

# ClassNK

Guidelines for Digital Smart Ships  
(Edition 2.2)

[ English ]





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## **Introduction**

The utilisation of Big Data is an issue currently being tackled worldwide not only by the maritime industry but by all industries. As part of its efforts, the maritime industry has already begun sharing and utilising data transferred from ships to shore-based facilities, which in turn has aided in the development of many innovative technologies.

By proactively providing certification services for these innovations and promoting their spread and development, ClassNK strives to support the preservation of the marine environment, further improve safety at sea, and support the sustainable development referred to in the SDGs. Therefore, the “Innovation Endorsement” certification service which targets innovative digital technology is being launched in line with this policy.

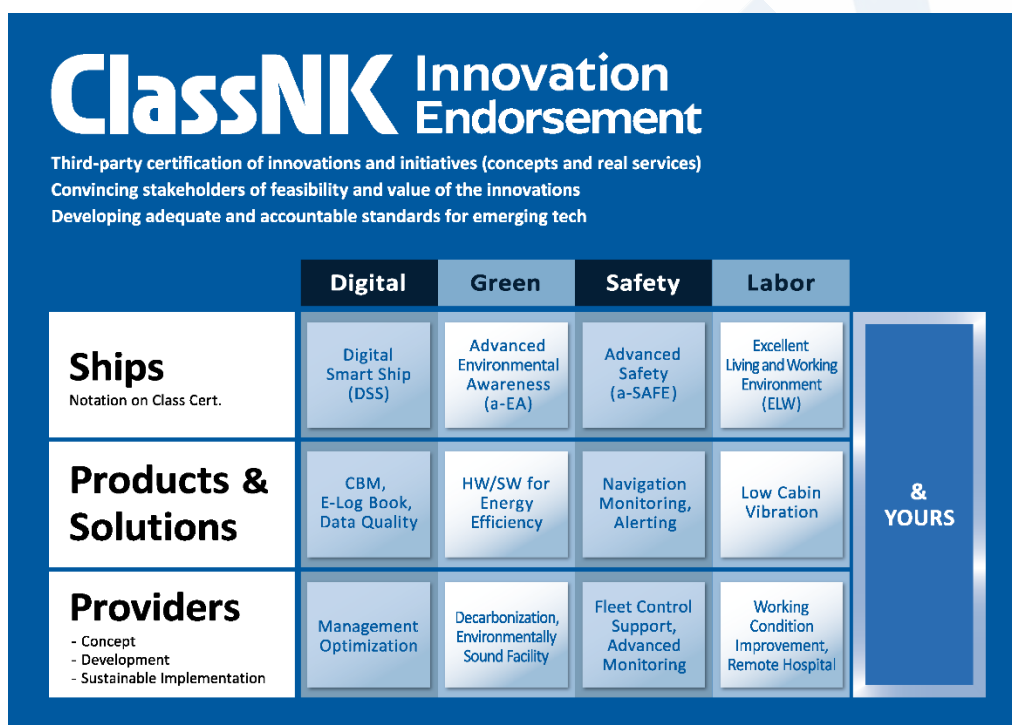
For ships applying digital technologies such as various types of monitoring and autonomous navigation (hereinafter referred to as “digital smart ships”), ClassNK decided to publish its Guidelines for Digital Smart Ships which specifies the relevant class notation that may be affixed to the classification characters of ships provided with smart systems (i.e. systems utilising digital technologies) that are in accordance with existing ClassNK Rules and Guidance. In addition, for ships provided with smart systems utilising innovative technologies not yet covered in this Guidelines, details are also specified for relevant class notation which may be affixed to classification characters of such ships in accordance with the types of smart systems they are using.

ClassNK hopes that this Guidelines will be a positive contribution to current efforts being undertaken worldwide by the maritime industry not only for improving current ship operations but also for furthering the development of innovative technologies.

## ClassNK Innovation Endorsement Approach

As companies pursue ESG management and the SDGs to realize a sustainable society, various innovations have been vital to resolve challenges.

ClassNK has offered Innovation Endorsement (IE) as a framework to support innovative initiatives through third-party certification. The basic concept of IE is introduced here as “ClassNK Innovation Endorsement Approach”.



