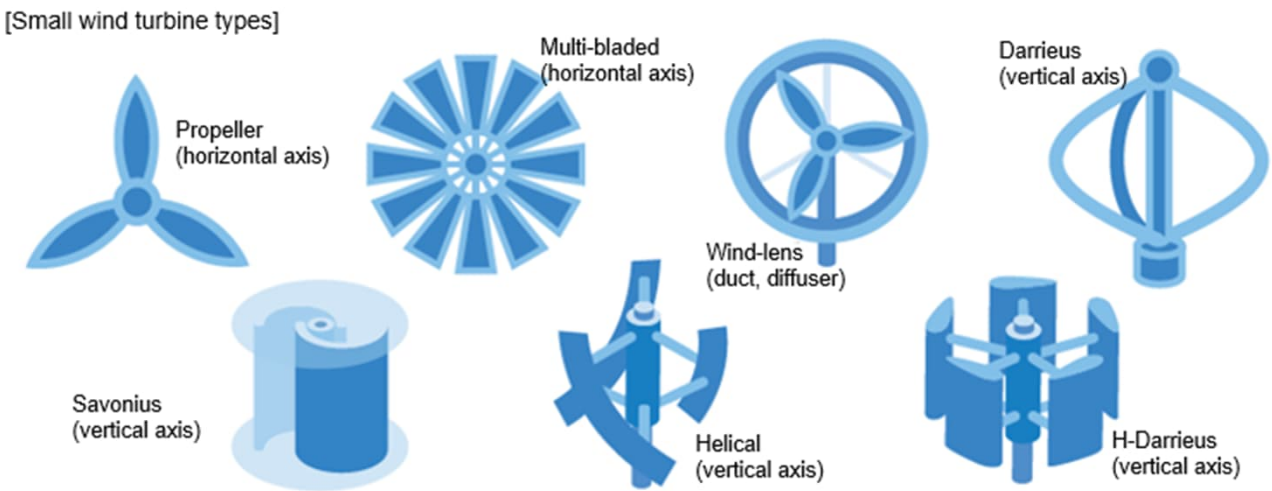
- A certificate is granted to wind turbines that satisfy every requirement in the design evaluation, type test, and manufacturing evaluation

Wind turbine certification [small wind turbines]

- Verifies whether the performance and safety of the wind turbine complies with the requirements specified in the Japan Small Wind Turbines Association Standards (JSWTA0001).
- Certification procedures comply with the “Guidelines for Certification of Wind Turbines and Wind Farms”

Small wind turbine definition

- Swept area: less than 200 m^2
- Output: less than 20 kW



Wind Turbine Certification Body Certificate (Japan Accreditation Board)

Wind Farm Certification overview

Evaluates the environmental conditions of the site where the wind farm is to be constructed and verifies that the strength and safety of the wind turbine and support structure are secured in terms of the design based on the environmental conditions. (This certification is unique to Japan and is intended for conformity to the Technical Standards for Wind Power Generation Facilities.)

- In principle, Wind Farm Certification is for wind farms in Japan that have an output of 500 kilowatts or more, consist of one or more wind turbines (RNA) and their support structures (tower and foundation), and are subject to the Electricity Business Act.
- The purpose of Wind Farm Certification is to assess whether the design for type-certified wind turbines (RNA) and their support structures (tower and foundation) are in conformity with the external conditions and the requirements under the Electricity Business Act.

<Main compliance criteria for wind farm certification>

- Ministerial Ordinance Prescribing Technical Standards for Wind Power Generation Facilities (Ordinance of Ministry of International Trade and Industry No. 53 of 1997)
- Interpretation of Technical Standards for Wind Power Generation Facilities (Ministry of Economy, Trade and Industry, No. 20230310, Bureau of Commerce No. 2, April 1, 2024)
- Guidelines for Design of Wind Turbine Support Structures and Foundation (Japan Society of Civil Engineers, 2010)

NIPPON KAIJI KYOKAI is accredited by the Japan Accreditation Board as an ISO/IEC 17065 (JIS Q 17065) Product Certification Body based on the Board's "Wind Power Generation System: Windfarm" accreditation criteria.

- Japan Accreditation Board website, accredited Product Certification Bodies : https://www.jab.or.jp/certification_institutions/863

ClassNK Accredited Certification Body for Wind Turbine Products
JAB Product P0070

Wind turbine support structure: Technical evaluation [Technical / Design]

A certification service that conducts third-party reviews and evaluations against the requirements defined for Wind Farm Certification carried out as a preliminary step to obtaining permits and approvals under domestic laws and regulations, for technologies related to wind turbine support structures not covered by existing international standards or guidelines.

<Review scope>

- Scope defined by the applicant with respect to technical and design methodologies, applicable to the following items
  - Onshore : Tower / Foundation
  - Offshore (Fixed) : Tower / Substructure / Foundation
  - Offshore (Floating) : Tower / Floating Structure

<Review criteria>

- As the review targets technologies and design methodologies that are not covered by existing international standards or guidelines, the review scope is defined on a case-by-case basis while the review proceeds.
- Reviews are conducted in the form of a committee comprising experts appropriate to the subject under review.

[Examples of previously issued certificate]

- For offshore (fixed bottom type) wind farm: Design methods for grouted connection of monopile foundation
- For offshore (floating type) wind farm: Design methods for composite structures of steel and concrete applied to floating structure
- For onshore wind farm: Design method of the anchoring section

Wind turbine support structure: Technical evaluation [Material / Product]

A certification service that conducts third-party reviews and evaluations against the requirements for permits and approvals under domestic laws and regulations, for materials and products used in wind turbine support structures. This applies to cases that do not fall under any of the following:

- Building Standards Act, Article 37: “Designated building materials”
- Materials approved by the Minister of Land, Infrastructure, Transport and Tourism
- Materials approved in terms of performance assessments pertaining to technical standards conformity for wind power generation facilities

<Review scope>

Tower flanges / Flange joint bolt and nut flat washer sets / Anchor bolts / Steel plates

<Review criteria>

- The review criteria used in the Ministry of Land, Infrastructure, Transport and Tourism Minister’s certification process under the Building Standards Act are applied mutatis mutandis (in the course of the technical review, a fatigue strength evaluation, which is important for wind power generation facilities, may be added)

Technical review (Statistical assessment)	Quality control system review
◆ Chemical property value stability (component ratio of present elements, especially weldability, crack sensitivity, etc.) ◆ Physical property value stability (dimensions, hardness, strength, tolerance, variance, relaxation, delayed fracture resistance, etc.)	◆ A quality management system equivalent to ISO 9001 is in place. ◆ A subcontract management system is in place and properly operated. ◆ A receiving system is in place and an inspection system at each stage within the company has been established. ◆ Testing and inspection equipment are properly managed.

3. Overview of Services for Onshore Wind Farm

Legal Regulations on Structural Safety for Onshore Wind Farm

Scope and approval format	Electricity Business Act	Port and Harbor Act	Ship Safety Act
Onshore wind farm	Applied	N/A	N/A
Offshore wind farm (bottom fixed)	Applied	Applied	N/A
Offshore wind farm (floating)	Applied	Applied	Applied
Approval format	Construction Plan Notification [directly reviewed by Japanese Government] + [Registered Conformity Assessment Body]	Conformity Verification by CDIT, a confirmation agency registered with the Minister of Land, Infrastructure, Transport and Tourism	Classification Survey by ClassNK, a classification society registered with the Minister of Land, Infrastructure, Transport and Tourism

From the perspective of structural safety, compliance with regulations under the Electricity Business Act is required.

- Compliance with the Electricity Business Act: conformity assessment and, as a preliminary step thereto, Wind Farm Certification (see p. 8–9 and p. 21–28).

Guidelines: Wind Farm Certification - Onshore Wind Farm edition

- ClassNK has compiled the requirements as formulated based on a number of examples of past Wind Farm Certification reviews for onshore wind farms and issued this compilation as a new set of guidelines in July 2021. The latest edition is the September 2024 version.
  - ✓ Since the start of certification services in 2016, ClassNK has issued Wind Farm Certificates for 241 onshore wind farms (as of the end of December 2025).
- The September 2024 edition reflects the following standards that were promulgated on April 1, 2024, and came into force on October 1 of the same year.
  1) Ordinance to Partially Amend the Ordinance Prescribing Technical Standards for Wind Power Generation Facilities
  2) Partial Amendment to the Interpretation of the Technical Standards for Wind Power Generation Facilities (Commercial Affairs Bureau Notification No. 1 dated March 28, 2014)

- In addition to certification review requirements, the guideline's annexes cover a comprehensive range of content, including details on implementation and verification methods for airflow analysis and wind pressure coefficients for the nacelle cover, which are based on the results of independent examinations by ClassNK.

Guidelines: Wind Farm Certification - Onshore wind farm edition Table of contents

Download form here : https://www.classnk.or.jp/hp/pdf/authentication/renewableenergy/en/windfarm/NKRE-GL-WFC01_September2024_Eng_20240901.pdf

Wind Farm Certification modules [for Onshore Wind Farms]

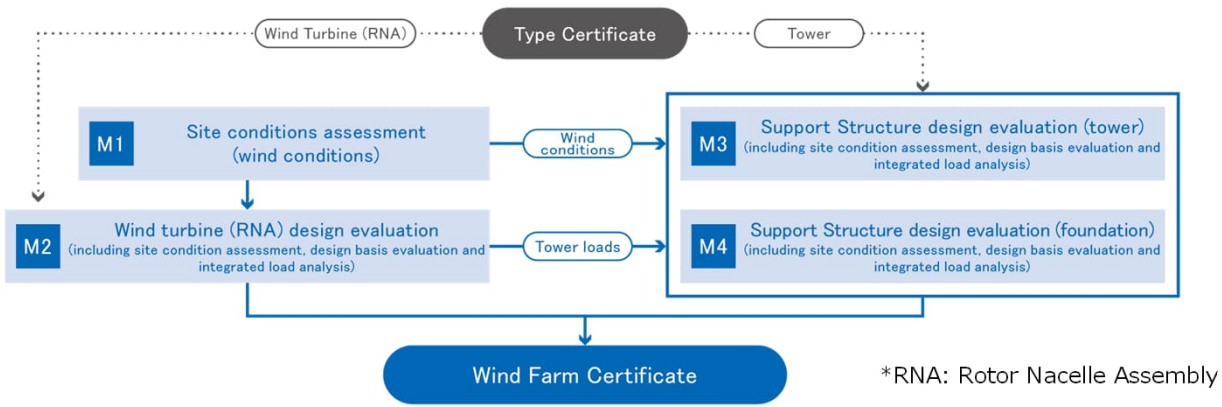
[M1] Site conditions assessment (wind conditions)

[M2] Wind turbine (RNA) design evaluation (including site conditions assessment, design basis evaluation, and integrated load analysis)

[M3] Support structure design evaluation (tower) (including site conditions assessment, design basis evaluation, and integrated load analysis)

[M4] Support structure design evaluation (foundation) (including site conditions assessment, design basis evaluation, and integrated load analysis)

- In the case of onshore wind farms, the applicant may specify whether they will implement all modules or only some modules, according to the applicant's judgement.
  - Considering the application for Registered Conformity Assessment Body, recommend to implement all modules.
  - The same as before, different applicants may apply for each module.



