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RULES FOR AUTOMATIC AND REMOTE CONTROL SYSTEMS

Chapter 1 GENERAL

1.1 General

1.1.1 Scope

1 The Rules for Automatic and Remote Control Systems (hereinafter referred to as “the Rules”) apply to the survey and construction of centralized monitoring and control systems for machinery, monitoring and control systems for periodically unattended machinery spaces and specific automation equipment (hereinafter referred to as “automatic and remote control systems”) of ships classed with NIPPON KAIJI KYOKAI (hereinafter referred to as “the Society”) and intended to be registered with those Installation Characters found in [Chapter 2 or 3 of the Regulations for the Classification and Registry of Ships](#).

2 The requirements given in [Chapter 18, Part D of the Rules for the Survey and Construction of Steel Ships](#) are also to apply to any equipment and systems used for automatic and remote control systems in addition to those specified in the Rules.

1.1.2 Equivalency

Automatic and remote 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 Modification of Requirements*

In cases where considered appropriate, the Society may modify parts of any requirements specified in the Rules in consideration of the national requirements of the ship flag states, ship type and intended service areas of ships.

1.1.4 Automatic and Remote Control Systems with Novel Design Features

In the case of automatic and remote 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.

1.1.5 Terminology

The terms in the Rules, in addition to those defined in [18.1.2, Part D of the Rules for the Survey and Construction of Steel Ships](#), are defined as follows:

- (1) Specific automation equipment, a general term for Class *A* specific automation equipment, Class *B* specific automation equipment, Class *C* specific automation equipment and Class *D* specific automation equipment is defined as follows:
 - (a) Class *A* specific automation equipment
Remote-controlled fuel oil filling arrangements, remote-control mooring arrangements, automatic steering systems, remote-controlled handling systems for liquid cargo in bulk, remote-controlled ballasting/deballasting arrangements, power-operated opening/closing appliances and automatic main propulsion machinery recording devices.
 - (b) Class *B* specific automation equipment
Remote-controlled fuel oil filling arrangements, remote-controlled mooring arrangements, automatic steering systems, remote-controlled handling systems for liquid cargo in bulk, remote-controlled ballasting/deballasting arrangements, power-operated opening/closing appliances, monitoring devices of refrigeration containers, emergency towing rope winches, cargo hose handling winches, automatic main propulsion machinery recording devices and centralized machinery monitoring systems.
 - (c) Class *C* specific automation equipment
Remote-controlled fuel oil filling arrangements, independent remote-controlled mooring arrangements, automatic steering systems, remote-controlled handling systems for liquid cargo in bulk, remote-controlled ballasting/deballasting arrangements, power-operated opening/closing appliances, monitoring devices of refrigeration containers, emergency towing rope winches, cargo hose handling winches, automatic main propulsion machinery recording devices, centralized

machinery monitoring systems, centralized machinery control systems, power-operated pilot ladder winding appliances and fixed deck washing arrangements.

(d) Class *D* specific automation equipment

Remote-controlled fuel oil filling arrangements, independent remote-controlled mooring arrangements, automatic steering systems, remote-controlled handling systems for liquid cargo in bulk, remote-controlled ballasting/deballasting arrangements, power-operated opening/closing appliances, monitoring devices of refrigeration containers, emergency towing rope winches, cargo hose handling winches, automatic main propulsion machinery recording devices, centralized machinery monitoring systems, centralized machinery control systems, power-operated pilot ladder winding appliances, fixed deck washing arrangements and bridge wing control devices.

- (2) The term **MC**-ship means those ships which are to be registered as a ship in which the centralized monitoring and control systems for machinery in accordance with those requirements given in **Chapter 3** are installed.
- (3) The term **M0**-ship means those ships which are to be registered as a ship in which the monitoring and control systems for periodically unattended machinery spaces in accordance with those requirements given in **Chapter 4** are installed.
- (4) The term **M0•A**-ship means those ships which are to be registered as a **M0**-ship in which the Class *A* specific automation equipment in accordance with those requirements given in **5.2.1** is installed.
- (5) The term **M0•B**-ship means those ships which are to be registered as a **M0**-ship in which the Class *B* specific automation equipment in accordance with those requirements given in **5.2.2** is installed.
- (6) The term **M0•C**-ship means those ships which are to be registered as a **M0**-ship in which the Class *C* specific automation equipment in accordance with those requirements given in **5.2.3** is installed.
- (7) The term **M0•D**-ship means those ships which are to be registered as a **M0**-ship in which the Class *D* specific automation equipment in accordance with those requirements given in **5.2.4** is installed.
- (8) Anniversary date means the day each year corresponding to the expiration date of classification certificates, excluding the expiration dates of classification certificates.
- (9) Centralized monitoring and control systems for machinery mean those remote monitoring and control systems used for main propulsion machinery, boilers, generating sets and other auxiliary machinery which are arranged in a centralized manner.
- (10) Centralized control stations means those rooms, other than the bridge, in which centralized monitoring and control systems for machinery are installed and from which main propulsion machinery is normally controlled.
- (11) Centralized monitoring and control stations on bridges means ship wheelhouses in which centralized monitoring and control systems for machinery are installed and from which main propulsion machinery is normally controlled.
- (12) Monitoring and control systems for periodically unattended machinery spaces mean those systems which operate machinery and equipment specified in the following **(a)** to **(g)** without watch-keeping personnel assigned specific duties of operation and surveillance during a predetermined period.
 - (a) Main propulsion machinery (propulsion generating sets in electric propulsion ships are excluded)
 - (b) Controllable pitch propellers
 - (c) Steam generating sets
 - (d) Electric generating sets (propulsion generating sets in electric propulsion ships are included)
 - (e) Auxiliary machinery associated with the machinery and equipment listed in **(a)** to **(d)**
 - (f) Fuel oil systems
 - (g) Bilge systems
- (13) Bridge means the area from which navigation and control of ships are exercised, including wheelhouses and bridge wings.
- (14) Bridge wings mean those parts of the bridge on both sides of ship wheelhouses which extended to ship sides.
- (15) Wheelhouses mean enclosed areas of the bridge.

1.1.6 Installations Characters

1 Character “MC” is given in the Register for any centralized monitoring and control systems used for main propulsion and essential auxiliary machinery of MC-ships.

2 Character “M0” is given in the Register for any operating systems for periodically unattended machinery spaces of M0-ships.

3 Character “M0•A” is given in the Register for the Class A specific automation equipment of M0•A ships.

4 Character “M0•B” is given in the Register for the Class B specific automation equipment of M0•B ships.

5 Character “M0•C” is given in the Register for the Class C specific automation equipment of M0•C ships.

6 Character “M0•D” is given in the Register for the Class D specific automation equipment of M0•D ships.

1.1.7 Manuals for Setting Points of Alarms and Safety Devices

The documents, in which the setting points and their confirmation test methods of alarms and safety devices are recorded, are to be kept on board.