### Background

Innovation Endorsement (IE) is ClassNK’s initiative as the third-party certification body to create new value based on “Third party certification/ evaluation/ rating”, which is one of the three business pillars on “ClassNK Digital Grand Design 2030”<sup>\*1</sup> announced in February 2020. It has described the future shape required to a classification society in the digital society.

(\*1) Related press release: “ClassNK develops its Digital Grand Design 2030”

[https://www.classnk.or.jp/hp/en/hp\\_news.aspx?id=4702&type=press\\_release&layout=1](https://www.classnk.or.jp/hp/en/hp_news.aspx?id=4702&type=press_release&layout=1)

### Policy

The principle policy of Innovation Endorsement (IE) is as follows

- Speed-focused: As the innovation progresses rapidly, we focus on the speed to fully follow their pace, establish evaluation technologies as a third party, and certify them.
- Corporation with front runners: It is likely that a clear evaluation standard has yet to be established for innovative technologies, we examine and develop evaluation standards in collaboration with pioneering front runners.

- Certification expected by customers and society: In response to the expansion of the scope of innovative initiatives, the scope and target of certification will be also expanded based on customer needs and social conditions.

### **Scope of certification**

The scope of Innovation Endorsement (IE) includes four categories: Digital<sup>\*2</sup>, Environment, Safety, and Labor. In addition, “Yours” demonstrates ClassNK’s commitment to work to meet any needs of customers and society.

(\*2) IE was launched focusing on digital innovation in July 2020.

### **Target of certification**

Innovation Endorsement (IE) covers three categories as the target of certification: Ships, Products & Solutions, and Providers.

- Notation: For ships, notations such as “DSS”<sup>\*3</sup> and “a-EA”<sup>\*4</sup> indicating advanced initiatives related to the digitalization and environment have been incorporated to the ship, are added in its certificate of classification and support the enhancement of the ship’s value.
- P&S certification: For products and solutions (P&S), we examine and verify their innovative functions based on our knowledge and experience as the third-party body and issue certificates for supporting the deployment of products and services.
- Provider certification: For organizations (providers) engaging in innovative initiatives, we provide flexible supports from the early stage with three levels of certification, (1) concept, (2) demonstration, and (3) sustainable implementation.

ClassNK is committed to contributing to the sustainable evolution of the maritime and offshore business by actively supporting innovative technologies through Innovation Endorsement (IE), and looks ahead to trends of innovations, and continues its innovation ecosystem to respond quickly to customers’ advanced initiatives.

(\*3) DSS: Abbreviation for Digital Smart Ship. Refer to Guidelines for Digital Smart Ships.

(\*4) a-EA: Abbreviation for Advanced-Environmental Awareness. Refer to Environmental Guideline Chapter 5.

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**Revision History**

No.	Date	Category	Details of revision
1	August 28, 2020	New	First issue
1.1	March 31, 2021	Addition	Added new provisions 3.2.7 to 3.2.9 (related to smart systems)
2.0	May 20, 2021	Amendment	Amended provision 3.2.2 and Table 3.1 (related to DSS(HM)) Amended provision 1.1.2 (related to affixation of class notation)
2.0	May 20, 2021	Addition	Added new provision 2.1.6 (related to surveys based on other guidelines) Added new provision 3.2.10 (related to smart systems)
2.1	December 10, 2021	Amendment	Amended provision 3.2.1 and Table 3.1 (related to DSS(EE)) Amended provision 3.2.3 and Table 3.1 (related to DSS(SLOSH))
2.2	November 15 2022	Amendment	Amended provision 1.1.1 (related to verification of safety aspects of ships) Deleted some provisions of 3.2 and Table 3.1 (related to DSS(NAV))

# Guidelines for Digital Smart Ships

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## Chapter 1 GENERAL PROVISIONS

### 1.1 General

#### 1.1.1 Application

This “Guidelines for Digital Smart Ships” (hereinafter referred to as “the Guidelines”) apply to ships registered with the Nippon Kaiji Kyokai (hereinafter referred to as “the Society”) that are considered to be “digital smart ships” (i.e. ships which are provided with systems utilising digital technology (smart systems)) for which applications for the affixation of special class notation to classification characters are submitted. It is assumed that the verification of the safety aspects of the ships to which the Guidelines applies has been carried out in the process required for classification in accordance with the provisions of the Rules for the Survey and Construction of Steel Ships, etc.

