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# RULES FOR CENTRALIZED CARGO MONITORING AND CONTROL SYSTEMS

## Chapter 1 GENERAL

### 1.1 General

#### 1.1.1 Scope

1 The Rules for Centralized Cargo Monitoring and Control Systems (hereinafter referred to as “the Rules”) apply to the survey and construction of the centralized cargo monitoring and control systems of ships carrying oil, dangerous chemicals and liquefied gases in bulk classed with NIPPON KAIJI KYOKAI (hereinafter referred to as “the Society”) and intended to be registered with those Installation Characters found in [Chapter 3 of the Regulations for the Classification and Registry of Ships](#).

2 The relevant requirements given in the **Rules for the Survey and Construction of Steel Ships** are also to apply to any equipment and systems used for centralized cargo monitoring and control systems in addition to those specified in the Rules.

#### 1.1.2 Equivalency

Centralized cargo monitoring and control systems which do not fully comply with the requirements of the Rules may be accepted provided that they are deemed by the Society to be equivalent to those specified in the Rules.

#### 1.1.3 Centralized Cargo Monitoring and Control Systems with Novel Design Features

In the case of centralized cargo monitoring and control systems with novel design features, the Society may impose appropriate requirements of the Rules to the extent that they are practically applicable with additional requirements made on design and test procedures other than those specified in the Rules.

#### 1.1.4 Terminology

The terms in the Rules are defined as follows:

- (1) “Cargo control room” means those locations in which the safe loading and unloading of cargoes, ballasting and deballasting, etc. as well as the state of the ship is centrally monitored and remotely controlled.
- (2) “Centralized cargo monitoring and control system” means those cargo monitoring and control systems which are to monitor state of cargo tanks, devices related to loading, ballast tanks, devices and equipment related to ballasting and deballasting, and all necessary remote controls operated by personnel evaluating such information.
- (3) The term “CCM-ship” means those ships which are to be registered as a ship in which centralized cargo monitoring and control systems in accordance with those requirements given in [Chapter 3](#) in addition to those requirements given in the **Rules for the Survey and Construction of Steel Ships** are installed.

#### 1.1.5 Installations Characters

Character “CCM” is given in the Register for any centralized cargo monitoring and control systems of CCM-ships.

### 1.2 System Design

System design is to comply with the following requirements in addition to those given in [18.2, Part D of the Rules for the Survey and Construction of Steel Ships](#).

#### 1.2.1 System Design\*

- (1) Control systems, alarm systems and safety systems are to be independent of each other or have redundancy as far as practicable. In addition, they are to be designed so that one fault does not result in any other faults as far as practicable, and the extent of any damage is kept to a minimum.
- (2) Means are to be provided for safety systems to investigate the cause of the action of any safety systems. Furthermore, the system

that executes the stoppage of the equipment and the devices of such safety systems are to be provided with self-monitoring functions and are to be independent other systems.

### 1.2.2 Supply of Power\*

#### 1 Supply of electrical power

The supply of electrical power is to be in accordance with the following (1) to (4):

- (1) Centralized cargo monitoring and control systems are to be supplied from main sources of electric power and reserve sources of electric power by two sets of independent circuits; moreover, those circuits are to be separated throughout their length as widely as practicable.
- (2) In cases where the supply of electric power has failed due to a failure of such main sources of electric power or short circuits, reserve sources of electric power are to be automatically supplied to centralized cargo monitoring and control systems.
- (3) In the case of a failure of the supply of electric power failure as specified in (2) above occurs, visible and audible alarms are to be activated in cargo control rooms.
- (4) In case of recovery from a electric power supply stoppage, centralized cargo monitoring and control systems are to be designed for speedy automatic or manual recovery in accordance with a planned process.

#### 2 Supply of oil pressure

The supply of control oil pressure is to be in accordance with the following (1) and (2):

- (1) Two or more sets of oil pressure pumps for control of the valves for piping systems are to be provided and they are to be capable of being remotely controlled from cargo control rooms.
- (2) In cases where one of the pumps specified in (1) above fails, stand-by pump(s) are to start automatically.

### 1.2.3 Environmental Conditions

The systems covered under the Rules are to be capable of withstanding the environmental conditions of the place and of those system types given in [1.3.1, Part D of the Rules for the Survey and Construction of Steel Ships](#) and [1.1.7, Part H of the Rules for the Survey and Construction of Steel Ships](#).