1.2 System Design

1.2.1 System Design*

System design is to comply with the following requirements in addition to those specified in **18.2.1, Part D of the Rules for the Survey and Construction of Steel Ships**.

- (1) Control systems, alarm systems and safety systems are to be independent each other as far as practicable.
- (2) Safety systems intended for those functions specified in **18.1.2(10)(c), Part D of the Rules for the Survey and Construction of Steel Ships** are to be, in all cases, independent of the other systems.
- (3) Means are to be provided for safety systems to investigate the cause of the action of any safety systems.

1.2.2 Alarm Systems

Alarm systems are to comply with the following requirements in addition to those specified in **18.2.5, Part D of the Rules for the Survey and Construction of Steel Ships**.

- (1) Alarm systems are to be provided with self-monitoring properties.
- (2) Alarm systems are to be capable of being tested during normal machinery operation.
- (3) In cases where practicable, means are to be provided at convenient and accessible positions to test sensors without affecting the operation of any machinery.
- (4) Visual and audible alarms are to be designed to keep detecting until being accepted even in the case of transient faults which may be subsequently self-corrected.

1.2.3 Computers and Computerized Systems*

The construction of systems in which computers are used is to comply with the following requirements in addition to those specified in **18.2.7, Part D of the Rules for the Survey and Construction of Steel Ships**.

- (1) Control systems, alarm systems and safety systems are in general to be independent each other in accordance with the requirements given in **1.2.1, 18.2.4-1 and 18.2.6-1, Part D of the Rules**. However, in cases where it is considered impracticable, they may be as deemed appropriate by the Society.
- (2) With respect to alarm systems, alternative alarm systems or a back-up means for computers are to be provided.

1.3 Prevention of Flooding and Fire Safety Measures

1.3.1 Prevention of Flooding*

1 The capacities of bilge wells in spaces where main propulsion machinery, propulsion shafting systems, boilers, electric generating sets and auxiliary machinery essential for main propulsion of ships are installed and in any other spaces considered necessary by the Society, are to be sufficient enough to accumulate the drainage under normal machinery operational conditions. Furthermore, high level alarm devices are to be provided at two or more positions in such wells so that any increase of bilge can be detected at normal angles of heel and trim, except for such spaces where the Society accepts that there is no fear of flooding.

2 In cases where bilge pumps are capable of being started and stopped automatically, small bilge wells may be accepted with consideration given to the operating frequency of such pumps.

3 In cases where bilge pumps are capable of being started and stopped automatically, alarm devices are to be provided to indicate either one of the following conditions:

- (1) In cases where the influx of bilge is greater than pump capacity.
- (2) In cases where pumps are operating more frequently than expected.

4 Control devices of any valves using sea inlets, discharge outlets located below summer load lines or bilge injection systems are to be located so as to allow adequate time for operation in cases where flooding of spaces happens under fully loaded conditions of ships, having regard to the time likely to be required in order to reach and operate such control devices.

1.3.2 Fire Safety Measures

Additional fire safety measures are to be arranged in accordance with those requirements given in **5.2.3, 7.4, 10.2.1-2, 10.5.3-1** and **10.5.5-2, Part R of the Rules for the Survey and Construction of Steel Ships**.

Chapter 2 SURVEYS OF AUTOMATIC AND REMOTE CONTROL SYSTEMS

2.1 General

2.1.1 Kinds of Surveys

Automatic and remote control systems registered or intended to be registered are to be subjected to the following surveys:

- (1) Surveys for registration of automatic and remote control systems (hereinafter referred to as “Registration Surveys”)
- (2) Surveys for maintaining registration of automatic and remote 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(1)** or **1.1.5-1(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.

2.1.5 Laid-up Ships

1 Laid-up ships are not subject to Registration Maintenance Surveys. However, Occasional Surveys may be carried out at the request of owners.

2 When laid-up ships are about to be re-entering service, the following surveys and surveys for specific matters which have been postponed due to being laid-up, if any, are to be carried out.

- (1) If the due dates for Registration Maintenance Surveys have not transpired while the ship was laid-up, then an equivalent to the Annual Surveys specified in 2.3.2 is to be carried out.
- (2) If the due dates for Registration Maintenance Surveys have transpired while the ship was laid-up, then these Registration Maintenance Surveys are, in principle, to be carried out. However, in cases where Special Surveys and Annual Surveys are due, only the Special Surveys may be carried out.

2.2 Registration Surveys

2.2.1 Drawings and Data*

In the case of automatic and remote control systems, three copies of the following drawings and data are to be submitted.

- (1) Centralized monitoring and control systems for machinery or monitoring and control systems for periodically unattended machinery spaces:
 - (a) Drawings and data specified in **18.1.3, Part D of the Rules for the Survey and Construction of Steel Ships**
 - (b) Schedules of on-board tests and sea trials
- (2) Specific automation equipment:
 - (a) Drawings and data specified in **18.1.3, Part D of the Rules for the Survey and Construction of Steel Ships**
 - (b) Other drawings and data relative to automatic and remote controls
 - (c) Drawings showing construction and layouts
 - (d) Particulars
 - (e) On-board test plan
- (3) Drawings and data other than those above in cases where deemed necessary by the Society

2.2.2 Shop Tests*

The devices, units, sensors and those systems composed of them which are used for centralized monitoring and control systems for machinery or monitoring and control systems for periodically unattended machinery spaces, in cases where considered necessary by the Society, are to be subjected to those environmental tests and completion tests specified in **18.7.1, Part D of the Rules for the Survey and Construction of Steel Ships** after being manufactured.

2.2.3 Approval of Use

Approval of use for those devices and equipment which have passed those environmental tests specified in 2.2.2 above is to be in accordance with those requirements specified in **18.7.2, Part D of the Rules for the Survey and Construction of Steel Ships**.

2.2.4 Tests after Installation On Board*

The devices and equipment controlled by automatic and remote control systems, in cases where deemed necessary by the Society, are to be confirmed to operate so as not to endanger ship safety even in cases where control systems fail as well as in addition to those tests specified in **18.7.3, Part D of the Rules for the Survey and Construction of Steel Ships**.