Overview of Certification Subcommittee / Section Meeting

Large Wind Turbine Certification Subcommittee

Evaluation items: [M1] Site conditions assessment (wind conditions)
[M2] Wind turbine (RNA) design evaluation (including site condition assessment, design basis evaluation, integrated wind load analysis)

Support Structure Certification Subcommittee / Tower Section Meeting

Evaluation items: [M3] The Support structure design evaluation (Tower) [including site conditions assessment, design basis evaluation and integrated load analysis] items that deviate from the Guidelines for Design of Wind Turbine Support Structures and Foundation (JSCE 2010).

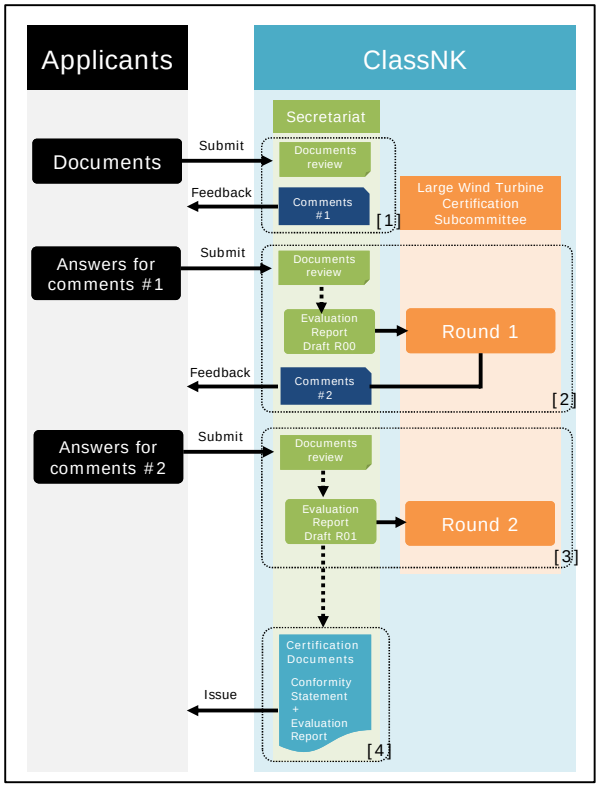
*Among the items to be examined by the Tower Section Meeting as deviations from the Guidelines for Design of Wind Turbine Support Structures and Foundation(JSCE 2010), the items for which the corresponding design methods have been established are summarized in Annex F of NKRE-GL-WFC01. If there is deviation in an item not listed in Annex F, or if a method that is different to the methods listed in Annex F is to be applied, the requirements shall be determined separately by the Tower Section Meeting.

Support Structure Certification Subcommittee / Ground & Foundation Section Meeting

Evaluation items: [M4] The Support structure design evaluation (Foundation) [including site conditions assessment, design basis evaluation and integrated load analysis] items that deviate from the Guidelines for Design of Wind Turbine Support Structures and Foundation (JSCE 2010).

*Among the items to be examined by the Tower Section Meeting as deviations from the Guidelines for Design of Wind Turbine Support Structures and Foundation(JSCE 2010), the items for which the corresponding design methods have been established are summarized in Annex G of NKRE-GL-WFC01. If there is deviation in an item not listed in Annex G, or if a method that is different to the methods listed in Annex G is to be applied, the requirements shall be determined separately by the Tower Section Meeting.

Review process : [M1] Site conditions assessment (wind conditions) + [M2] Wind turbine (RNA) design evaluation



[1] Documents submitted by applicants for review are firstly reviewed by the secretariat.

→ Comments for each documents are informed to applicants. (In some cases, comments is informed after step [2].)

[2] Based on the answers against comments at step [1], the draft Evaluation Report is completed. The secretariat explain their review results to the members of the Large Wind Turbine Certification Subcommittee.

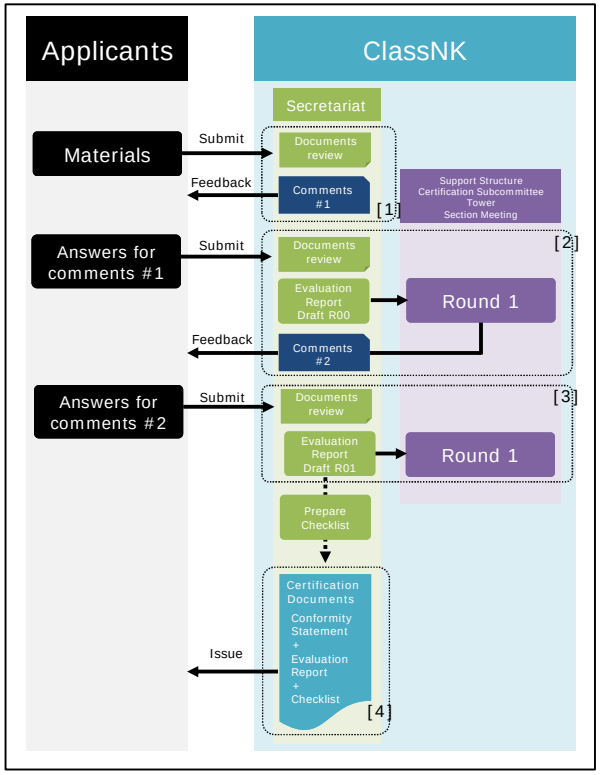
→ All comments at the subcommittee are informed to applicants.

[3] Based on the answers against comments at step [2], the draft Evaluation Report is revised. The secretariat explain the review results of the answers against comments to the members of the Large Wind Turbine Certification Subcommittee.

→Go to step [4] if no more additional comments.
→Repeat step [2] and [3] when additional comments are remaining.

[4] Conformity statement and Evaluation Report are issued formally.

Review process : [M3] Support structure design evaluation (tower)



[1] Review materials submitted by applicants for review are first reviewed by the secretariat.

→ Comments for each documents are informed to applicants.
(In some cases, comments is informed after step [2].)

[2] Based on the answers against comments at step [1], the draft Evaluation Report is completed. The secretariat explain their review results to the members of the Support Structure Certification Subcommittee / Tower Section Meeting.

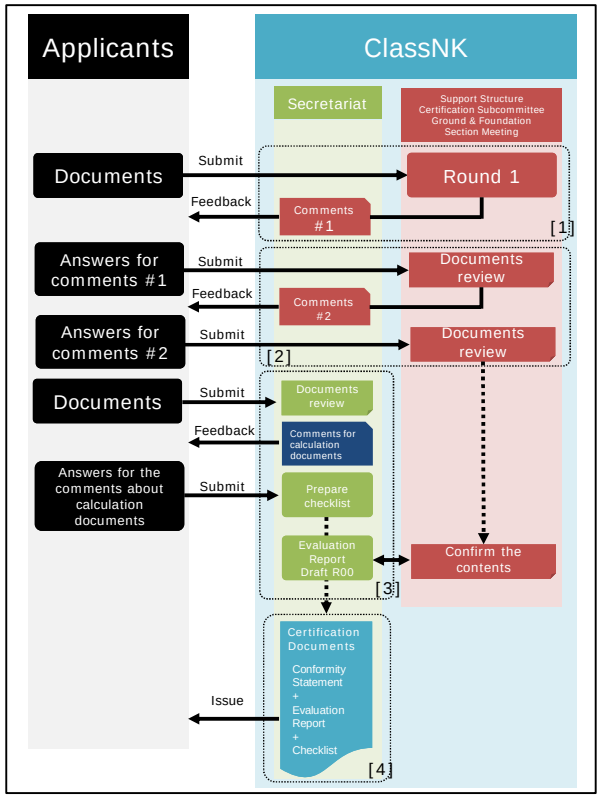
→ This review covers deviated from Guidelines and explanation for the design of support structures of wind power generation facilities (Japan Society of Civil Engineers, 2010), and the others are reviewed by the Secretariat only.
→ All comments at the subcommittee are informed to applicants.

[3] Based on the answers against comments at step [2], the draft Evaluation Report is revised. The secretariat explain the review results of the answers against comments to the members of Support Structure Certification Subcommittee / Tower Section Meeting.

→ Go to step [4] if no comments.
→ Repeat step [2] and [3] when additional comments are remaining.

[4] Conformity statement, Evaluation Report and Checklist are issued formally.

Review process : [M4] Support structure design evaluation (foundation)



In the design of foundations, if there are any deviations from the Guidelines for Design of Wind Turbine Support Structures and Foundations [2010 Edition], start from [1]. If there are no deviations, start from [3].

[1] Based on the documents submitted by the applicants, members of the Support Structure Certification Subcommittee / Ground & Foundation Section Meeting review with a focus on those items which are deviated from Guidelines for the Design of Wind Turbine Support Structures and Foundations [2010 Edition].

→ The Support Structure Certification Subcommittee utilizes a format in which the operator, support structure design firm, and wind turbine manufacturer directly explain the design to the experts in each field that serve as committee members.

[2] The answers to comments during the step [1] are confirmed by document review. Documents review is similarly conducted for additional study documents and newly added comments.

→ Go to Step [3], when applicants answered against all comments and received no more new comment about their answers and additional study documents.

→ Depending on the comments and answers against comments, 2nd subcommittee will be held instead of documents review.

[3] The secretariat conducts a review of calculation documents and exchanges comments and prepare checklist.

→ Also, reviewed results at the Support Structure Certification Subcommittee / Ground & Foundation Section Meeting which is mentioned in the evaluation report is confirmed by its members.

[4] Conformity statement, Evaluation Report and Checklist are issued formally.