### 1.2.4 Monitoring Systems\*

Monitoring system design is to comply with the following requirements for indication functions and alarm functions in addition to requirements of alarm functions specified in [18.2.5-1, Part D of the Rules for the Survey and Construction of Steel Ships](#).

#### 1 Indication function

- (1) The state of operating equipment and devices, the open/close condition of piping system valves (including the open angle if indicated), the state of tanks (such as cargo tanks, ballast tanks, etc.) that influence ship draft and ship conditions such as trim and heel (e.g. liquid levels and in cases where required temperature and pressure levels) and alarm conditions are to be indicated graphically.
- (2) Back-up devices are to be provided for indication devices.
- (3) In cases where safety systems and alarm systems activate, the indication of such conditions is to be given priority.

#### 2 Alarm function

- (1) A self-monitoring function is to be provided.
- (2) Alarm sensor maintenance checks are to be carried out without interfering with any loading unless this is considered impracticable by the Society.
- (3) The activation of visible and audible alarms is to be maintained until confirmation can be made by an operator in order to detect any transitional and abnormal conditions even in the case of natural recovery.
- (4) Audible alarms for centralized cargo monitoring and control systems are to be clearly distinguishable from other audible alarms in cargo control rooms.

### 1.2.5 Control Systems

The construction and function of control systems are to comply with the following (1) and (2):

- (1) Control devices are to be provided with suitable interlocking arrangements in order to prevent any damage to machinery and equipment due to anticipated malfunctions and mal-operation.
- (2) Any valves that need to be operated after loading has begun, such as the inlet valves of tanks and the outlet valves of pumps, etc., are to be remotely controlled valves.

### **1.2.6 Safety Systems\***

The construction and function of safety systems are to comply with the following (1) and (2):

- (1) Safety systems are to be, as far as practicable, provided independently of control systems and alarm systems.
- (2) The alarm functions of the monitoring systems specified in [1.2.4](#) are to operate in cases where safety systems are put into action.

### **1.2.7 Computers and Computerized Systems\***

The construction of monitoring systems, control systems and safety systems in which computers are used is to provide back-up means for such computers in addition to those specified in [18.2.7, Part D of the Rules for the Survey and Construction of Steel Ships](#).

## Chapter 2      SURVEYS

### 2.1      General

#### 2.1.1      Kinds of Surveys

Centralized cargo monitoring and control systems registered or intended to be registered are to be subjected to the following surveys:

- (1) Surveys for the registration of centralized cargo monitoring and control systems (hereinafter referred to as “Registration Surveys”)
- (2) Surveys for maintaining the registration of centralized cargo monitoring and control systems (hereinafter referred to as “Registration Maintenance Surveys”), which are:
  - (a) Special Surveys
  - (b) Annual Surveys
  - (c) Occasional Surveys
  - (d) Unscheduled Surveys

#### 2.1.2      Survey Intervals\*

Surveys are to be carried out in accordance with the following requirements given in (1) and (2):

- (1) Registration Surveys are to be carried out at the time of application for registration.
- (2) Registration Maintenance Surveys are to be carried out at those times as prescribed in (a) to (d) below.
  - (a) Special Surveys are to be carried out at those intervals specified in **1.1.3-1(3), Part B of the Rules for the Survey and Construction of Steel Ships**.
  - (b) Annual Surveys are to be carried out at those intervals specified in **1.1.3-1(1), Part B of the Rules for the Survey and Construction of Steel Ships**.
  - (c) Occasional Surveys: at a time falling on any of **i)** to **iii)** mentioned below, independently of Special Surveys and Annual Surveys. To implement the survey, in lieu of the traditional ordinary surveys where a surveyor is in attendance, the Society may approve survey methods which it considers to be appropriate.
    - i) In cases where any main parts of systems have been damaged, repaired or renewed.
    - ii) In cases where any systems are modified or altered.
    - iii) In cases where considered necessary by the Society.
  - (d) The classed ships may be subject to Unscheduled Surveys when the confirmation of the status of systems by survey is deemed necessary in cases where the Society considers the systems to be subject to **1.4-3 of the Conditions of Service for Classification of Ships and Registration of Installations**.