#### 1.1.2 Class Notations

**1** For ships provided with the relevant smart systems, the notation “*Digital Smart Ship(XX)*” (abbreviated as *DSS(XX)*) is to be affixed to the classification characters of the ships in accordance with the requirements of the Guidelines. The relevant smart system is described in “XX”. For example, for ships provided with the hull structure monitoring systems specified in the Guidelines, the notation “*Digital Smart Ship(Hull Monitoring)*” (abbreviated as *DSS(HM)*) is to be affixed to the classification characters of the ships.)

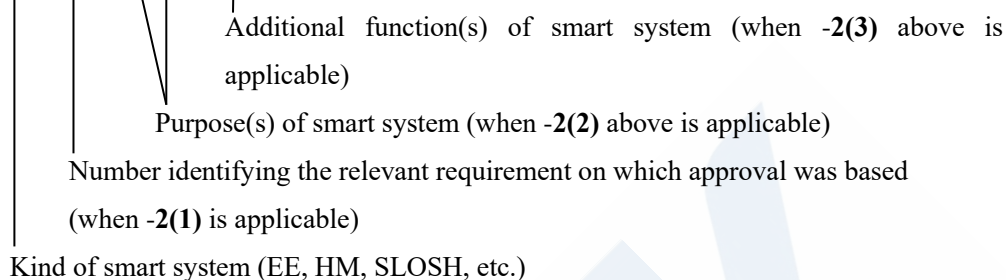
**2** In the following three cases, the notation “XX” defined in -1 above is to be affixed with additional numbers or letters respectively.

- (1) In cases where the relevant requirements for a smart system specified in 3.2 are amended as technology advances and it is considered appropriate by the Society that smart systems approved according to amended requirements should be identified from those approved according to previous requirements, the notation “XX” is to be affixed with an additional number to be separately specified by the Society at some future date. (e.g. “*Digital Smart Ship(XX2)*”)
- (2) In cases where a smart system specified in 3.2 can be used for multiple purposes specified by the Society, the notation “XX” is to be affixed with additional letters in order to identify the purpose(s) of the smart system. (e.g. “*Digital Smart Ship(XX(Y, Z))*”)
- (3) In cases where a smart system specified in 3.2 has additional functions specified by the Society, the notation “XX” is to be affixed with additional letters in order to identify the additional function(s) of the smart system. (e.g. “*Digital Smart Ship(XX+A)*”) or “*Digital Smart Ship(XX(Y+A))*”)

**3** In cases where a ship is provided with a smart system that is not specified in the Guidelines, relevant class notation may be affixed to the classification characters of the ships based on the application for said notation.

e.g.

NS\*(...)(DSS( XX 2 (Y, Z +A )))



### 1.1.3 Termination of Class Notation

The Society will delete relevant class notation in cases where a smart system in accordance with the Guidelines is not properly maintained. Compliance with the requirements of the Guidelines, however, is optional and not a condition of class maintenance.

## Chapter 2 SURVEYS

### 2.1 General

#### 2.1.1 Kinds of Surveys

The kinds of surveys are specified in the following (1) to (3).

- (1) Initial Surveys
- (2) Periodical Surveys
- (3) Occasional Surveys

#### 2.1.2 Timing of Surveys

The timing of surveys is as specified in the following (1) to (3).

- (1) Initial Surveys are to be carried out at the time the application for the survey is made.
- (2) Periodical Surveys are to be carried out at the times of Annual Surveys, Intermediate Surveys and Special Surveys for Classification (i.e. those times given in **1.1.3-1(1) to (3), Part B of the Rules for the Survey and Construction of Steel Ships**).
- (3) Occasional Surveys are to be carried out on the following occasions at times other than Initial Surveys or Periodical Surveys.
  - (a) In cases where the smart systems of ships are changed or replaced.
  - (b) In cases where any conversions affecting the smart systems of ships are carried out.
  - (c) In cases where any applications for surveys are submitted by owners.
  - (d) Other occasions when Occasional Surveys are considered to be necessary.