3. Overview of Services for Onshore Wind Farm

Windfarm Certificate and Certification Assessment Report Issuance System [for Onshore Wind Farms]

[M1] Site conditions assessment (wind conditions)

- **Site Conditions Conformity Statement**
  - Evaluation Report (site conditions assessment, wind conditions)

[M2] Wind turbine (RNA) design evaluation

- **RNA Design Conformity Statement**
  - Evaluation Report (wind turbine design evaluation)

[M3] Support structure design evaluation (tower) / [M4] Support structure design evaluation (foundation)

- **Support Structure Design Conformity Statement**
  - Evaluation Report (support structure design evaluation, tower)
  - Evaluation Report (support structure design evaluation, foundation)
  - Checklist

Support Documents for Registered Conformity Assessment Body

- **Windfarm Certificate**
  - Conformity checklist of Technical Standards for Wind Power Generation Facilities (Article 4,5 and 7)

- Windfarm Certificate will be issued in case when an application for all of modules ([M1] to [M4]) are submitted. (This certificate will be issued for power utility operator if applications for review is made separately for each module.)
- In case where no application for any of four (4) modules, a checklist with only the items for the modules that have been evaluated will be issued. (No Windfarm Certificate will be issued.)

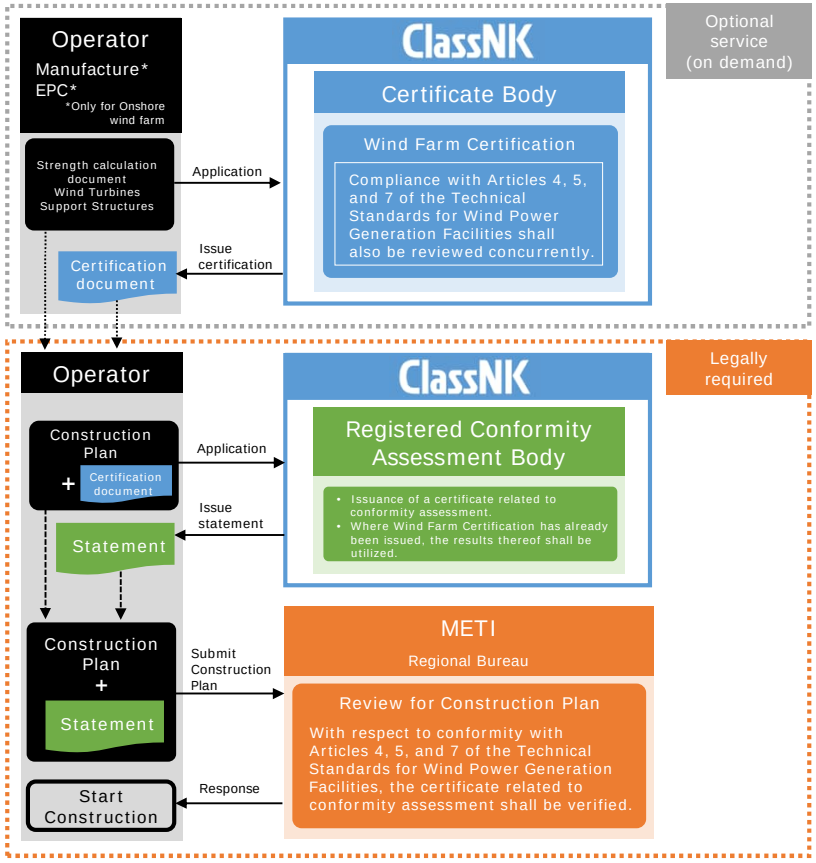

ClassNK
RNA Design Conformity Statement
SAMPLE

Example of a Conformity Statement


ClassNK
認証評価報告書
（風車設計評価）
SAMPLE

Example of a Certification Assessment Report

3. Overview of Services for Onshore Wind Farm



- Following the issuance of the Wind Farm Certification documentation, the process proceeds to conformity assessment.

- The conformity assessment shall be conducted in accordance with NKRE-SP-0009, the Operational Regulations* for Registered Conformity Assessment Bodies.

*: Japanese only

NKRE-SP-0009 Operating regulation for Conformity Assessment

<Table of contents>

4. Overview of Services for Offshore (Bottom Fixed) Wind Farm

Legal Regulations on Structural Safety for Offshore (Bottom Fixed) Wind Farm

Scope and approval format	Electricity Business Act	Port and Harbor Act	Ship Safety Act
Onshore wind farm	Applied	N/A	N/A
Offshore wind farm (bottom fixed)	Applied	Applied	N/A
Offshore wind farm (floating)	Applied	Applied	Applied
Approval format	Construction Plan Notification [directly reviewed by Japanese Government] + [Registered Conformity Assessment Body]	Conformity Verification by CDIT, a confirmation agency registered with the Minister of Land, Infrastructure, Transport and Tourism	Classification Survey by ClassNK, a classification society registered with the Minister of Land, Infrastructure, Transport and Tourism

From the perspective of structural safety, compliance with laws and regulations under Electricity Business Act and Port and Harbor Act is required.

- Compliance for Electricity Business Act : conformity assessment and, as a preliminary step thereto, Wind Farm Certification (refer to p.8~9 / p.32~44)
- Compliance for Port and Harbor Act : Joint review with CDIT (refer to p.10, 44)

Wind Farm Certification module【Offshore Wind Farm】

[OM1] Site conditions assessment

- Assess environmental conditions at the construction site (environmental conditions include general weather conditions, such as wind conditions, temperature conditions, and humidity conditions, as well as marine conditions, altitude conditions, landforms, topography, earthquakes, lightning, and changes in operating methods related to grid interconnections)

[OM2] Design basis evaluation

- Evaluates whether appropriate design criteria (design policies, etc.) considering the site conditions have been set based on the design criteria applied at the time of type certification for the purpose of safe design and project execution.

[OM3] Integrated load analysis evaluation

- Evaluates whether the loads and load effects for the site-specific environmental conditions on the integrated wind turbine structure, including the wind turbine, support structure (including tower, substructure, foundation), and supporting soils, have been calculated in conformity with the design basis.

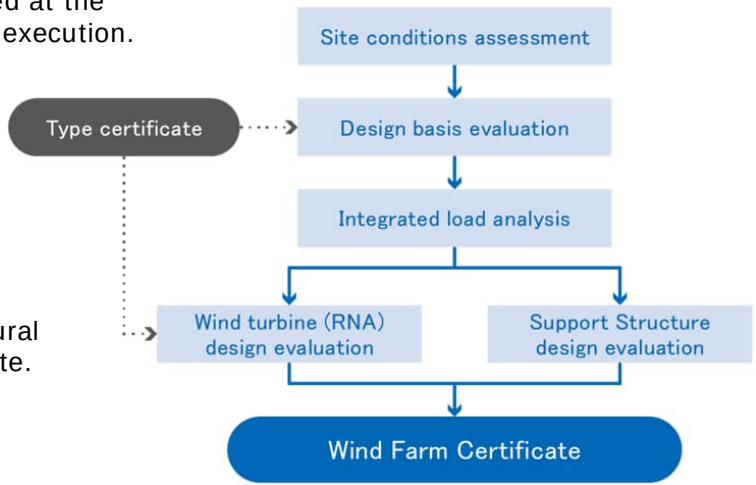
[OM4] Wind turbine (RNA) design evaluation

- Evaluates whether the type-certified wind turbine (RNA) has structural integrity against the environmental conditions of the construction site.

*RNA: Rotor Nacelle Assembly

[OM5] Support structure design evaluation

- Evaluates the structural integrity of the support structure (including tower, substructure, foundation) against the environmental conditions of the construction site.



*In the case of offshore wind farms, only the power utility operator can apply for review.
(Applications for review cannot be made separately for each module)

[OM1] Site conditions assessment [1]

■ Evaluates whether the following value settings for environmental and external conditions at the construction site as provided by the operator are valid.

Classification	Item (examples)	Setting methods, etc. (examples)
Wind conditions	[1]Wind conditions during wind turbine operations (wind turbine position and hub height) - 10-minute average wind speed, turbulence intensity, wind shear exponent, air density, etc. [2]Wind conditions during wind turbine storm standby (wind turbine position and hub height) [50-year recurrence periods] - 10-minute average wind speed, turbulence intensity, 3-second average wind speed, wind shear exponent, air density, etc.	[1]Wind conditions during wind turbine operations −Calculate values at each wind turbine position and hub height based on observation data at the site and simulations [2]Wind conditions during wind turbine storm standby −Calculate values at each wind turbine position and hub height based on the reference wind speed under the Building Standards Act or other simulations
Marine conditions	[1]Marine conditions during normal states (during wind turbine operations) (wind turbine position) - Significant wave height, significant wave period, tide level, currents, etc. [2]Marine conditions during storm waves (wind turbine position) [50-year recurrence interval] - Significant wave height, significant wave period, tide level, currents, etc.	[1]Marine conditions during normal periods −Calculate values at each wind turbine position based on observation data at the site and simulations [2]Marine conditions during storm waves −In addition to existing wave observation and wave prediction data, calculate the values at each wind turbine position with reference to design values for nearby port and coastal protection facilities

[OM1] Site conditions assessment [2]

- Evaluates whether the following value settings for environmental and external conditions at the construction site as provided by the operator are valid.

Classification	Item (examples)	Setting methods, etc. (examples)
Soil and Geology	[1]Submarine topography of the sea area [2]Soil composition, structure, and properties at the wind turbine position (physical properties, mechanical properties, etc.)	[1] Conduct a submarine topography survey [2] Set the required values for the design at each wind turbine position based on the results of geophysical exploration, ground boring and sampling, field tests, and laboratory tests
Earthquake	Seismic waves at the wind turbine position [1] Spectrally matched waves [2] Observed waves [3] Site waves	Set [1] and [2] as rarely occurring earthquake ground motions and extremely rarely occurring earthquake ground motions specified in “Interpretation of Technical Standards for Wind Power Generation Facilities” Set [3] as Port and Harbor Level 1 earthquake ground motions specified in the Technical Standards for Port and Harbor Facilities in Japan (consideration should also be given to Port and Harbor Level 2 earthquake ground motions as necessary)
Other environmental conditions	Tsunamis, snow cover, sea ice and ice accumulation, marine growth, temperature and humidity, sea water density, lightning	Set site-specific values based on relevant laws and regulations, local ordinances, and observation data at the site, etc.

[OM2] Design basis evaluation

- Assesses whether the design criteria considering the site conditions (design policies, etc.), as indicated below, have been appropriately set for the purpose of safe design and project execution.