#### 2.1.3      Special Surveys and Annual Surveys Carried Out in Advance, etc.

##### 1      Surveys carried out in advance

The requirements for Special Surveys and Annual Surveys carried out in advance are to be in accordance with those provisions specified in **1.1.4, Part B of the Rules for the Survey and Construction of Steel Ships**.

##### 2      Postponement of Special Surveys

The requirements for the postponement of Special Surveys are to be in accordance with those provisions specified in **1.1.5(1) or 1.1.5(2), Part B of the Rules for the Survey and Construction of Steel Ships**.

#### 2.1.4      Preparation for Surveys and Others

1      All such preparations required for surveys to be carried out as well as any preparations which may be required by Surveyors as necessary in accordance with the requirements given in the Rules are to be made by survey applicants. Such preparations are to include provisions for easy and safe access, necessary facilities and necessary records for survey execution. Any inspection, measuring and test equipment, which Surveyors rely on to make decisions affecting classification are to be individually identified and calibrated to standards deemed appropriate by the Society. However, Surveyors may accept simple measuring equipment (e.g.

rulers, measuring tapes, weld gauges, micrometers) without individual identification or confirmation of calibration, provided that they are of standard commercial design, properly maintained and periodically compared with other similar equipment or test pieces. Surveyors may also accept equipment fitted on board ship and used in the examination of shipboard equipment (e.g. pressure, temperature or rpm gauges and meters) based either on calibration records or comparison of readings with multiple instruments.

2 Survey applicants are to arrange supervisors who are well conversant with those survey items intended for survey preparation in order to provide any necessary assistance to Surveyors according to their requests during surveys.

3 Surveys may be suspended in cases where the necessary preparations have not been made, any appropriate attendant mentioned in the -2 above is not present, or Surveyors consider that safety for survey execution is not ensured.

4 In cases where repairs are deemed necessary as a result of a survey, Surveyors will notify survey applicants of their recommendations. Upon notification, repairs are to be made to the satisfaction of the Surveyor.

## 2.2 Registration Surveys

### 2.2.1 Drawings and Data

In the case of centralized cargo monitoring and control systems, three copies of the following drawings and data are to be submitted.

- (1) Diagram of piping systems concerning cargoes, ballast water, fuel oil, inert gases, etc.
- (2) List of measuring points and alarm points for centralized monitoring systems
- (3) Drawings for computers concerning power supply sources, construction of systems and self-monitoring functions
- (4) Arrangement plans of cargo control rooms
- (5) Schedules of onboard tests
- (6) Drawings and data other than those above in cases where deemed necessary by the Society

### 2.2.2 Shop Tests\*

The test methods of the following devices making up centralized cargo monitoring and control systems are to be methods deemed appropriate by the Society.

- (1) Computers
- (2) Level measure systems
- (3) Level switches (for high level alarm systems, over flow control systems)
- (4) Other than those above in cases where deemed necessary by the Society

### 2.2.3 Tests after Installation On Board\*

Centralized cargo monitoring and control systems are to be confirmed to effectively operate under conditions as similar to actual conditions as much as possible after installation onboard.

## 2.3 Registration Maintenance Surveys

### 2.3.1 Special Surveys

During the Special Surveys of centralized cargo monitoring and control systems, performance tests and general examinations for the auto change over of computer systems (if used), power supply sources, etc. are to be carried out with confirming satisfactory results. In cases where appropriate records of daily checks and periodical maintenance have been kept, some of these tests may be dispensed with at Surveyor discretion.

### 2.3.2 Annual Surveys

During the Annual Surveys of centralized cargo monitoring and control systems, general examinations are to be carried out. In cases where appropriate records of daily checks and periodical maintenance have been kept, some of these tests may be dispensed with at Surveyor discretion.

### 2.3.3 Occasional Surveys\*

During Occasional Surveys, inspections, tests or investigations are to be carried out on necessary items according to individual cases to the satisfaction of Surveyors. To implement the survey, in lieu of the traditional ordinary surveys where a surveyor is in attendance, the Society may approve survey methods which it considers to be appropriate.

**2.3.4      **Unscheduled Surveys****

At Unscheduled Surveys, investigations, examinations or tests are to be made to the satisfaction of the Surveyor with respect to the matters concerned.