2.2.5 Sea Trials*

1 Centralized monitoring and control systems for machinery are to be subjected to the following tests:

- (1) Main propulsion machinery and controllable pitch propellers

- (a) Main propulsion machinery or controllable pitch propellers are to be subjected to starting tests, ahead-astern tests and running tests in their whole range of output, by means of remote control devices from centralized control stations or centralized monitoring and control stations on bridges.
- (b) In addition to output increase and decrease tests, operation tests of the main propulsion machinery or the controllable pitch propellers using bridge control devices are to be carried out as deemed appropriate by the Society.
- (c) In cases where there are two or more control stations for main propulsion machinery or controllable pitch propellers, tests on the transfer of control are to be carried out during ahead and astern operations of such main propulsion machinery or controllable pitch propellers. In cases where the transfer of control of remote control devices of main propulsion machinery or controllable pitch propellers is carried out in accordance with **18.3.2-2(3)(b), Part D of the Rules for the Survey and Construction of Steel Ships**, the above-mentioned tests are to be carried out during stopping conditions of main propulsion machinery.
- (d) After completion of those tests on the transfer of control specified in (c) above, it is to be shown that main propulsion machinery or the controllable pitch propellers can be smoothly operated from their respective control stations.

(2) Boilers

- (a) With respect to main boilers, it is to be confirmed that feed water control devices, combustion control devices and so on can operate stably in response to any load variations of main boilers, and such main boilers can stably supply steam to main propulsion machinery, the electric generating sets and any auxiliary machinery essential for main propulsion of ships without any local manual operations.
- (b) With respect to essential auxiliary boilers, it is to be confirmed that they can supply steam stably to any auxiliary machinery essential for main propulsion of ships without any manual operations.
- (c) In cases where exhaust gas economizers are used as sources of steam supplies to turbines for driving generators and steam is supplied from boilers automatically in cases where low power conditions of main propulsion machinery, operation tests of automatic control devices for such systems are to be carried out.

(3) Electric generating sets

In cases where generators driven by main propulsion machinery are installed, systems of automatic or remote control of electric generating sets are to be subjected to operation tests.

2 Monitoring and control systems for periodically unattended machinery spaces are to be subjected to the following tests in addition to those tests specified in **-1** above.

- (1) It is to be confirmed that all machinery can be safely and surely monitored and controlled with monitoring and control systems for periodically unattended machinery spaces under normal sea going conditions as much as possible. In such cases, except in cases where operation modes are changed over, running conditions of machinery are not to be adjusted by means of manual operation from any control station other than the bridge.
- (2) In substitution of those tests specified in **-1(1)(a)** and **(b)** above, main propulsion machinery or controllable pitch propellers are to be confirmed to be safely and surely operated in all service ranges of outputs including starting and ahead-astern conditions, by means of centralized monitoring and control systems for machinery or bridge control devices.
- (3) Auxiliary machinery (excluding any auxiliary machinery for specific use and other auxiliary machinery) is to be subjected to the following tests while controlling main propulsion machinery or controllable pitch propellers from the bridge.
 - (a) Automatic starting tests of those standby pumps specified in **3.3.2-1(3), 3.3.2-2(3)(a), 3.3.2-3(3), 3.3.2-4(1), 3.3.3-2, 3.3.5-1** and **18.2.2-2(3), Part D of the Rules for the Survey and Construction of Steel Ships**, and automatic changeover tests for those circulating pumps specified in **3.3.2-2(3)(b)**.
 - (b) Tests to confirm that, while main propulsion machinery is operating under normal continuous cruise output, exclusive air reservoirs for control use, if fitted, are capable of supplying air for at least five minutes after operation of low pressure alarms for control air on the condition that the automatic starting functions of control air compressors is stopped.
- (4) In cases where exhaust gas economizers are used as sources of steam supply to turbines for driving generators, the following are to be confirmed:
 - (a) While any main propulsion machinery is operating under normal continuous cruise outputs, additional heating for boilers and automatic starting for generating sets driven by reciprocating internal combustion engines are to be performed in cases where any handles of main propulsion machinery are rapidly put back into stop positions.

- (b) When the main propulsion machinery is operated from a stopping position to a normal continuous cruise output expeditiously, no critical condition occurs to water separator drums, piping, steam turbines and so on.

2.3 Registration Maintenance Surveys

2.3.1 Special Surveys

1 During Special Surveys of centralized monitoring and control systems for machinery, the following devices or systems are to be functionally tested and placed in order.

- (1) Main propulsion machinery or controllable pitch propellers
 - (a) Remote control changeover devices between the following control positions as well as any remote control systems located in these positions:
 - i) Wheelhouses and centralized control stations, in cases where bridge control devices are installed
 - ii) Wheelhouses and local control positions, or wheelhouses and sub-control stations, in cases where centralized monitoring and control systems for machinery are installed on the bridge
 - iii) Centralized control stations and local control positions, in cases where centralized monitoring and control systems for machinery are installed in locations other than the bridge
 - (b) Safety devices
- (2) Boilers
 - (a) Automatic control systems and remote control systems
 - (b) Safety devices
- (3) Electric generating sets
 - (a) Automatic control systems and remote control systems
 - (b) Safety devices
- (4) Automatic changeover devices of essential pumps to their standby pumps, and automatic starting devices (or remote start/stop devices) of air compressors
- (5) Alarm systems including their indicating devices and confirmation setting points
- (6) Remote monitoring systems

2 During Special Surveys of monitoring and control systems for periodically unattended machinery spaces, the following are to be functionally tested and placed in order.

- (1) Main propulsion machinery or controllable pitch propellers
 - (a) Remote control changeover devices between the following control positions as well as any remote control systems located in these positions:
 - i) Wheelhouses and centralized control stations, in cases where bridge control devices are installed
 - ii) Wheelhouses and local control positions, or wheelhouses and sub-control stations, in cases where centralized monitoring and control systems for machinery are installed on the bridge
 - (b) Safety devices
- (2) Boilers
 - (a) Automatic control systems and remote control systems
 - (b) Safety devices
- (3) Electric generating sets
 - (a) Automatic control systems and remote control systems
 - (b) Safety devices
- (4) Automatic changeover devices of essential pumps to their standby pumps, and automatic starting devices of air compressors
- (5) Communication systems specified in [4.3.2](#)
- (6) Alarm systems including their indicating devices and confirmation setting points
- (7) Remote monitoring systems

3 During Special Surveys of specific automation equipment, general examination and performance tests are to be carried out.

4 In cases where considered necessary by Surveyors, sea trials may be required after completion of the any of the tests mentioned

in -1, -2 or -3 above.

2.3.2 Annual Surveys

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

- (1) Safety devices for main propulsion machinery and emergency stopping devices for main propulsion machinery fitted in remote control stations for main propulsion machinery or controllable pitch propellers
- (2) Safety devices for boilers
- (3) Safety devices for electric generating sets

2 During Annual Surveys of monitoring and control systems for periodically unattended machinery spaces, the following surveys **(1)** and **(2)** are to be carried out.