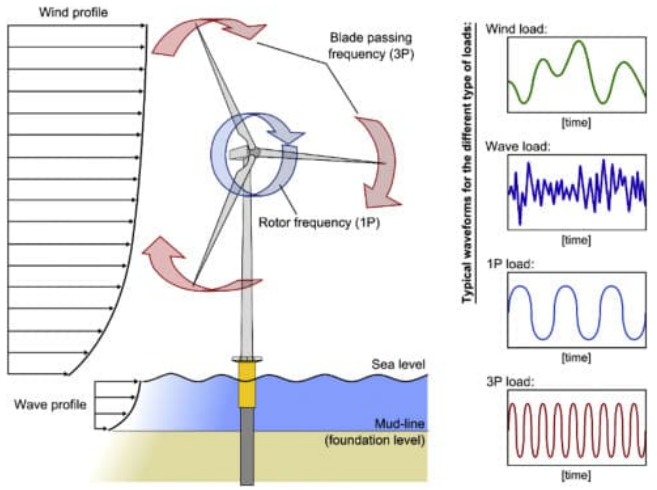
Design Criteria Part A Site conditions (Examples)	Design Criteria Part B Wind turbines and towers (Examples)	Design Criteria Part C Foundation (Examples)
Prepared by: Operator	Prepared by: Wind turbine manufacturer	Prepared by: Foundation designer
1) Wind turbine installation location 2) Wind conditions 3) Wave conditions 4) Other marine conditions 5) Soil and geological conditions 6) Seismic conditions 7) Other environmental conditions 8) Constraints, etc. *Includes items that overlaps with the site conditions assessment	1) Applicable criteria and standards 2) Site conditions 3) Wind turbine and tower specifications 4) Design policy (required performance, reference items, materials used, etc.) 5) Design parameters related to the load calculations, and the validity of the applied load analysis method 6) Load case table 7) Partial safety factor 8) Overview of the load analysis model 9) Simulation details 10) Extreme and fatigue design loads and response analysis 11) Materials and welds 12) Coatings and corrosion prevention systems	1) Applicable criteria and standards 2) Site conditions 3) Support structure specifications (including additional installations) 4) Design policy (required performance, reference items, materials used, etc.) 5) Design parameters related to the load calculations, and the validity of the applied load analysis method 6) Load case table 7) Partial safety factor 8) Overview of the load analysis model 9) Simulation details 10) Extreme and fatigue design loads and response analysis 11) Materials and welds 12) Coatings and corrosion prevention systems

[OM3] Integrated load analysis evaluation

- Assesses whether the loads and load effects for the site-specific environmental conditions on the integrated wind turbine structure, including the wind turbine, support structure, and supporting soils, have been calculated in conformity with the design basis.

<Main assessment items>

1. Combinations of external and design conditions
   - Wind turbine in operation (wind conditions + normal marine conditions during wind turbine operation)
   - Wind turbine during storm standby (wind conditions during wind turbine storm standby + marine conditions during storm waves)
   - During an earthquake (during wind turbine operations/wind turbine emergency shutdown/wind turbine standby)
2. Design load cases defined with reference to site conditions, as well as to wind turbine operational and safety systems
3. Partial safety factor
4. Calculation methods (simulation procedures, number of simulations, and combinations of wind and wave loads, etc.)
5. Analytical model employed as the integrated load analysis and validation outcome for its results



Analysis Concept for a Wind Turbine During Operations (analysis is conducted in consideration of the effects of wind turbine operations, wind, waves, flow, and soil at the same time)

Source: Wind Energy Engineering, A Handbook for Onshore and Offshore Wind Turbines, P. 276

[OM4] Wind turbine（RNA）design evaluation

- Assesses whether the type-certified wind turbine (RNA) has structural integrity against the environmental conditions of the construction site

<Main assessment items>

- Closely examines the following items to verify whether the wind turbine is structurally safe against the site-specific load based on the site conditions obtained from the integrated load analysis

  [1] Comparison of the design load set at the time of type certification (certified design load), and the site-specific load obtained from the integrated load analysis
  [2] Detailed calculation/analysis results for each component when the site-specific load exceeds the design load set at the time of type certification (certified design load)
  [3] Specifications and the validation results for any parts and systems that are NOT fully covered by type certification and that have been newly modified or reinforced for the site

- Assesses connection part between tower top and RNA
  → Closely examines strength evaluation results for tower top load receiving from RNA
- Strength assessment of nacelle cover
  → Closely examines whether the nacelle cover has been satisfied with requirements as Wind Farm Certification
- Assesses the natural frequency
  → Confirm whether the resonance is correctly prevented by comparing natural frequency including support structure and modal frequency with operating wind turbines
- Assesses corrosion prevention (Assesses about corrosion measures for RNA)
- The protection design for the power cable (that passes from the seafloor surface into the wind turbine foundation)
  → Closely examines parts to protect the power cable (In addition, closely examine the adjustment with support structure design evaluation)

[OM5] Support structure design evaluation

- Assesses whether the support structure (including tower, substructure, foundation and each connecting system) has structural integrity against the environmental conditions of the construction site

<Main assessment items>

- Closely examines the following items to verify whether the support structure (including tower / substructure and foundation / floating structure and mooring equipment / each connecting system) is structurally safe against the site-specific load based on the site conditions obtained from the integrated load analysis

  [1] Closely examines validation of drawing and detailed strength calculation statement for the support structure
  → Strength evaluation for the limit states (ULS/FLS/SLS/ALS) associated by designer

  [2] Closely examines validation of drawings and calculation statements for additional installations (such as landing facilities, ladders, platforms, the power cable protection)
  → Strength evaluation for the limit states (ULS/FLS/SLS/ALS) associated by designer
  → Strength detail evaluation for the connection to support structures

- SLS evaluation for support structures
  → Evaluation for wind turbine limitation, such as the residual rotation argument of foundation and natural frequency

- Design for scour protection (if necessary)
  → Evaluation for location and required volume of bagged compaction materials and edge settlement at the location
  → Evaluation for the validation of associated design and inspection / maintenance plan

- Assesses corrosion prevention (Assesses about corrosion measures for the support structure)

- The protection design for the power cable (that passes from the seafloor surface into the wind turbine foundation)
  → Evaluation for such as location and required volume of pouched foot protection works which fix the power cable and edge settlement at the location
  → Evaluation for the conformity and validation of associated design and inspection / maintenance plan

Overview of Certification Subcommittee / Section Meeting

Large Wind Turbine Certification Subcommittee

Evaluation items: [OM4] Wind turbine (RNA) design evaluation (common to both offshore (bottom fixed) and offshore (floating))

* Includes the part of [OM1] Site condition assessment / [OM2] Design basis evaluation / [OM3] Integrated load analysis related to [OM4].

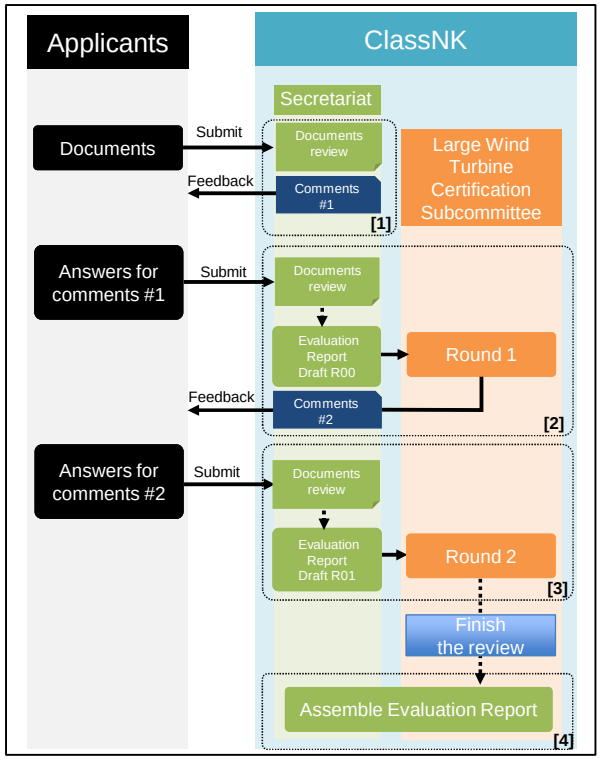
Support Structure Certification Subcommittee / Offshore (Bottom Fixed) Section Meeting

Evaluation items: [OM5] Support structure design evaluation (Offshore (bottom fixed))

* Includes the part of [OM1] Site condition assessment / [OM2] Design basis evaluation / [OM3] Integrated load analysis related to [OM5].

4. Overview of Services for Offshore (Bottom Fixed) Wind Farm

Review process: [OM4] Wind turbine (RNA) design evaluation (including RNA-related items of [OM1] Site conditions assessment , [OM2] Design basis evaluation and [OM3] Integrated load analysis evaluation)



[1] Documents submitted by applicants for review are firstly reviewed by the secretariat.
→Comments for each documents are informed to applicants.
(In some cases, comments is informed after step [2].)

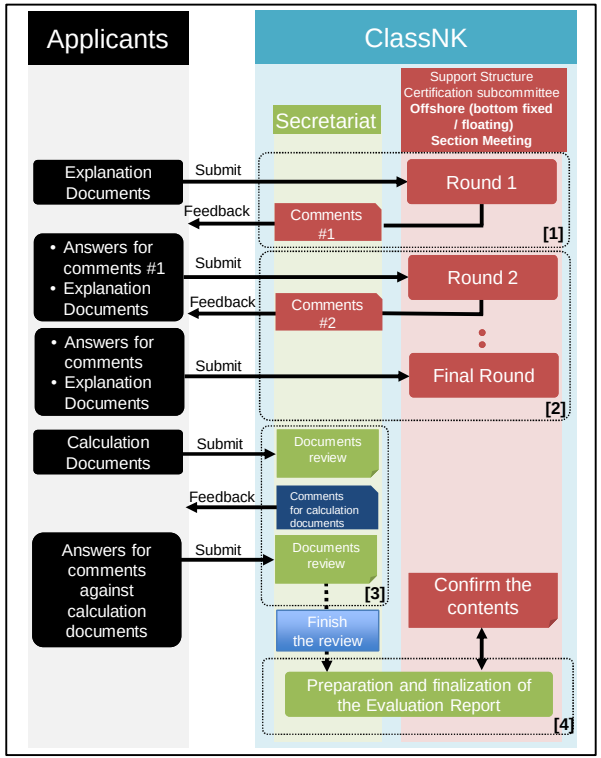
[2]Based on the answers against comments at step [1], the draft Evaluation Report is completed. The secretariat explain their review results to the members of the Large Wind Turbine Certification Subcommittee.
→All comments at the subcommittee are informed to applicants.

[3]Based on the answers against comments at step [2], the draft Evaluation Report is revised. The secretariat explain the review results of the answers against comments to the members of the Large Wind Turbine Certification Subcommittee.
→Go to step [4] if no more additional comments.
→Repeat step [2] and [3] when additional comments are remaining.

[4]The review will be finished when no additional comments are received from the subcommittee. In addition, the Evaluation Reports of each module are assembled . (confirm the adjustment with support structure design evaluation)

4. Overview of Services for Offshore (Bottom Fixed) Wind Farm

Review process: [OM5] Support structure design evaluation (including Support structure-related items of [OM1] Site conditions assessment , [OM2] Design basis evaluation and [OM3] Integrated load analysis evaluation)



[1] Based on the documents submitted by the applicants, members of the Support Structure Certification.