## Chapter 3 CENTRALIZED CARGO MONITORING AND CONTROL SYSTEMS

### 3.1 General

#### 3.1.1 Scope

The requirements given in this Chapter apply to centralized cargo monitoring and control systems installed in CCM-ships.

### 3.2 Cargo Control Room Installations

#### 3.2.1 Centralized Cargo Monitoring and Control Systems\*

1 A suitable sounding device approved by the Society is to be fitted onto cargo tanks, ballast tanks, tanks that influence ship draft and ship condition such as trim and heel in order to be able to centrally monitor relevant tank levels.

2 The following remote control operations are to be capable of being performed in a centralized manner during loading:

- (1) Open/close or open angle control of remote control valves
- (2) Remote start/stop for devices related to loading such as cargo pumps, stripping pumps, ballast pumps, etc.
- (3) Remote start of ventilation devices in cargo pump rooms and cargo compressor rooms

3 During loading and ballasting, the necessary information concerning the main equipment and system construction of the loading systems of ships specified in **Table 3.1** to **Table 3.3** are to be capable of being centrally monitored from the same location in accordance with the type of ship.

4 Appropriate communication measures are to be provided between cargo control rooms and loading areas.

5 In cases where cargo requires to be heated and have its temperature maintained while stowed on board, remote temperature control systems and cargo tank temperature monitoring systems are to be provided in cargo control rooms. Furthermore, visible and audible alarms, activated in cases of permissible temperature control range deviation, are to be provided in cargo control rooms and on navigation bridges.

6 In cases where cargo requires tank pressure monitoring while stowed on board, cargo tank pressure monitoring systems are to be provided in cargo control rooms. Furthermore, visible and audible alarms, activated in cases of permissible pressure control range deviation, are to be provided in cargo control rooms and on navigation bridges.

7 The stopping systems for cargo pumps, etc. are to be capable of being operated from machinery operating locations and cargo control rooms.

#### 3.2.2 Safety Measures\*

In order to prevent miss operation, essential remote control valves are to be operated by a two-step procedure after the confirmation of the valve condition.



Table 3.1 Loading Monitoring (for Tankers)

	Monitored Targets	Indicators	Alarms	Records	Remarks
Temperature	Cargo tanks	○	H		in cases where heating cargoes and maintaining such temperatures
	Cargo pumps, Tank cleaning pumps, Stripping pumps and Ballast pump casings		H		driven by shafts through bulkheads in pump rooms
	Cargo pumps, Tank cleaning pumps, Stripping pumps and Ballast pump bearings		H		
	Cargo pumps, Tank cleaning pumps, Stripping pumps and Ballast pumps penetrating bulkhead stuffing boxes		H		
Pressure	Inlet sides and outlet sides of cargo pumps	○			
	Inlet sides and outlet sides of ballast pumps	○			
	Inlet sides and outlet sides of tank cleaning pumps	○			
	Inlet sides and outlet sides of stripping pumps	○			
	Eductor drive fluid inlets and outlets, Vacuum pressure	○			if necessary
	Cargo manifolds	○			
	Inert gas deck main lines	○	H, L	R	
Level	Cargo tanks	○	H, HH, L		
	Ballast tanks	○	L		
	FPT, APT	○	L		
	Inert gas deck seal units		L		
	Inert gas scrubbers		H		
Pump	Emergency stops of cargo pumps, stripping pumps		S		
	Ballast pumps		S		
	Revolutions of cargo pumps, stripping pumps	○			
	Deck seal pumps		S		
	Scrubber pumps		S		
Others	Oil discharge monitors (ODM)		H	R	
	Draft of Fore, Aft, Middle	○			
	Pump room bilge		H		
	Gas concentrations in pump rooms	○	H		
	Location of piping system valves	○			open/close or open angle indication
	Inert gases, O <sub>2</sub> concentrations	○	H	R	
	Calculation results of loading computers (indicated on loading computer)	○			installation location of loading computer is to be the cargo control room or a work division that is adjacent to the cargo control room
	Failures of Control power, Control system hydraulic pressure, Control system air pressure		F		

Notes:

 “○” means installing detectors. “H” and “L” mean high and low. “S” means abnormal condition. “F” means failure condition occurred. “R” means recording. Same meanings are applied in **Tables 3.1 to 3.3**.