#### 2.1.3 Periodical Surveys Carried Out in Advance and Postponement

The requirements for Periodical Surveys carried out in advance are to be in accordance with the provisions relevant to Periodical Surveys for Classification (i.e. **1.1.4 or 1.1.5, Part B of the Rules for the Survey and Construction of Steel Ships**).

#### 2.1.4 Ships Laid-up

Ships laid-up are not subject to the Periodical Surveys specified in **2.1.1(2)**.

#### 2.1.5 Preparation for Surveys and Other Related Issues

**1** In cases where ships are to be surveyed in accordance with the Guidelines, it is the responsibility of the Owners to notify Surveyors of the locations where they wish to undergo such surveys. Surveyors are to be advised of surveys a reasonable time in advance so that such surveys can be carried out at proper times.

**2** All such preparations as required for registration, periodical and other surveys specified in the Guidelines as well as those which may be required by Surveyors in accordance with provisions given in the Guidelines are the responsibility of Owners or their representatives.

**3** Applicants for surveys are to arrange supervisors who are well conversant with all of the

survey items required for the preparation of such surveys and who are able to provide all necessary assistance to the Surveyor according to their requests during such surveys.

4 Surveys may be suspended in cases where necessary preparations have not been made, any appropriate supervisor is not present, or the Surveyor considers that the safety needed for the execution of the survey is not ensured.

5 In cases where repairs are considered to be necessary as a result of surveys, Surveyors notify survey applicants of their findings. Applicants, upon receiving such notification, are to obtain Surveyor verification after carrying out any necessary repairs.

#### 2.1.6 Other

For the smart systems specified in **3.2.2**, relevant surveys are to be conducted in accordance with **the Guidelines for Hull Monitoring** in place of this chapter.

## 2.2 Initial Surveys

### 2.2.1 General

During Initial Surveys, the smart systems of ships are to be examined and surveyed in order to ascertain whether the requirements of the Guidelines are satisfied.

### 2.2.2 Submission of Plans and Document

1 For ships intending to undergo Initial Surveys, the relevant plans and documents specified in **Chapter 3** are to be submitted to the Society.

2 Notwithstanding the requirement specified in **-1** above, it is not necessary to submit a separate set of such documents for Initial Surveys at Classification Surveys During Construction.

3 Submission of additional plans and documents may be required in cases where deemed necessary by the Society.

### 2.2.3 Survey Items

During Initial Surveys, the following items are to be confirmed:

- (1) The appropriate installation of all relevant equipment.
- (2) The proper provision on board of all relevant documents, procedures manuals and record books.
- (3) In cases where Initial Surveys are carried out at times other than at Classification Surveys During Construction, proper maintaining on board of all relevant equipment, documents, procedural manuals, and record books, etc. In addition, required record keeping is being carried out for record books, etc.



## **2.3 Periodical Surveys**

### **2.3.1 General**

During Periodical Surveys, the smart systems of ships are to be surveyed in order to ascertain whether the requirements of the Guidelines are satisfied.

### **2.3.2 Survey Items**

During Periodical Surveys, the following items are to be confirmed.

- (1) The condition of relevant equipment is in good order.
- (2) Relevant documents, procedures manuals, etc. are being appropriately maintained.
- (3) Relevant record books, etc. are being appropriately maintained, and required record keeping is being carried out.

## **2.4 Occasional Surveys**

### **2.4.1 General**

In cases where the smart systems of ships are changed or replaced, Occasional Surveys are to be carried out and such smart systems are to be confirmed as complying with the requirements of the Guidelines.

## Chapter 3 DIGITAL SMART SHIPS

### 3.1 General

#### 3.1.1 Submission of Plans and Documents

During Initial Surveys, the plans and documents specified in **Table 3.1** are to be submitted to the Society in order to examine those items specified in **3.2**.

### 3.2 Digital Smart Ships

For ships provided with the following smart systems, relevant class notation may be affixed to the classification characters of the ships.

#### 3.2.1 Digital Smart Ship(Energy Efficiency) (DSS(EE))

**1** For ships provided with systems for energy consumption monitoring or energy efficiency analysis using voyage information (trim, draught, operation profile, meteorological and oceanographic information during voyage, etc.) and operational parameters for ship performance management, navigation plan development, operation management, maintenance planning, etc., the class notation “*Digital Smart Ship(Energy Efficiency)*” (abbreviated as *DSS(EE)*) may be affixed to the classification characters of the ship.