- (1) The arrangements for periodically unattended machinery spaces are to be examined, and, in particular, the random testing of alarm, automatic and shutdown functions is to be carried out.
- (2) The following performance tests 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.
 - (a) Safety devices for main propulsion machinery and emergency stopping devices for main propulsion machinery fitted in remote control stations for main propulsion machinery or controllable pitch propellers
 - (b) Safety devices for boilers
 - (c) Safety devices for electric generating sets
 - (d) Communication systems specified in **4.3.2**

3 During Annual Surveys of specific automation equipment, general examinations are to be carried out. In cases where considered necessary by Surveyors, performance tests of equipment may be required.

2.3.3 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 MONITORING AND CONTROL SYSTEMS FOR MACHINERY

3.1 General

3.1.1 Scope

The requirements given in this Chapter apply to centralized monitoring and control systems for machinery to be installed in MC-ships.

3.2 Centralized Monitoring and Control Systems for Machinery

3.2.1 General

With respect to MC-ships, centralized monitoring and control systems for machinery are to be installed in centralized control stations or centralized monitoring and control stations on bridges in order to ensure the safe operation of main propulsion machinery under all sailing conditions including maneuvering as much as that can be achieved by means of manual control under direct supervision.

3.2.2 Centralized Monitoring and Control Systems for Machinery*

Centralized monitoring and control systems for machinery are to include the following devices:

- (1) Remote control devices specified in **18.3.2, Part D of the Rules for the Survey and Construction of Steel Ships** and necessary monitoring devices for main propulsion machinery or controllable pitch propellers
- (2) Remote control devices and monitoring devices for boilers specified in **18.4.1, Part D of the Rules for the Survey and Construction of Steel Ships**

The remote control devices are to comply with the following:

- (a) Main boilers
 - Control systems of the number of firing burners except the ignition sequence and combustion control systems. In cases where such systems are automatically controlled, these devices may be dispensed with.
- (b) Auxiliary boilers
 - Control systems of steam supplies to turbines used for driving generators in order to maintain stable electrical power in the case of any low power condition of main propulsion machinery. In cases where such systems are automatically controlled, these devices may be dispensed with.
- (3) Monitoring devices for electric generating sets
- (4) Remote starting and stopping devices and monitoring devices for pumps used as auxiliary machinery essential for main propulsion

In cases where standby pumps for these pumps are arranged to start automatically, remote starting and stopping devices may be dispensed with.
- (5) Remote starting and stopping devices and monitoring devices for starting main propulsion machinery and for controlling air compressors

In cases where such air compressors are arranged to operate automatically, remote starting and stopping devices may be dispensed with.
- (6) Alarm devices to indicate any activation of safety systems and faults of machinery as specified in **3.3** and **18.3** through **18.6, Part D of the Rules for the Survey and Construction of Steel Ships**
- (7) Emergency stopping devices for main propulsion machinery specified in **18.3.2-3(5), Part D of the Rules for the Survey and Construction of Steel Ships**
- (8) Communication means specified in **1.3.7(1), Part D of the Rules for the Survey and Construction of Steel Ships** and those engineers alarms specified in **1.3.8, Part D of the Rules for the Survey and Construction of Steel Ships**
- (9) Bilge alarm devices specified in **1.3.1-1** and **-3**
- (10) Fire detectors and manual call points for those fire alarms specified in **7.4.1, Part R of the Rules for the Survey and**

Construction of Steel Ships

- (11) For ships provided with selective catalytic reduction systems, those specified in the following (a) to (c):
- (a) the monitoring devices of reductant agent injection systems and the changeover devices of exhaust gas pipes which comprise the SCR system
 - (b) the monitoring devices of the on-off devices for exhaust gas heating devices (in cases where exhaust gas heating devices are fitted)
 - (c) an alarm system which indicates the activation of the safety devices specified in **21.3.2-4** and **21.6.4, Part D of the Rules for the Survey and Construction of Steel Ships** as well as the alarm systems required by said provisions
- (12) For ships provided with exhaust gas cleaning systems or exhaust gas recirculation systems, remote control devices and monitoring devices of exhaust gas cleaning systems and changeover devices of exhaust gas pipes, as applicable. However, in cases where exhaust gas cleaning systems and changeover devices of exhaust gas pipes are controlled fully automatically, alarm devices indicating abnormal conditions of related devices may be accepted.
- (13) Any other devices considered necessary by the Society

3.3 Additional Requirements for Safety Measures**3.3.1 General**

In the case of MC-ships, safety measures in accordance with the requirements given in this **3.3** are to be taken in addition to those requirements specified in **Chapter 18, Part D of the Rules for the Survey and Construction of Steel Ships**.

3.3.2 Main Propulsion Machinery or Controllable Pitch Propellers

1 Main propulsion machinery in ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships)

(1) Safety devices

Safety devices are to be provided to automatically shut off the fuel supply to the main propulsion machinery under the following conditions:

- (a) Over-speed
- (b) Pressure drops of lubricating oil to main bearings and thrust bearings
- (c) Pressure drops of lubricating oil to crosshead bearings in the case of crosshead engines which have separate lubricating oil systems
- (d) Pressure drops of lubricating oil to camshafts in the case of crosshead engines which have separate lubricating oil systems
- (e) High temperatures of thrust bearings or thrust bearing lubricating oil in cases where engines have thrust bearings

(2) Reductions of speeds or loads

Measures are to be taken to automatically reduce speeds or loads to main propulsion machinery under the following conditions. However, in cases where alternative measures such as activating alarms to request such reductions are taken, manual reductions of speeds or loads may be accepted.

- (a) Pressure drops of lubricating oil to main bearings and thrust bearing in the case of crosshead engines
- (b) Pressure drops of lubricating oil to crosshead bearings in cases where crosshead engines have separate lubricating oil systems
- (c) High temperatures of thrust bearings or thrust bearing lubricating oil in cases where engines have thrust bearings
- (d) Low flows of lubricating oil at each cylinder lubricator (non-flow may be accepted)
- (e) Pressure drops of piston coolant at inlets in the case of crosshead engines (not required when cooling oil is provided from main lubricating oil systems of engines)
- (f) High temperatures of piston coolant at cylinder outlets in the case of crosshead engines
- (g) Low flows of piston coolant at cylinder outlets (alternative means may be accepted for those crosshead engines which have piston coolant flows that cannot be measured.)
- (h) Pressure drops of cylinder cooling water at inlets (low flows may be accepted in the case of trunk piston engines)
- (i) High temperatures of cylinder cooling water at cylinder outlets

Temperatures at cylinder common outlets may be accepted in case where engines have no individual stop valves at their

cylinder outlets.