Table 3.2 Loading Monitoring (for Ships Carrying Dangerous Chemicals in Bulk)

Monitored Targets		Indicators	Alarms	Records	Remarks
Temperature	Cargo tanks	○	H		according to <b>Part S of the Rules for the Survey and Construction of Steel Ships</b> .
	Cargo pumps, Tank cleaning pumps, Stripping pumps and Ballast pump casings		H		if necessary
	Cargo pumps, Tank cleaning pumps, Stripping pumps and Ballast pump bearings		H		
	Cargo pumps, Tank cleaning pumps, Stripping pumps and Ballast pumps penetrating bulkhead stuffing boxes		H		
Pressure	Cargo tanks	○	H, L		according to <b>Part S of the Rules for the Survey and Construction of Steel Ships</b> .
	Inlet sides and outlet sides of cargo pumps	○			
	Inlet sides and outlet sides of ballast pumps	○			
	Inert gas deck main lines	○	H, L		according to <b>Table S17.1, Part S of the Rules for the Survey and Construction of Steel Ships</b> .
Level	Cargo tanks	○	H, HH, L		according to <b>Table S17.1, Part S of the Rules for the Survey and Construction of Steel Ships</b> for HH.
	Ballast tanks	○	L		
	FPT, APT	○	L		
Pump	Emergency stops of cargo pumps		S		in cases where the driving sources for cargo pumps are hydraulic types.
	Ballast pumps		S		
	Revolutions of cargo pumps	○			
	Oil temperature of hydraulic systems		H		
	Oil pressure of hydraulic systems		L		
	Oil level of hydraulic systems		H, L		
Others	Draft of Fore, Aft, Middle	○			
	Pump room bilge		H		
	Gas concentrations	○	H		according to <b>Table S17.1, Part S of the Rules for the Survey and Construction of Steel Ships</b> .
	Location of piping system valves	○			open/close or open angle indication
	Inert gases, O <sub>2</sub> concentrations	○	H	R	according to <b>Table S17.1, Part S of the Rules for the Survey and Construction of Steel Ships</b> .
	Calculation results of loading computers (indicated on loading computer)	○			installation location of loading computer is to be the cargo control room or a work division that is adjacent to the cargo control room
	Failures of Control power, Control system hydraulic pressure, Control system air pressure			F	

Table 3.3 Loading Monitoring (for Ships Carrying Liquefied Gases in Bulk)

Monitored Targets		Indicators	Alarms	Records	Remarks
Pressure	Cargo tanks	○	H, L		
	Outlet side of cargo pumps and spray pumps	○			
	Inlet sides and outlet sides of ballast pumps	○			
	Hold spaces		H, L		
	Shore manifold headers	○			
Level	Cargo tanks	○	H, HH, L		
	Ballast tanks	○	L		
	FPT, APT	○	L		
Pump	Emergency stops of cargo pumps and spray pumps		S		ESDS
	Ballast pumps		S		
	Ampere of cargo pump and spray pumps	○	S		detection of over current and lower current is acceptable
Gas compressor	Temperatures of outlet gases, L.O. for bearings and stuffing boxes, bodies of stuffing boxes	○	H		similar measures are acceptable in cases other than stuffing boxes with L.O.
	Pressures of L.O. for bearings and stuffing boxes		L		
	Emergency stop of gas compressors		S		ESDS
Others	Draft of Fore, Aft, Middle	○			
	Hold space bilge		H		
	Gas concentrations	○	H		location specified in <b>13.6.2, Part N of the Rules for the Survey and Construction of Steel Ships.</b>
	Location of piping system valves	○			open/close or open angle indication
	Inert gases, O <sub>2</sub> concentrations	○	H	R	
	Ventilation in the cargo machinery rooms and motor rooms		F		
	Calculation results of loading computers (indicated on loading computer)	○			installation location of loading computer is to be the cargo control room or a work division that is adjacent to the cargo control room
	Failures of Control power, Control system hydraulic pressure, Control system air pressure		F		

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# GUIDANCE FOR CENTRALIZED CARGO MONITORING AND CONTROL SYSTEMS

## Chapter 1 GENERAL

### 1.2 General

#### 1.2.1 System Design

The wording “self-monitoring functions” specified in **1.2.1(1) of the Rules** refers to the following:

- (1) The monitoring for short circuits with respect to safety system power sources, emergency stop systems, etc. of those systems which do not use computers; or
- (2) The monitoring for abnormal conditions with respect to the Central Processing Units (CPU), communication, sensors, etc. of those systems which use computers

#### 1.2.2 Supply of Power

1 The wording “reserve sources of electric power” specified in **1.2.2-1(1) of the Rules** refers to either batteries or an Uninterruptible Power Supply (UPS).