→ The Support Structure Certification Subcommittee utilizes a format in which the operator, support structure design firm, and wind turbine manufacturer directly explain the design to the experts in each field that serve as committee members.

→ When the design is not yet complete, the review can be accelerated to the extent possible as a preliminary review.

→ Preliminary review is not mandatory. (Preliminary review is conducted upon the request of the applicant.)

[2] At the after second subcommittee meetings, the responses to the comments in [1] and other new items shall be reviewed. This process is repeated until all items to be reviewed are completed and there are no more comment.

→ subcommittee meetings will be set according to the progress of the design and the wishes of the applicant for review.

→ Go to Step [3], when applicants answered against all comments and received no more new comment.

[3] The secretariat will conduct a document review of the calculation documents, exchange comments, and complete the review when there are no additional comments.

[4] Prepare and finalize the Evaluation Report for each module. (The consistency with the RNA side evaluation results shall be checked.)

→ The contents of the Evaluation Report will also be reviewed by the members of the Supporting Structures Certification Subcommittee.

4. Overview of Services for Offshore (Bottom Fixed) Wind Farm

Windfarm Certification Assessment Report Issuance System [for offshore farms]

- **Windfarm Certificate**
  - **Site Condition Conformity Statement**
    - Evaluation Report (site conditions evaluation)
  - **Design Basis Conformity Statement**
    - Evaluation Report (design basis evaluation)
  - **Integrated Load Analysis Conformity Statement**
    - Evaluation Report (integrated load analysis)
  - **RNA Design Conformity Statement**
    - Evaluation Report (wind turbine design evaluation)
  - **Support Structure Design Conformity Statement**
    - Evaluation Report (support structure design evaluation)

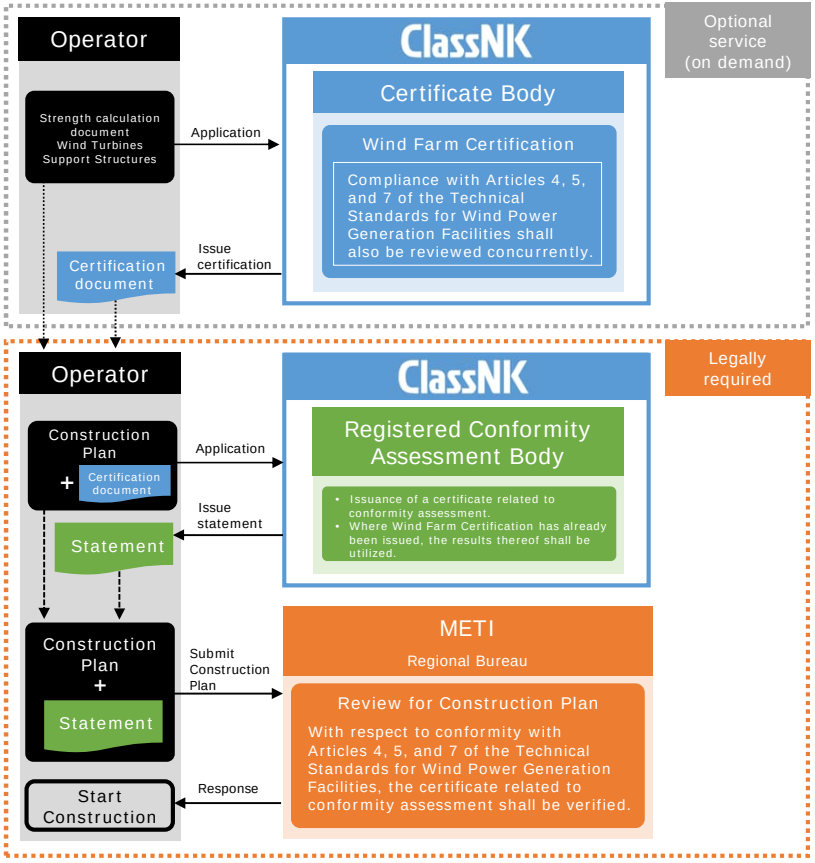
Support Documents for permits and approvals, such as Registered Conformity Assessment Body, etc.

- Conformity checklist of interpretation of technical standards for offshore wind power generation facilities
- Conformity checklist of technical standards for wind power generation facilities (Article 4,5 and 7)

Example of a Conformity Statement

Example of a Certification Assessment Report

4. Overview of Services for Offshore (Bottom Fixed) Wind Farm



- Following the issuance of the Wind Farm Certification documentation, the process proceeds to conformity assessment.

- The conformity assessment shall be conducted in accordance with NKRE-SP-0009, the Operational Regulations* for Registered Conformity Assessment Bodies.

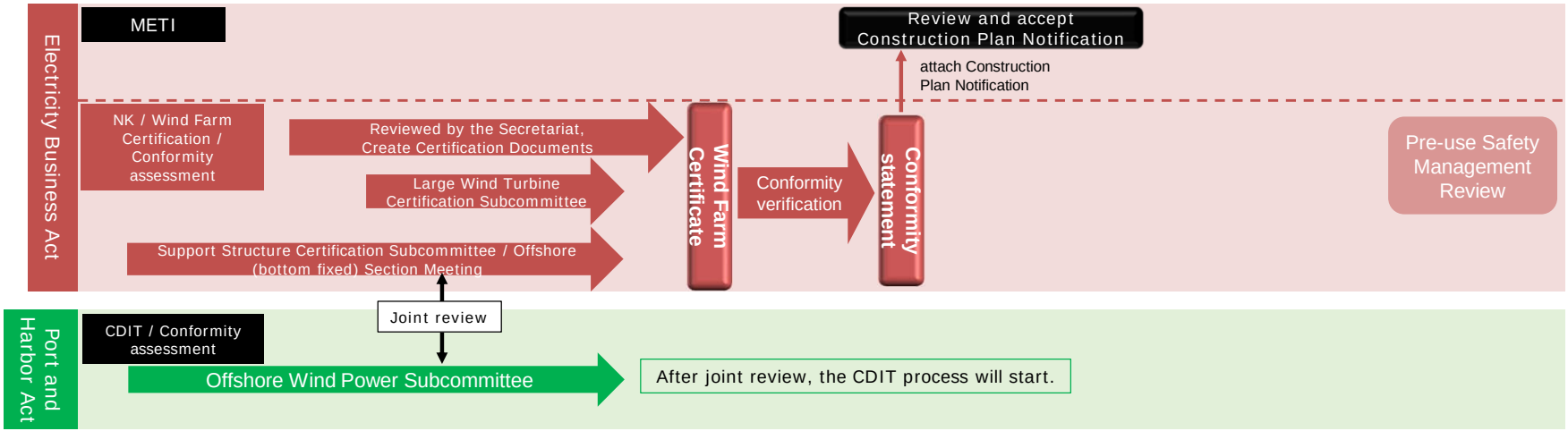
*: Japanese only

NKRE-SP-0009 Operating regulation for Conformity Assessment

<Table of contents>

4. Overview of Services for Offshore (Bottom Fixed) Wind Farm

Legal Regulations on Structural Safety for Offshore (Bottom Fixed) Wind Farm (Procedure Outline)



* These figures are intended solely to illustrate the overall process. The length of the arrows does not indicate how long each step takes.

5. Overview of Services for Offshore (Floating) Wind Farm

Legal Regulations on Structural Safety for Offshore (floating) Wind Farm

Scope and approval format	Electricity Business Act	Port and Harbor Act	Ship Safety Act
Onshore wind farm	Applied	N/A	N/A
Offshore wind farm (bottom fixed)	Applied	Applied	N/A
Offshore wind farm (floating)	Applied	Applied	Applied
Approval format	Construction Plan Notification [directly reviewed by Japanese Government] + [Registered Conformity Assessment Body]	Conformity Verification by CDIT, a confirmation agency registered with the Minister of Land, Infrastructure, Transport and Tourism	Classification Survey by ClassNK, a classification society registered with the Minister of Land, Infrastructure, Transport and Tourism

From the perspective of structural safety, compliance with laws and regulations under Electricity Business Act, Port and Harbor Act and Ship Safety act is required.

- Compliance for Electricity Business Act : conformity assessment and, as a preliminary step thereto, Wind Farm Certification (refer to p.8~9 / p.47~58, 61)
- Compliance for Port and Harbor Act : Joint review with CDIT (refer to p.10, 61)
- Compliance for Ship Safety act : Classification survey (p.11~12 / p.59~61)

Wind Farm Certification module【Offshore (Floating) Wind Power Plant】

[OM1] Site conditions assessment

- Assess environmental conditions at the construction site (environmental conditions include general weather conditions, such as wind conditions, temperature conditions, and humidity conditions, as well as marine conditions (for offshore wind farms), altitude conditions, landforms, topography, earthquakes, lightning, and changes in operating methods related to grid interconnections)

[OM2] Design basis evaluation

- Evaluates whether appropriate design criteria (design policies, etc.) considering the site conditions have been set based on the design criteria applied at the time of type certification for the purpose of safe design and project execution

[OM3] Integrated load analysis evaluation

- Evaluates whether the loads and load effects for the site-specific environmental conditions on the integrated wind turbine structure, including the wind turbine, support structure (tower, floating structure and mooring system), and supporting soils, have been calculated in conformity with the design basis.

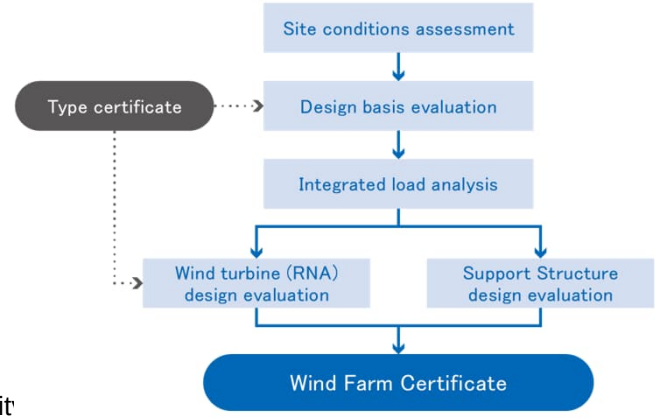
[OM4] Wind turbine (RNA) design evaluation

- Evaluates whether the type-certified wind turbine (RNA) has structural integrity against the environmental conditions of the construction site

*RNA: Rotor Nacelle Assembly

[OM5] Support structure design evaluation

- Evaluates the structural integrity of the support structure (tower, floating structure and mooring system) against the environmental conditions of the construction site



*In the case of offshore wind farms, only the power utility operator can apply for review. (Applications for review cannot be made separately for each module)

[OM1] Site conditions assessment [1]

- Evaluates whether the following value settings for environmental and external conditions at the construction site as provided by the operator are valid.