- (j) High temperatures or fires in scavenge air boxes in the case of crosshead engines
- (k) High temperatures of exhaust gases at cylinder outlets (not required for those trunk piston engines of maximum continuous power not exceeding 500kW/cylinder)
- (l) Other fault conditions considered necessary by the Society

(3) Standby pumps

Standby pumps for any pumps used as auxiliary machinery essential for main propulsion are to be arranged so as to start automatically or so as to be capable of being immediately remotely started from centralized control stations or the centralized monitoring and control stations on bridges under the following conditions:

- (a) With respect to lubricating oil pumps, in cases where delivery pressures or flow rates of any pumps in operation fall below their predetermined values.
- (b) With respect to cooling pumps used for cylinders, pistons, fuel valves and coolers and fuel oil supply pumps, in cases where delivery pressures or flow rates of any pumps in operation fall below their predetermined values or such pumps stop.

(4) Alarm devices

Main propulsion machinery is to be provided with alarm devices which activate in the event of any of those abnormal conditions given in **Table 3.1**.

(5) Monitoring devices

Monitoring devices for main propulsion machinery specified in **3.2.2(1)** are to be provided, and are to indicate at least the following information.

- (a) Pressure of fuel oil to fuel oil burning pumps
- (b) Pressure of lubricating oil to main and thrust bearings
- (c) Pressure of lubricating oil to crosshead bearings in cases where crosshead engines have separate lubricating oil systems
- (d) Differential pressure between inlets and outlets of lubricating oil strainers, or the pressure of lubricating oil at inlets and outlets of strainers in the case of trunk piston engines
- (e) Temperature of lubricating oil to engines in the case of trunk piston engines
- (f) Revolutions of turbochargers
- (g) Pressure of lubricating oil to turbochargers in cases where trunk piston engines have separate lubricating oil systems
- (h) Pressure of cooling seawater (including central cooling systems)
- (i) Pressure at cylinder cooling water inlets
- (j) Temperature of cylinder cooling water at cylinder outlets or at cylinder common outlets in cases where one common cooling space without individual stop valves is provided
- (k) Pressure at starting air inlets
- (l) Pressure of control air
- (m) Pressure of scavenge air receivers
- (n) Exhaust gas temperatures at cylinder outlets (not required for those engines with a maximum continuous power not exceeding 500 kW/cylinder)
- (o) Exhaust gas temperatures at turbocharger inlets
- (p) Exhaust gas temperatures at turbocharger outlets
- (q) Pressure of low temperature cooling water in cases where central cooling systems are adopted
- (r) Speed and direction of rotation of main propulsion machinery
- (s) Any other information deemed necessary by the Society

2 Main propulsion machinery in ships in which steam turbines are used as main propulsion machinery (excluding electric propulsion ships)

(1) Safety devices

Safety devices are to be provided to shut off steam supplies to main propulsion steam turbines under the following conditions:

- (a) Over-speed
- (b) Pressure drops of lubricating oil

- (c) Low vacuum of main condensers
- (d) Stoppage of all main boilers
- (2) Reduction of speeds or loads

Measures are to be taken to automatically reduce speeds or loads to main propulsion machinery under the following conditions. However, in cases where alternative measures such as activating alarms to request such reductions are taken, manual reductions of speeds or loads may be accepted.

 - (a) Excessive vibration of rotor shafts or casings
 - (b) Excessive axial displacement of rotor shafts
 - (c) High condensate levels in main condensers
 - (d) Excessive drops of steam pressure at inlets of turbines
- (3) Standby pumps and scoop systems

Standby pumps and scoop systems are to comply with the following **(a)** and **(b)**:

 - (a) Standby pumps for any pumps used as auxiliary machinery essential for main propulsion are to be arranged so as to start automatically or so as to be capable of being immediately remotely started from centralized control stations or centralized monitoring and control stations on bridges under the following conditions:
 - i) With respect to lubricating oil pumps, in cases where delivery pressures or flow rates of any pumps in operation fall below their predetermined values.
 - ii) With respect to condensate pumps, cooling water (oil) pumps including circulating pumps for main condensers and drain pumps, in cases where delivery pressures or flow rates of any pumps in operation fall below their predetermined values or in cases where such pumps stop.
 - (b) In cases where scoop systems are adopted, such systems are to be arranged so as to change over automatically to circulating pumps in any abnormal conditions where those values specified in **i)** to **iii)** exceeds either the upper limits or lower limits of their predetermined values. However, such automatic changeover devices may not be required in cases where alarm devices designed to indicate any of those abnormal conditions mentioned above and remote changeover devices to circulating pumps are provided in centralized control stations or centralized monitoring and control stations on bridges.
 - i) Ship speed
 - ii) Vacuums of the main condenser
 - iii) Indices equivalent to **i)** and **ii)** above
- (4) Spinning devices

Automatic spinning devices or other suitable measures are to be employed to prevent any risk of rotor distortion due to propulsion turbines being stopped for long periods of time.
- (5) Alarm devices

Steam turbines used as main propulsion machinery are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in **Table 3.2**.

3 Propulsion motors

- (1) Safety devices

Safety devices are to be provided to shut off power supplies to propulsion motors under the following conditions:

 - (a) Over-speed
 - (b) Pressure drops of lubricating oil
 - (c) Loss of control of semiconductor converters
 - (d) Any others as deemed necessary by the Society
- (2) Reductions of speeds or loads

Measures are to be taken to automatically reduce speeds or loads to propulsion motors under the following conditions. However, in cases where alternative measures such as activating alarms to request such reductions are taken, manual reduction of speeds or loads may be accepted.

 - (a) Over loads
 - (b) High temperatures of stator windings or inter pole windings

- (c) Abnormal stopping of cooling fans for semiconductor converters
- (d) Actuation of semiconductor protective devices for semiconductor converters
- (e) Any others as deemed necessary by the Society

(3) Standby pumps

Standby pumps for any pumps necessary for the operation of propulsion motors such as lubricating oil pumps, cooling water pumps are to be arranged so as to start automatically or so as to be capable of being immediately remotely started from centralized control stations or centralized monitoring and control stations on bridges under conditions where delivery pressures or flow rates of any pumps in operation fall below their predetermined values.

(4) Alarm devices

Propulsion motors are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.8](#).

4 Controllable pitch propellers

(1) Standby pumps

Standby pumps for the operation of controllable pitch propellers for propulsion are to be arranged so as to start automatically or so as to be capable of being immediately remotely started from centralized control stations or centralized monitoring and control stations on bridges immediately under conditions where delivery pressures or flow rates of any pumps in operation fall below their predetermined value or in cases where such pumps stop.

(2) Alarm devices

Controllable pitch propellers for propulsion are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.6](#).

3.3.3 Boilers

1 Safety devices

Safety devices are to comply with the following **(1)** and **(2)**:

- (1) Self-closing valves are to be provided in the feed water piping of main boilers, and are to operate automatically in the event of any abnormal increase of water levels in main boilers.
- (2) Safety devices for low water levels in main boilers are to be put into action by means of signals from either one of two low water level detectors which are independent of each other. However, one of these detectors may be used for other purposes.