**2** In addition to **-1** above, for ships provided with systems for carrying out examination support for energy efficient route planning or trim optimization in combination with information on route characteristics and meteorological and oceanographic forecasts, etc., the class notation “*Digital Smart Ship(Energy Efficiency 2)*” (abbreviated as *DSS(EE2)*) may be affixed to the classification characters of the ship.

**3** In cases where the system has a function for automatically and periodically acquiring sensor data used for monitoring, etc., “*+Sensor(+Sn)*” may be added to the class notation specified in **-1** or **-2** above. (e.g. “*Digital Smart Ship(Energy Efficiency+Sensor)*” (abbreviated as *DSS(EE+Sn)*)

#### 3.2.2 Digital Smart Ship(Hull Monitoring) (DSS(HM))

For ships provided with hull structure monitoring systems that analyse quantitatively based on information collected through hull structure monitoring and provide useful information that contributes to ship safety according to the purpose(s) of the system (e.g. fatigue analysis, support for manoeuvring in rough seas), the class notation “*Digital Smart Ship(Hull Monitoring)*” (abbreviated as *DSS(HM)*) may be affixed to the classification characters of the ship.

(Refer to **the Guidelines for Hull Monitoring** for further information.)

#### 3.2.3 Digital Smart Ship(Sloshing) (DSS(SLOSH))

For ships provided with systems that detect or predict sloshing in cargo tanks, liquefied gas fuel tanks, etc. and display useful information for to aid ship masters during navigation, the class

notation “*Digital Smart Ship(Sloshing)*” (abbreviated as *DSS(SLOSH)*) may be affixed to the classification characters of the ship.

Such systems are roughly categorised into those based on real-time monitoring by strain sensors, acceleration sensors, etc.; those which estimate and predict the sloshing risk from the hull motion and the fluid tuning characteristics in the tank; and those which are a combination of the aforementioned two.

(For real-time monitoring devices, the requirements of **the Guidelines for Hull Monitoring** are to be correspondingly applied.)

#### **3.2.4 Digital Smart Ship(Machinery Monitoring) (DSS(MM))**

For ships provided with systems that can diagnose the deterioration, etc. of the functions of equipment or equipment components either independently or through the use of information obtained from sensors that monitor the status of equipment or equipment components, the class notation “*Digital Smart Ship(Machinery Monitoring)*” (abbreviated as *DSS(MM)*) may be affixed to the classification characters of the ship.

(**Chapter 9 of Part B of Rules for the Survey and Construction of Steel Ships** is to be correspondingly applied to such systems. In cases where the Condition Based Maintenance Scheme (CBM) specified in **Chapter 9 of Part B of Rules for the Survey and Construction of Steel Ships** is adopted, however, it is necessary to satisfy the requirements for CBM separately.)

#### **3.2.5 Digital Smart Ship(Connected Ship) (DSS(CNS))**

For ships equipped with hardware and software such as data servers (e.g. correspondingly apply the standard of *ISO 19847* etc.) for executing specific data processing functions (e.g. navigation information and the state of machinery installations used by the ship) are installed, and the ships is capable of transmitting such data to onshore facilities, the class notation “*Digital Smart Ship(Connected Ship)*” (abbreviated as *DSS(CNS)*) may be affixed to the classification characters of the ship.

#### **3.2.6 Digital Smart Ship(Shore Monitoring) (DSS(SM))**

For ships whose sensor data obtained on board (such as the state of machinery installations, but excluding voyage information and any other data specified to be transmitted per the other paragraphs of this **3.2**) is automatically and periodically transmitted to onshore facilities for monitoring by specialists, etc., the class notation “*Digital Smart Ship(Shore Monitoring)*” (abbreviated as *DSS(SM)*) may be affixed to the classification characters of the ship. The means for data transmission specified in **3.2.5** may be used for this type of data transmission to onshore facilities.