Classification	Item (examples)	Setting methods, etc. (examples)
Wind conditions	[1]Wind conditions during wind turbine operations (wind turbine position and hub height) - 10-minute average wind speed, turbulence intensity, wind shear exponent, air density, etc. [2]Wind conditions during wind turbine storm standby (wind turbine position and hub height) [50-year recurrence periods] - 10-minute average wind speed, turbulence intensity, 3-second average wind speed, wind shear exponent, air density, etc.	[1]Wind conditions during wind turbine operations −Calculate values at each wind turbine position and hub height based on observation data at the site and simulations [2]Wind conditions during wind turbine storm standby −Calculate values at each wind turbine position and hub height based on the reference wind speed under the Building Standards Act or other simulations
Marine conditions	[1]Marine conditions during normal states (during wind turbine operations) (wind turbine position) - Significant wave height, significant wave period, tide level, currents, etc. [2]Marine conditions during storm waves (wind turbine position) [50-year recurrence interval] - Significant wave height, significant wave period, tide level, currents, etc.	[1]Marine conditions during normal periods −Calculate values at each wind turbine position based on observation data at the site and simulations [2]Marine conditions during storm waves −In addition to existing wave observation and wave prediction data, calculate the values at each wind turbine position with reference to design values for nearby port and coastal protection facilities

[OM1] Site conditions assessment [2]

- Evaluates whether the following value settings for environmental and external conditions at the construction site as provided by the operator are valid.

Classification	Item (examples)	Setting methods, etc. (examples)
Soil and geology	[1]Submarine topography of the sea area [2]Soil composition and properties required for the design depending on the anchor type at the anchor position (physical properties, mechanical properties, etc.)	[1] Conduct a submarine topography survey [2] Set the required values for the anchor design based on the results of geophysical exploration, CPT and sampling, field tests, and laboratory tests
Earthquake	Seismic waves at the wind turbine position [1] Spectrally matched waves [2] Observed waves [3] Site waves *Based on the type of anchor, determine on a case-by-case basis which seismic wave is required, depending on factors such as the need for a liquefaction assessment or seismic design.	Set [1] and [2] as rarely occurring earthquake ground motions and extremely rarely occurring earthquake ground motions specified in “Interpretation of Technical Standards for Wind Power Generation Facilities” Set [3] as Port and Harbor Level 1 earthquake ground motions specified in the Technical Standards for Port and Harbor Facilities in Japan (consideration should also be given to Port and Harbor Level 2 earthquake ground motions as necessary)
Other environmental conditions	Tsunamis, snow cover, sea ice and ice accumulation, marine growth, temperature and humidity, sea water density, lightning	Set site-specific values based on relevant laws and regulations, local ordinances, and observation data at the site, etc.

[OM2] Design basis evaluation

- Assesses whether the design criteria considering the site conditions (design policies, etc.), as indicated below, have been appropriately set for the purpose of safe design and project execution.

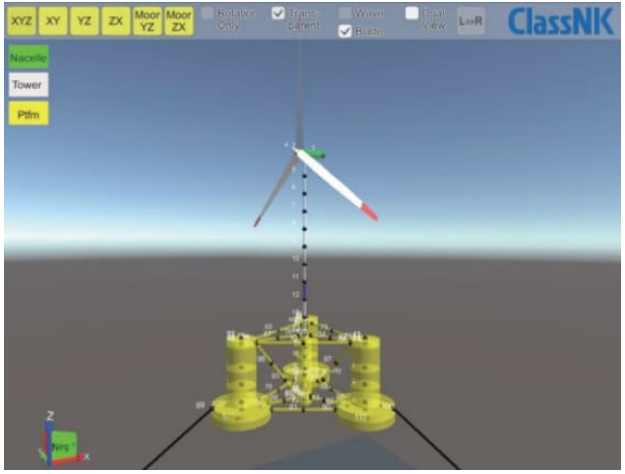
Design Criteria Part A Site conditions (Examples)	Design Criteria Part B Wind turbines and towers (Examples)	Design Criteria Part C Foundation (Examples)
Prepared by: Operator	Prepared by: Wind turbine manufacturer	Prepared by: Floating structure and mooring system designer
1) Wind turbine installation location 2) Wind conditions 3) Wave conditions 4) Other marine conditions 5) Soil and geological conditions 6) Seismic conditions 7) Other environmental conditions 8) Constraints, etc. *Includes items that overlaps with the site conditions assessment	1) Applicable criteria and standards 2) Site conditions 3) Wind turbine and tower specifications 4) Design policy (required performance, reference items, materials used, etc.) 5) Design parameters related to the load calculations, and the validity of the applied load analysis method 6) Load case table 7) Partial safety factor 8) Overview of the load analysis model 9) Simulation details 10) Extreme and fatigue design loads and response analysis 11) Materials and welds 12) Coatings and corrosion prevention systems	1) Applicable criteria and standards 2) Site conditions 3) Support structure specifications (including additional installations and mooring system) 4) Design policy (required performance, reference items, materials used, etc.) 5) Design parameters related to the load calculations, and the validity of the applied load analysis method 6) Load case table 7) Partial safety factor 8) Overview of the load analysis model 9) Simulation details 10) Extreme and fatigue design loads and response analysis 11) Materials and welds 12) Coatings and corrosion prevention systems

[OM3] Integrated load analysis evaluation

- Assesses whether the loads and load effects for the site-specific environmental conditions on the integrated wind turbine structure, including the wind turbine, support structure (tower, floating structure and mooring system), and supporting soils, have been calculated in conformity with the design basis.

<Main assessment items>

1. Combinations of external and design conditions
   - Wind turbine in operation (wind conditions + normal marine conditions during wind turbine operation)
   - Wind turbine during storm standby (wind conditions during wind turbine storm standby + marine conditions during storm waves)
   - During an earthquake (during wind turbine operations/wind turbine emergency shutdown/wind turbine standby)
2. Design load cases defined with reference to site conditions, as well as to wind turbine operational and safety systems
3. Partial safety factor
4. Calculation methods (simulation procedures, number of simulations, and combinations of wind and wave loads, etc.)
5. Analytical model employed as the integrated load analysis and validation outcome for its results



An example of coupled analysis model (analysis is conducted in consideration of the effects of wind turbine operations, wind, waves, flow, and soil at the same time)

[OM4] Wind turbine（RNA）design evaluation

■ Assesses whether the type-certified wind turbine (RNA) has structural integrity against the environmental conditions of the construction site

<Main assessment items>

- Closely examines the following items to verify whether the wind turbine is structurally safe against the site-specific load based on the site conditions obtained from the integrated load analysis
  - [1] Comparison of the design load set at the time of type certification (certified design load), and the site-specific load obtained from the integrated load analysis
  - [2] Detailed calculation/analysis results for each component when the site-specific load exceeds the design load set at the time of type certification (certified design load)
  - [3] Specifications and the validation results for any parts and systems that are NOT fully covered by type certification and that have been newly modified or reinforced for the site
- Assesses connection part between tower top and RNA
  → Closely examines strength evaluation results for tower top load receiving from RNA
- Strength assessment of nacelle cover
  → Closely examines whether the nacelle cover has been satisfied with requirements as Wind Farm Certification
- Assesses the natural frequency
  → Confirm whether the resonance is correctly prevented by comparing natural frequency including support structure and modal frequency with operating wind turbines
- Assesses coating and corrosion prevention (Assesses about corrosion measures for RNA)
- The design for the connecting system power cable into the floating structure (In addition, closely examine the adjustment with support structure design evaluation)

[OM5] Support structure design evaluation

- Assesses whether the support structure (tower, floating structure and mooring system including each connecting system) has structural integrity against the environmental conditions of the construction site

<Main assessment items>

- Closely examines the following items to verify whether the support structure is structurally safe against the site-specific load based on the site conditions obtained from the integrated load analysis

  [1] Closely examines validation of drawing and detailed strength calculation statement for the support structure
  → Strength evaluation for the limit states (ULS/FLS/SLS/ALS) associated by designer

  [2] Closely examines validation of drawings and calculation statements for additional installations (such as landing facilities, ladders, platforms, the power cable protection)
  → Strength evaluation for the limit states (ULS/FLS/SLS/ALS) associated by designer
  → Strength detail evaluation for the connection to support structures

- SLS evaluation for support structures
  → Evaluation for wind turbine limitation, such as the angle of inclination and natural frequency of the floating structure

- Assesses coating and corrosion prevention (Assesses about corrosion measures for floating structure, mooring system and tower)

- The design for the connecting system power cable into the floating structure
  → Assesses of the relationship between power cable behavior, dynamic motion and buoyancy devices attached to the cable, as well as the effect of marine growth
  → Assesses of the consistency and validity of the design assumptions in relation to the inspection and maintenance plans

Overview of Certification Subcommittee / Section Meeting

Large Wind Turbine Certification Subcommittee

Evaluation items: [OM4] Wind turbine (RNA) design evaluation (common to both offshore (bottom fixed) and offshore (floating))

* Includes the part of [OM1] Site condition assessment / [OM2] Design basis evaluation / [OM3] Integrated load analysis related to [OM4].

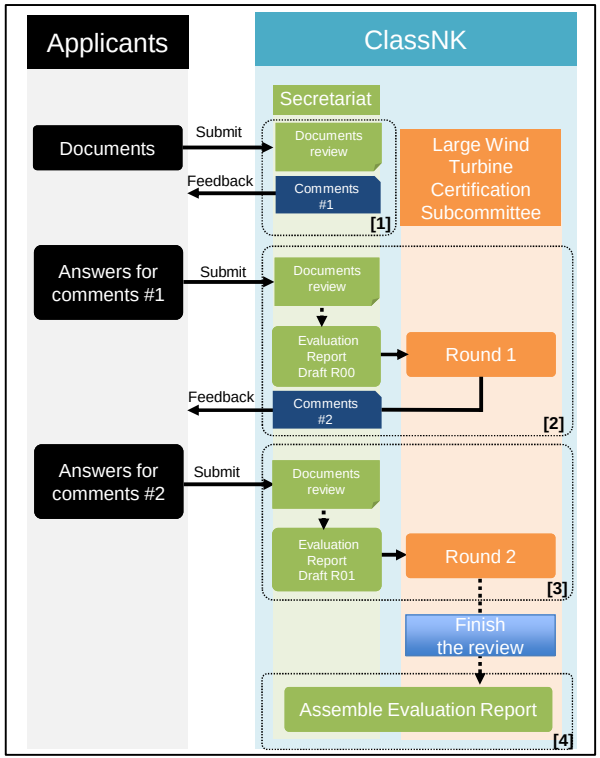
Support Structure Certification Subcommittee / Offshore (Floating) Section Meeting

Evaluation items: [OM5] Support structure design evaluation (Offshore (floating))

* Includes the part of [OM1] Site condition assessment / [OM2] Design basis evaluation / [OM3] Integrated load analysis related to [OM5].