2 Standby pumps

Standby pumps for any of the following pumps necessary for the operation of main boilers and essential auxiliary boilers are to be arranged so as to start automatically or so as to be capable of being immediately remotely started from centralized control stations or centralized monitoring and control stations on bridges under conditions where delivery pressures or flow rates of any pumps in operation fall below their predetermined values or in cases where such pumps stop. This requirement need not be applied to fuel oil burning pumps for essential auxiliary boilers provided that alternative means are available to ensure normal navigation and cargo heating in the case of any failure of such fuel oil burning pumps.

- (1) Feed water pumps
- (2) Fuel oil burning pumps

3 Alarm devices

Boilers are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.3](#).

3.3.4 Generating Sets**1 Safety devices**

Safety devices for electric generating sets are to comply with the following (1) through (3):

- (1) Reciprocating internal combustion engines driving generators are to be provided with safety devices to automatically shut off fuel oil supplies to engines under the following conditions:
 - (a) Over-speed
 - (b) Pressures drop of lubricating oil
 - (c) High temperatures, low pressures or low flow rates of cooling water at outlets
- (2) Turbines driving generators are to be provided with safety devices to automatically shut off steam supplies to turbines under the following conditions:
 - (a) Over-speed
 - (b) Pressures drop of lubricating oil
 - (c) High exhaust gas pressures or low condenser vacuums
 - (d) Abnormal vibrations (except in cases where steam is supplied by main boilers)
- (3) Propulsion generators are to be provided with means to automatically reduce speeds (or reduce loads) of propulsion motors in cases where propulsion generators are overloaded. However, in cases where alarm devices asking for such speed reductions (or load reductions) deemed appropriate by the Society are provided, manual reduction means may be accepted.

2 Alarm devices

Electric generating sets are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.4](#).

3.3.5 Thermal Oil Installations**1 Standby pumps**

Standby pumps for any of the following pumps of the thermal oil installations for essential use are to be arranged so as to start automatically or so as to be capable of being immediately remotely started from centralized control stations or centralized monitoring and control stations on bridges under conditions where delivery pressures or flow rates of any pumps in operation fall below their predetermined values or in cases where such pumps stop. This requirement need not be applied to fuel oil burning pumps provided that alternative means are available to ensure normal navigation and cargo heating in the case of any failure of such fuel oil burning pumps.

- (1) Thermal oil circulating pumps
- (2) Fuel oil burning pumps

2 Alarm devices

Thermal oil installations are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.5](#).

3.3.6 Prime Movers Driving Auxiliary Machinery**1 Safety measures**

Prime movers driving auxiliary machinery essential for main propulsion of ships are to be arranged so as to automatically stop under the following conditions:

- (1) Over-speed
- (2) Pressure drops of lubricating oil

2 Alarm devices

Prime movers driving auxiliary machinery essential for main propulsion of ships are to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.7](#).

3.3.7 Other Machinery**1 Air compressors**

Air compressors are to be arranged so as to automatically stop in the event of pressure drops of lubricating oil.

2 Heat Exchangers

The following heat exchangers used for main propulsion machinery, main boilers, essential auxiliary boilers, generators and prime movers driving auxiliary machinery essential for main propulsion of ships are to be provided with temperature control devices in order

to regulate the temperatures of lubricating oils, coolants and fuel oils within a predetermined range:

- (1) Lubricating oil coolers
- (2) Coolers for cylinder cooling water
- (3) Coolers for piston coolant
- (4) Coolers for fuel valve coolant
- (5) Fuel oil heaters
- (6) Heaters for fuel oil purifiers
- (7) Heaters for lubricating oil purifiers

3 Alarm devices

Other machinery is to be provided with alarm devices which activate in the event of any of those abnormal conditions given in [Table 3.9](#).

Table 3.1 Reciprocating Internal Combustion Engines used as Main Propulsion Machinery (and Gearing)

	Monitored Variables	Alarms	Remarks
Temperature	Cylinder cooling water cylinder outlets	H	cylinder cooling water common outlets in cases where individual stop valves are not provided for each cylinder outlet
	Piston coolant cylinder outlets	H	in the case of crosshead engines
	Fuel valve coolant outlets	H	
	L.O. inlets	H	
	L.O. camshaft inlets	H	in the case of crosshead engines with a separate L.O. system
	Thrust bearings or L.O. thrust bearing outlets	H	in the case of engines with a thrust bearing
	L.O. turbocharger bearing outlets	H	in cases where it is not possible to measure such temperature, continuous monitoring of inlet pressure and inlet temperature in combination with specific intervals for bearing inspection in accordance with turbocharger manufacturer instructions may be accepted as an alternative measure.
	L.O. reduction gear inlets	H	in the case of engines with a separate L.O. system
	F.O. burning pump inlets	H L	in cases where viscosity is controlled (e.g. heavy fuel oil burning engines). Alternatively, high and low viscosity alarms may be accepted.
	Exhaust gas in cylinder outlets	H	not required for trunk piston engines of max. continuous power not exceeding 500kW/cylinder
	Exhaust gas deviation for cylinder outlets	H	
	Exhaust gas in turbocharger inlets	H	
	Exhaust gas in turbocharger outlets	H	
	Air in scavenge air boxes	H	in the case of crosshead engines. Alternatively, fire alarm may be accepted.
	Air in scavenge air receivers	H	in the case of trunk piston engines
Air in air cooler outlets	H L	in cases where temperatures are automatically controlled	
Pressure	Cylinder cooling water inlets	L	
	Piston coolant inlets	L	in the case of crosshead engines
	Fuel valve coolant inlets	L	
	L.O. main bearing and thrust bearing inlets	L	
	L.O. crosshead bearing inlets	L	in the case of crosshead engines with separate L.O. systems
	L.O. camshaft inlets	L	
	L.O. strainer in/out differentials	H	
	L.O. turbocharger inlets	L	in the case of crosshead engines with separate L.O. systems
	L.O. reduction gear inlets	L	
	F.O. burning pump inlets (Engine inlet after filter)	L	
	Common accumulators fuel oil pressure	L	in the case of electronically-controlled engines (only they have common accumulators)

	Monitored Variables	Alarms	Remarks
	Common accumulators or high pressure pipe hydraulic oil pressure	L	in the case of electronically-controlled engines
	Starting air engine inlets	L	
	Cooling sea water	L	
	Low temperature cooling water	L	in cases where central cooling systems are adopted
Others	Oily contamination of cylinder cooling water	H	in cases where cylinder cooling water is used in F.O. or L.O. heat exchangers
	Piston coolant flow rate for cylinder outlets	L	in the case of crosshead engines Non –flow alarms may be accepted. Other alternative means may be accepted where it is impracticable to monitor piston coolant flows due to engine design.
	Cylinder oil flow rates for lubricators	L	non-flows may be accepted
	Scavenge air receiver water levels	H	alternative means may be accepted
	Wrong way	○	in the case of self-reversing reciprocating internal combustion engines
	Failure of engine starting	○	
	Leakage from F.O. burning pipes, level in leakage tanks	○	
	Revolutions of turbochargers	H	applied only to categories <i>B</i> and <i>C</i> turbochargers specified in 2.1.2, Part D of the Rules for the Survey and Construction of Steel Ships , with novel design features or no service records

Note : “H” and “L” mean high and low. “○” means abnormal condition occurred. Same meaning is applied to [Table 3.1](#) to [3.9](#).