#### **3.2.7 Digital Smart Ship(Onboard Local Area Network) (DSS(LAN))**

For ships provided with fixed facilities (e.g. those that comply with *ISO 16425*) that provide a ship communication network that is available for use from almost anywhere in all designated spaces

(such as machinery spaces, cargo spaces (e.g. ro-ro spaces), but excluding accommodation spaces) and/or on open decks for the purpose of cargo monitoring, inspections etc., the class notation “*Digital Smart Ship(Onboard Local Area Network)*” (abbreviated as *DSS(LAN)*) may be affixed to the classification characters of the ship.

### **3.2.8 Digital Smart Ship(Refrigerated Cargo Shore Monitoring) (DSS(RCSM))**

For ships provided with facilities that automatically and periodically transmit data such as the temperatures in refrigerated cargo spaces or refrigerated containers to onshore facilities so that the history of such data can be confirmed, the class notation “*Digital Smart Ship(Refrigerated Cargo Shore Monitoring)*” (abbreviated as *DSS(RCSM)*) may be affixed to the classification characters of the ship. The means for data transmission specified in 3.2.5 may be used for this type of data transmission to onshore facilities.

(Refer to **Chapter 5 of the Rules for Cargo Refrigerating Installations** for the relevant requirements related to temperature measuring arrangements.)

### **3.2.9 Digital Smart Ship(Emission Shore Monitoring) (DSS(ESM))**

For ships that automatically and periodically transmit data regarding gases released from internal combustion engines, boilers, or other facilities into the atmosphere (concentration or quantity of NO<sub>x</sub>, SO<sub>x</sub>, CO<sub>2</sub>, CO, etc.) to onshore facilities for monitoring by specialists, etc., the class notation “*Digital Smart Ship(Emission Shore Monitoring)*” (abbreviated as *DSS(ESM)*) may be affixed to the classification characters of the ship. The means for data transmission specified in 3.2.5 may be used for this type of data transmission to onshore facilities.

### **3.2.10 Other**

In cases where ships are provided with other smart systems deemed appropriate by the Society, relevant class notation may be affixed to the classification characters of the ships.



Table 3.1 Plans and Documents to Be Submitted

Reference	Class notation	Plans and documents to be submitted	Note
3.2.1	<i>DSS(EE)</i>	(1) System outlines (2) Operation manuals (3) Service agreements (in the case of service contracts) (4) Drawings showing sensor locations (5) Documents showing that the data obtained by the sensors in (4) are used for monitoring, etc.	Item (4) and (5) only apply when +Sn is added
3.2.2	<i>DSS(HM)</i>	Refer to <b>the Guidelines for Hull Monitoring</b>	
3.2.3	<i>DSS(SLOSH)</i>	(1) Systems with real-time monitoring devices (a) See <b>the Guidelines for Hull Monitoring</b> (b) Documents showing rationale for detecting and determining sloshing and verifying results (2) Systems without real-time monitoring devices (a) Documents deemed appropriate by the Society (b) Documents showing rationale for determining sloshing and verifying results	For application of (1)(a), it is not necessary to comply with the requirement for UPS
3.2.4	<i>DSS(MM)</i>	Refer to <b>B9.1.4-4(1)(c) to (j), Part B of the Guidance for the Survey and Construction of Steel Ships</b>	
3.2.5	<i>DSS(CNS)</i>	(1) Wiring diagrams (2) Network diagrams	Including shipowner supplied equipment
3.2.6	<i>DSS(SM)</i>	(1) System outlines (2) Network diagrams (onboard and ship to shore) (3) List of data that is transmitted between ship and onshore facilities (4) List of data that can be monitored by onshore facilities (5) Service agreements (in the case of service contracts)	
3.2.7	<i>DSS(LAN)</i>	(1) Wiring diagrams (2) Network diagrams (documents that show the area where the network is available onboard)	Including shipowner supplied equipment
3.2.8	<i>DSS(RCSM)</i>	(1) System outlines (2) Network diagrams (onboard and ship to shore) (3) List of data that is transmitted between ship and onshore facilities (4) List of data that can be monitored by onshore facilities (5) Service agreements (in the case of service contracts)	
3.2.9	<i>DSS(ESM)</i>	(1) System outlines (2) Network diagrams (onboard and ship to shore) (3) List of data that is transmitted between ship and onshore facilities (4) List of data that can be monitored by onshore facilities (5) Service agreements (in the case of service contracts)	

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