2 In cases where the requirements specified in **1.2.2-1(1) of the Rules** are applied, the supply from reserve sources of electric power is to be for a period sufficient enough to allow the backing-up of data related to current conditions, the stoppage of any loading operations and ensure communication between the loading area and the control room.

#### 1.2.4 Monitoring Systems

1 The wording “piping system valves” specified in **1.2.4-1(1) of the Rules** refers to valves that influence loading safety such as the inlet valves of each tank, the outlet valves of each pump, shore manifold valves, valves that might cause contamination by miss operation, etc.

2 In cases where the requirements specified in **1.2.4-1(2) of the Rules** are applied, reserve monitors are to be provided for systems using monitor display devices.

#### 1.2.6 Safety Systems

The wording “safety systems” specified in **1.2.6 of the Rules** refers to protective functions such as the emergency stoppage of cargo pumps and inert gas systems as well as emergency shut down systems, etc. required by the **Rules for the Survey and Construction of Steel Ships**.

#### 1.2.7 Computers and Computerized Systems

The wording “back-up means for such computers” specified in **1.2.7 of the Rules** refers to one of the following:

- (1) Reserve computers (each computer is to be maintained in “hot standby condition”)
- (2) Monitoring and control systems that do not depend on computers and which can be remotely controlled from cargo control rooms

## Chapter 2 SURVEYS

### 2.1 General

#### 2.1.2 Survey Intervals

The wording “the Society may approve the survey methods which it considers to be appropriate.” in **2.1.2(2)(c) of the Rules** means survey methods which the Society considers to be able to obtain information equivalent to that obtained through traditional ordinary surveys where a surveyor is in attendance.

### 2.2 Registration Surveys

#### 2.2.2 Shop Tests

**1** The wording “deemed appropriate by the Society” specified in **2.2.2 of the Rules** means devices satisfy the requirements specified in **Chapters 1 and 4, Part 7 of the Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

**2** In cases where the requirements specified in **2.2.2(1) of the Rules** are applied, each input/output point, indication function for monitoring and alarm systems, etc. are to be confirmed. To implement surveys, in lieu of traditional ordinary surveys where the Surveyor is in attendance, the Society may approve other survey methods which it considers to be able to obtain information equivalent to that obtained through traditional ordinary surveys.

#### 2.2.3 Tests after Installation On Board

Confirmation of the functions of the following is to be performed by testing after installation on board:

- (1) The input/output points and indications for monitoring and alarm systems, etc.
- (2) Each safety system
- (3) Each measurement system for level, temperature, pressure
- (4) Remote controls for cargo pumps, ventilation devices, control valves, etc.
- (5) Loading computers
- (6) The communication systems specified in **3.2.1-4 of the Rules**
- (7) Fail safe and back-up functions related to computer failures (including electric power failures)

### 2.3 Registration Maintenance Surveys

#### 2.3.3 Occasional Surveys

The wording “the Society may approve the survey methods which it considers to be appropriate.” in **2.3.3 of the Rules** means survey methods which the Society considers to be able to obtain information equivalent to that obtained through traditional ordinary surveys where a surveyor is in attendance.

## **Chapter 3      CENTRALIZED CARGO MONITORING AND CONTROL SYSTEMS**

### **3.2      Cargo Control Room Installations**

#### **3.2.1      Centralized Cargo Monitoring and Control Systems**

In cases where the requirements specified in **3.2.1-2(1) of the Rules** are applied, only remote stop capability is required for pumps driven by turbines.

#### **3.2.2      Safety Measures**

The wording “essential remote control valves” specified in **3.2.2 of the Rules** refers to cross-over valves, etc.