Table 3.2 Steam Turbines used as Main Propulsion Machinery (and Gearing, Main Condenser)

	Monitored Variables	Alarms	Remarks
Temperature	L.O. inlets	H	
	Rotor bearings or L.O. outlets	H	
	Rotor thrust bearings or L.O. outlets	H	
	Reduction gear bearings or L.O. outlets	H	
	Thrust bearings or L.O. outlets	H	
Pressure	L.O. inlets	L	
	Main condenser vacuums	L	
	Gland steam	H L	
	Cooling gear water	L	or flow
Others	Levels in main condensers	H	applied when main condensers are situated on the same level on which turbines are situated
	Rotor vibrations or casing vibrations	H	sensors for safety systems may be used
	Rotor axial displacement	H	

Table 3.3 Boilers

Monitored Variables		Alarms	Remarks
Temperature	F.O. to burners	L	or F.O. heater outlets for aux. boilers
	Gas air heaters or economizer outlets	H	applied to main boilers
	Superheater steam outlets	H	
Pressure	Steam drums or superheater outlets	L	in cases where superheaters are fitted, superheater outlets are required
	Forced drafts	L	or stoppage of driving units
	F.O. to burners (atomizing press)	L	applied to water tube boilers with max. working pressures exceeding 1MPa not used for only heating and general use
	Atomizing mediums	L	
Others	Water levels	H L	
	Stoppage of air preheater driving units	○	applied to main boilers
	Feed water pressures at feed water pump outlets	L	applied to water tube boilers with max. working pressures exceeding 1MPa
	Salinity in feed water pump inlets	H	applied to ships provided with steam turbine driving generators

Table 3.4 Electric Generating Sets

Monitored Variables		Alarms	Remarks
Reciprocating internal combustion engines driving generators			
Temperature	L.O. inlets	H	
	Cooling water or air outlets	H	
	Exhaust gas, turbo-blower inlets or cylinder outlets	H	at each cylinder outlet is required in the case of the engines with max. continuous power exceeding 500kW/cylinder
	F.O. burning pump inlets	H L	in cases where viscosity is controlled (e.g. heavy fuel oil burning engines). Alternatively, high and low viscosity alarms may be accepted.
Pressure	L.O. inlets	L	
	Common accumulators fuel oil pressure	L	in the case of electronically-controlled engines (only they have common accumulators)
	Common accumulators or high pressure pipe hydraulic oil pressure	L	in the case of electronically-controlled engines
	Cooling water inlets	L	low flow may be accepted
	Starting air	L	not required when starting air piping for propulsion engines is commonly used
Others	Leakage from F.O. burning pipes, levels leakage tanks	○	
	Revolutions of turbochargers	H	applied only to the categories B and C turbochargers specified in 2.1.2, Part D of the Rules for the Survey and Construction of Steel Ships , with novel design features or no service records
Steam turbines driving generators			
Temperature	L.O. inlets	H	
Pressure	L.O. inlets	L	

Monitored Variables		Alarms	Remarks
	Steam inlets	L	for ships in which steam turbines are used as main propulsion machinery (excluding electric propulsion ships), only applicable where extracted steam is used
	Exhaust	H	
Main generator			
Electricity	Ampere	H	sensors for controllers may be used
	Voltage	H L	
	Frequencies or revolutions of generators	H	
Propulsion generator			
Electricity	Current	H	sensors for controllers may be used
	Voltage	H L	
	Frequencies or revolutions of generators	H	
Temperature	Bearing L.O. inlets	H	applicable to the forced lubrication systems
	Stator windings or communication pole windings	H	applicable of 500kW or more
	Cooling air cooling water outlets	H	
Pressure	Bearing L.O. inlets	L	applicable to the forced lubrication systems

Table 3.5 Thermal Oil Installations

Monitored Variables		Alarms	Remarks
F.O.	Pressure, burner inlets	L	
	Temperature burner inlets	L	
Thermal oil	Temperatures	H	
	Flows or pressure differences between outlets and inlets of heaters	L	
	Levels in expansion tanks	L	
Others	Flame failure	○	

Table 3.6 Controllable Pitch Propellers

Monitored Variables		Alarms	Remarks
Hydraulic oil	Tanks, levels	L	
	Pressures	L	

Table 3.7 Engine Driving Auxiliary Machinery

Monitored Variables		Alarms	Remarks
Reciprocating internal combustion engines			
Temperature	L.O. inlets	H	
	Cooling water outlets	H	low pressures/flows may be accepted
	Exhaust gas, turbo charger inlets or cylinder outlets	H	
	F.O. burning pump inlets	H L	in cases where viscosity is controlled (e.g. heavy fuel oil burning engines). Alternatively, high and low viscosity alarms may be accepted.
Pressure	L.O. inlets	L	
	Common accumulators fuel oil pressure	L	in the case of electronically-controlled engines (only they have common accumulators)
	Common accumulators or high pressure pipe hydraulic oil pressure	L	in the case of electronically-controlled engines
	Cooling water outlets	L	low flows or high temperatures at cooling water outlets may be accepted
Others	Leakage from F.O. burning pipes, levels in leakage tanks	○	
	Revolutions of turbochargers	H	applied only to categories <i>B</i> and <i>C</i> turbochargers specified in 2.1.2, Part D of the Rules for the Survey and Construction of Steel Ships , with novel design features or no service records
Steam turbines			
Temperature	L.O. inlets	H	
Pressure	L.O. inlets	L	
	Steam inlets	L	for ships in which steam turbines are used as main propulsion machinery (excluding electric propulsion ships), only applicable when extracted steam is used
	Exhaust steam	H	