5. Overview of Services for Offshore (Floating) Wind Farm

Review process: [OM4] Wind turbine (RNA) design evaluation (including RNA-related items of [OM1] Site conditions assessment , [OM2] Design basis evaluation and [OM3] Integrated load analysis evaluation)



[1] Documents submitted by applicants for review are firstly reviewed by the secretariat.

→Comments for each documents are informed to applicants.
(In some cases, comments is informed after step [2].)

[2] Based on the answers against comments at step [1], the draft Evaluation Report is completed. The secretariat explain their review results to the members of the Large Wind Turbine Certification Subcommittee.

→All comments at the subcommittee are informed to applicants.

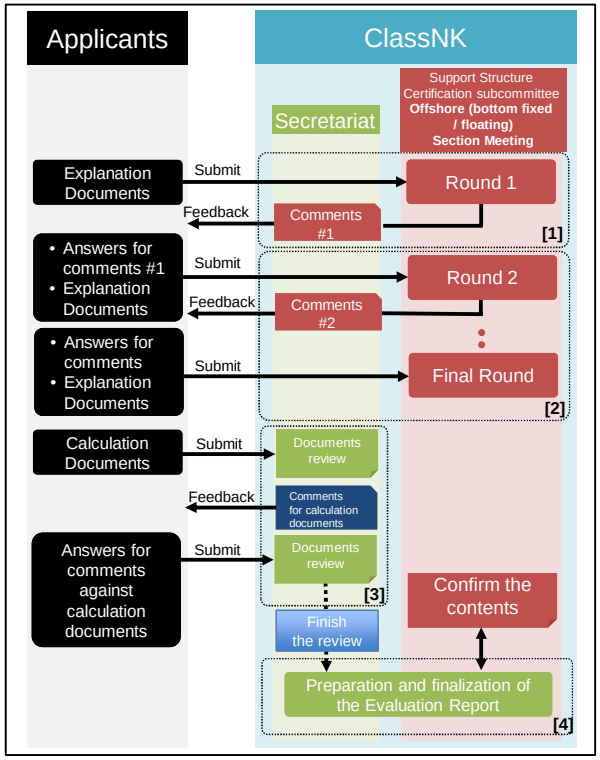
[3] Based on the answers against comments at step [2], the draft Evaluation Report is revised. The secretariat explain the review results of the answers against comments to the members of the Large Wind Turbine Certification Subcommittee.

→Go to step [4] if no more additional comments.
→Repeat step [2] and [3] when additional comments are remaining.

[4] The review will be finished when no additional comments are received from the subcommittee. In addition, the Evaluation Reports of each module are assembled . (confirm the adjustment with support structure design evaluation)

5. Overview of Services for Offshore (Floating) Wind Farm

Review process: [OM5] Support structure design evaluation (including Support structure-related items of [OM1] Site conditions assessment , [OM2] Design basis evaluation and [OM3] Integrated load analysis evaluation)



[1] Based on the documents submitted by the applicants, members of the Support Structure Certification.

→ The Support Structure Certification Subcommittee utilizes a format in which the operator, support structure design firm, and wind turbine manufacturer directly explain the design to the experts in each field that serve as committee members.

→ When the design is not yet complete, the review can be accelerated to the extent possible as a preliminary review.

→ Preliminary review is not mandatory. (Preliminary review is conducted upon the request of the applicant.)

[2] At the after second subcommittee meetings, the responses to the comments in [1] and other new items shall be reviewed. This process is repeated until all items to be reviewed are completed and there are no more comment.

→ subcommittee meetings will be set according to the progress of the design and the wishes of the applicant for review.

→ Go to Step [3], when applicants answered against all comments and received no more new comment.

[3] The secretariat will conduct a document review of the calculation documents, exchange comments, and complete the review when there are no additional comments.

[4] Prepare and finalize the Evaluation Report for each module. (The consistency with the RNA side evaluation results shall be checked.)

→ The contents of the Evaluation Report will also be reviewed by the members of the Supporting Structures Certification Subcommittee.

5. Overview of Services for Offshore (Floating) Wind Farm

Windfarm Certification Assessment Report Issuance System [for offshore farms]

- **Windfarm Certificate**
  - **Site Condition Conformity Statement**
    - Evaluation Report (site conditions evaluation)
  - **Design Basis Conformity Statement**
    - Evaluation Report (design basis evaluation)
  - **Integrated Load Analysis Conformity Statement**
    - Evaluation Report (integrated load analysis)
  - **RNA Design Conformity Statement**
    - Evaluation Report (wind turbine design evaluation)
  - **Support Structure Design Conformity Statement**
    - Evaluation Report (support structure design evaluation)

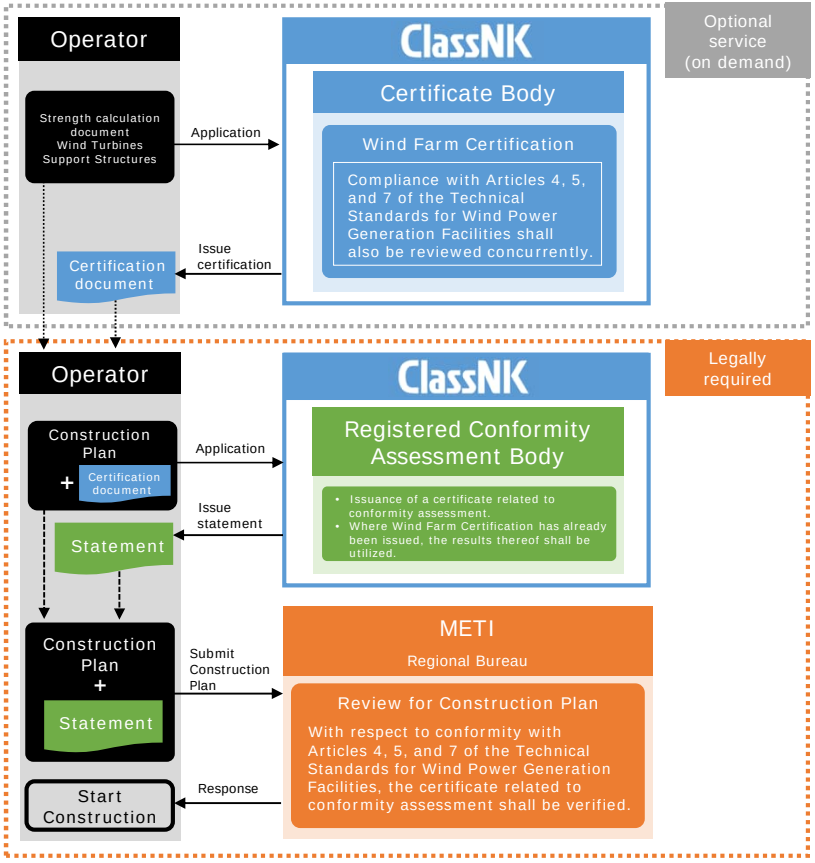
Support Documents for permits and approvals, such as Registered Conformity Assessment Body, etc.

- Conformity checklist of interpretation of technical standards for offshore wind power generation facilities
- Conformity checklist of technical standards for wind power generation facilities (Article 4,5 and 7)

Example of a Conformity Statement

Example of a Certification Assessment Report

5. Overview of Services for Offshore (Floating) Wind Farm



- Following the issuance of the Wind Farm Certification documentation, the process proceeds to conformity assessment.

- The conformity assessment shall be conducted in accordance with NKRE-SP-0009, the Operational Regulations* for Registered Conformity Assessment Bodies.

*: Japanese only

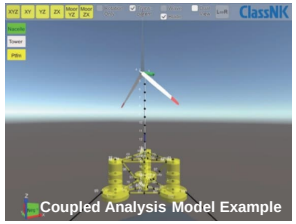
NKRE-SP-0009 Operating regulation for Conformity Assessment

<Table of contents>

Classification Survey as a Classification Society authorized by the MLIT under constructing

- In addition to design review, the following inspections are conducted during the construction phase.
- Approval of materials and equipment used in the mooring system- On-site inspections during the fabrication of the floating structure- On-site inspections of offshore construction work in the installation area- Final acceptance inspections A class certificate is only issued once all of these inspections have been successfully completed.
- Equipment usege

Item	Contents of the survey
Design Review	■ Review designs for floating structures, towers, and mooring lines based on the Guidelines for Floating Offshore Wind Power Facilities. ■ Review site condition (wind conditions, marine conditions, etc.) settings, wind turbine and floating structure coupled analyses, and support structure design evaluations at the same time as wind farm certification. ■ Confirm that the steel plate and fittings to be used are approved by NK.
Approval for the steel plate and mooring equipment	■ Confirm that the materials used for the main structure shall comply with the provisions of Part K of the Rules for the Survey and Construction of Steel Ships. ■ Confirm that the equipment used for mooring system shall be approved in accordance with the provisions of Part L of the Rules for the Survey and Construction of Steel Ships.
Witness survey during floating structure manufacturing	■ Conduct a witness survey for the following items: • floating structure and tower manufacturing (Confirm welding parts, etc.) • floating structure test (water pressure tests, etc.)
Witness survey for on-site work	■ Conduct a witness survey for the following items: • Installation work tests (holding capacity tests, etc.) • construction work to connect the floating structure and mooring lines, etc.
Completion Survey	■ Conduct a witness survey for the following items: • verification tests of wind turbine control systems • verification tests of floating structure ballast systems, etc.

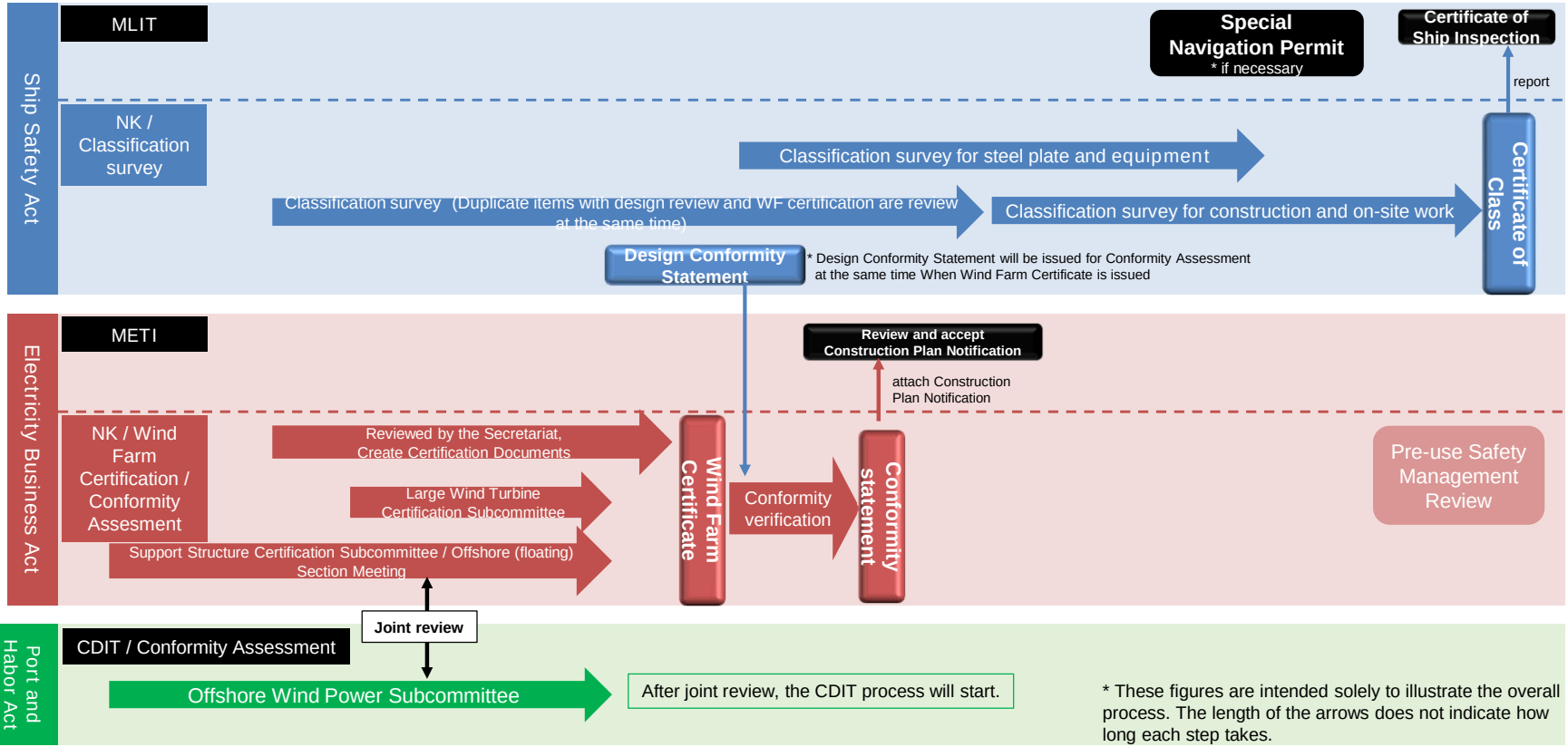


Classification Survey as a Classification Society authorized by the MLIT after operating

- The validity period of a class certificate is 5 years. To maintain this validity, regular inspections (including annual, intermediate and special surveys) must be properly conducted even after starting operation. Passing the special surveys every 5 years will extend the validity period of the class certificate.

Item	Contents of te Survey
Annual surveys	■ Surveys conducted annually • Confirm the maintenance records, the records relating to the natural environment and records of the amount movement the floating body (document check only)
Intermediate surveys	■ Surveys conducted every 2 – 3 years • In addition to the annual survey, confirm the current state that can be viewed during the operation
Special surveys	■ Surveys conducted every 5 years • In addition to intermediate surveys, for example, confirm an internal survey of ballast tanks and the current sate of the mooring system
Occasional surveys	■ Conduct the survey for the following situations which is different from special survey: • When a FOWT encounters an external force exceeding the environmental conditions used at the time of the design • When a major part of the FOWT, or important equipment etc., is to be repaired, changed or modified.

Legal Regulations on Structural Safety for Offshore (floating) Wind Farm (Procedure outline)



6. Related Services

Renewable Energy Technical Services

For various requests that do not fall under certifications (such as wind farm certification) or third-party evaluations (such as MWS), ClassNK provides Renewable Energy–related Technical Services.

Service Item	Specific Examples
(1) Inspection on behalf of the client	■ Incoming inspection and quality verification of wind turbine components at the request of EPC contractors
(2) Third-party certification or appraisal for testing and inspection of materials, structures, and equipment	■ Manufacturing assessment of outfitting equipment installed on SEP vessels ■ Issuance of third-party certificates for heavy lifting tools ■ Manufacturing assessment of wind turbine support structures (tower manufacturing assessment) ■ Manufacturing assessment of wind turbine support structures for bottom-fixed offshore wind farms (manufacturing assessment of monopiles and transition pieces)
(3) Technical investigation of manufacturing sites and technical assessment of manufacturing processes	■ Third-party review of manufacturing factories for monopiles used in bottom-fixed offshore wind farms ■ Manufacturing assessment of wind turbine towers
(4) Assessment of construction plans for offshore wind farms	■ Third-party review of construction method statements for bottom-fixed offshore wind farm projects
(5) Third-party certification or appraisal of damage and condition of structures and equipment	■ Third-party assessment for recommissioning wind farms after wind turbine damage incidents
(6) Third-party certification related to design (including issuance of Approval in Principle (AiP))	■ Issuance of AiP certificates for floating offshore wind power facilities
(7) Other technical services deemed appropriate by ClassNK	■ Inspection on behalf of vessel operators used for the construction of bottom-fixed offshore wind farms ■ Third-party assessment of operations of vessels equipped with Dynamic Positioning (DP) systems

Marine Warranty Survey（MWS）

A Marine Warranty Survey (MWS) refers to the review and assessment of documentation and actual offshore operations(such as transportation and installation of structures and subsea cable laying)conducted by a third-party organization approved by insurance companies. To manage and mitigate risks associated with offshore construction, compliance with relevant standards is verified.

- To manage and mitigate the risks associated with offshore construction, verify compliance with construction standards

  ◆Construction Risks
  - ・Improper use of equipment, inadequate planning, or unsuitable construction methods
  - ・Human error (lack of operational competence)

  ◆Natural Hazard Risks
  - ・Operations conducted under inappropriate weather or sea conditions

- Scope of MWS Activities

  ① Document review (review of construction procedures and method statements)
  ② On-site inspection of work vessels and equipment
  ③ On-site attendance and inspection at offshore construction sites

ClassNK has received accreditation for conducting MWS from five major reinsurance companies, including

Codan A/S

GCube Underwriting Limited

Canopius B.V.

Markel International


Swiss Reinsurance Company Ltd

Through the implementation of MWS that also considers Japanese regulations, seismic and typhoon conditions, and the use of domestic vessels, ClassNK contributes to the reliable execution of offshore wind projects.

Marine Warranty Survey（MWS）

Scope of MWS

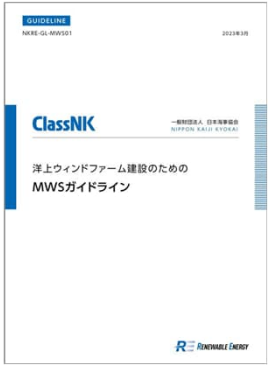
Scope of MWS Conducted by ClassNK	Location
■ Pre-assembly of towers in fabrication yards ■ Temporary vertical storage of transition pieces (TPs) and towers in yards ■ Load-out, transportation, and installation of foundations, TPs, and wind turbine components (towers, nacelles, blades, etc.) ■ Load-out, transportation, and installation of auxiliary equipment (e.g., filter units) ■ Load-out, transportation, and installation of subsea cables (including burial, protection, and landfall)	Construction site / Marshalling port
■ Transportation of foundations, TPs, and wind turbine components from overseas ports to Japanese ports (including load-out at overseas ports)	Transportation

出典: https://renewablesnow.com/news/mhi-vestas-building-pcm-assembly-plant-at-danish-port-568643/

出典https://www.evwind.es/2019/10/03/final-wind-turbine-installed-on-worlds-largest-offshore-wind-farm/71178

出典:https://www.offshorewindindustry.com/sites/default/files/field/image/offshore_cable_lay_godе_wind.jpg

Construction Standards: MWS Guidelines for Offshore Wind Farm Construction



＜Table of Contents＞

- This guideline is primarily intended for bottom-fixed offshore wind turbines installed in Japan.
- For floating offshore wind turbines, relevant provisions are applied by analogy.

→ Due to the diversity of floating foundation types and installation methods, construction methods are currently assessed on a case-by-case basis to avoid restricting technical innovation.

Marine Assurance Services

Marine Assurance Services refer to third-party assessments of operational aspects of vessels used in offshore construction.

Item	Services
1. General Ship Inspection	Evaluation of crew qualifications and experience, operational manuals, and onboard equipment management from the charterer's perspective (ensuring safe and reliable operations and identifying potential risks).
2. DP Operation Assessment	Confirmation that sufficient operational management systems and countermeasures are in place for DP operations, including preparedness for equipment failures.
2. IMCA *1) eCMID *2) Inspection	Vessel inspections conducted in accordance with eCMID standards operated by the IMCA (International Marine Contractors Association).

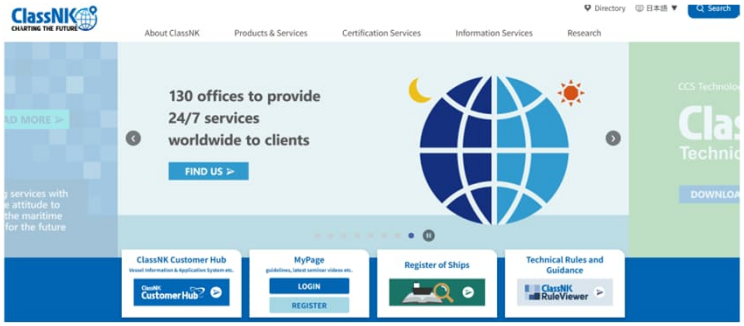
***1) IMCA: International Marine Contractors Association**

- An organization comprising approximately 700 companies, including contractors, operating companies, classification societies, and educational institutions in the oil, gas, and renewable energy industries. It establishes various guidelines for workboats, such as those for DP operations, which have become de facto international standards.

***2) eCMID: electronic Common Marine Inspection Document**

- This refers to a standardized digital inspection report for offshore use (a standardized format for ship inspections), which is prepared based on the results of ship inspections conducted by AVI. In the construction of offshore wind turbines, vessels equipped with eCMID may be specified as a condition for chartering.

Contact Information



please scroll down on the ClassNK website top page.

<Contact for Wind Power–Related Inquiries>
NIPPON KAIJI KYOKAI
Renewable Energy Department
TEL: +81-3-5226-2032、E-mail: re@classnk.or.jp

For the latest information,