Table 3.8 Electrical Equipment for Propulsion in Electrical Propulsion Ships

Monitored Variables		Alarms	Remarks
Propulsion motor			
Temperature	Bearing L.O. inlets	H	applied to forced lubrication systems
	Stator windings/interpole windings	H	applied to motors of 500kW or more
	Cooling air cooling water outlets	H	
Pressure	Bearing L.O. inlets	L	applied to forced lubrication systems
	Cooling water inlets	L	applied to closed circuit cooling systems
Others	Overload	○	
	Insulation of excitor circuits	L	
	Insulation of power circuits	L	
	Loss of control power	○	
Semiconductor converter			
Electricity	Output currents	H	sensors for controllers may be used
	Output voltages	H L	
	Output frequencies	H	
Temperature	Cooling air or cooling water outlets	H	
Pressure	Cooling water inlets	L	applied to closed circuit cooling systems
Others	Operation of protection devices for semiconductor converters	○	
	Stoppage of cooling fans	○	
	Loss of control power	○	

Table 3.9 Other Machinery

Monitored Variables		Alarms	Remarks
Auxiliaries			
Distilling plants, salinity		H	
Purifiers, malfunctions		○	
F.O. or L.O. heater outlets, temperatures		H	or heater outlets, flow lows
Cooling sea water pressures		L	in cases where central cooling systems are adopted for the main propulsion machinery
Condensate pump outlets, pressures		L	or stoppage of driving units
Condensate pump outlets, salinity		H	for ships in which steam turbines are used as main propulsion machinery (excluding electric propulsion ships)
Drain pump outlets, salinity		H	
External desuperheaters, steam temperatures		H L	
Deaerator, levels		H L	
Tanks			
F.O.	Settling tanks, levels	H L	H is required in the case of automatic filling tanks or tanks without overflow arrangements
	Service tanks, levels	H L	
	Drain tanks, levels	H	
	Sludge tanks, levels	H	
	Settling tanks, temperatures	H	applied to tanks where heating devices are provided
	Service tanks, temperatures	H	
L.O. and control oil	Sump tanks for propulsion engines, levels	L	applied to each tank in cases where separate lubricating oil systems and relevant tanks (e.g. camshaft, rocker arms) are installed
	Drain tanks, levels	H	
	Sludge tanks, levels	H	
	Gravity tanks, levels	L	applied to oil bath type stern tube bearings, exhaust driven turboblowers, and reduction gear for propulsion steam turbines
Water	Cooling water expansion (makeup) tanks, levels	L	
	Purifier water tanks, levels	L	
	Cascade tanks, levels	L	applied to ships in which reciprocating internal combustion engines are used as main propulsion machinery (excluding electric propulsion ships)
	Atmospheric drain tanks, levels	H L	applied to ships in which steam turbines are used as main propulsion machinery (excluding electric propulsion ships)
	Distilled water tanks, levels	L	
Air	Starting air tanks for propulsion engines, pressures	L	
	Starting air tanks for generator prime movers, pressures	L	applied to ships in which steam turbines are used as main propulsion machinery (excluding electric propulsion ships)
Control and Safety systems			

Monitored Variables		Alarms	Remarks
Control system hydraulic pressures		L	not required in cases where it is integrated with controlled objects
Control system pneumatic pressures		L	not required in cases where starting air is used without decompressing
Control system electric sources		○	
Safety system hydraulic pressure systems		L	
Safety system pneumatic pressures		L	not required in cases where starting air is used without decompressing
Safety system electric sources		○	
Alarm system electric sources		○	
Hydraulic coupling oil in main shafting systems, pressures		L	
Main shafting			
Temperature	Stern tube bearings or bearing oil in oil baths	H	or stern tube outlet oil when forced circulation systems are used, applied to oil lubrication systems
Flow rate	Lubricating water for stern tube bearings	L	Applied to the ships whose classification characters are affixed with the notation <i>PSCM-IA</i>
Differential pressure	Filtration systems of lubrication water for stern tube bearings	H	Applied to the ships whose classification characters are affixed with the notation <i>PSCM-IA</i> Alarms for non-filter methods are to be those deemed appropriate by the Society.
Others	Abnormal lubricating water pumps for stern tube bearings	○	Applied to the ships whose classification characters are affixed with the notation <i>PSCM-IA</i>
Others	Critical speed	○	

Chapter 4 MONITORING AND CONTROL SYSTEMS FOR PERIODICALLY UNATTENDED MACHINERY SPACES

4.1 General

4.1.1 Scope

The requirements given in this Chapter apply to monitoring and control systems for periodically unattended machinery spaces to be installed in M0-ships.

4.2 Monitoring and Control Systems for Periodically Unattended Machinery Spaces

4.2.1 General

1 With respect to M0-ships, monitoring and control systems for periodically unattended machinery spaces are to be installed in order to ensure the safe operation of main propulsion machinery under all sailing conditions including maneuvering to the same extent that can be achieved by means of manual control under direct supervision. Systems are to be capable of performing unattended machinery operations for at least 24 consecutive *hours*.

2 Monitoring and control systems for periodically unattended machinery spaces are to include those devices and systems specified in this Chapter as well as centralized monitoring and control systems for machinery specified in [Chapter 3](#).

3 Centralized monitoring and control systems for machinery used as monitoring and control systems for periodically unattended machinery spaces are to comply with the following requirements in addition to those requirements specified in [Chapter 3](#).

- (1) Standby pumps specified in the following requirements are to be arranged so as to be capable of being automatically started.
 - (a) [3.3.2-1\(3\)](#)
 - (b) [3.3.2-2\(3\)\(a\)](#)
 - (c) [3.3.2-3\(3\)](#)
 - (d) [3.3.2-4\(1\)](#)
 - (e) [3.3.3-2](#)
 - (f) [3.3.5-1](#)
 - (g) [18.2.2-2\(3\), Part D of the Rules for the Survey and Construction of Steel Ships](#)
- (2) Those circulating pumps specified in [3.3.2-2\(3\)\(b\)](#) are to be arranged so as to be capable of being automatically changed over.
- (3) For ships provided with selective catalytic reduction systems, the alarm devices provided in accordance with [3.2.2\(11\)\(c\)](#) are to satisfy the requirements of [4.3.3](#).
- (4) For ships provided with exhaust gas cleaning systems or exhaust gas recirculation systems, the alarm devices provided in accordance with [3.2.2\(12\)](#) are to satisfy the requirements of [4.3.3](#).

4.2.2 Bridge Control Devices or Centralized Monitoring and Control Systems for Machinery Installed in Bridge

1 Bridge control devices specified in [18.3.3, Part D of the Rules for the Survey and Construction of Steel Ships](#) or centralized monitoring and control systems for machinery are to be provided on bridges.

2 Bridge control devices or centralized monitoring and control systems for machinery installed on bridges are to include the following devices. In cases where special approval, taking into consideration the kind of main propulsion machinery, etc., from the Society has been received, these devices may be dispensed with.

- (1) Any program control devices or their equivalent which allow speeds of main propulsion machinery to be rapidly increased or reduced in order to ensure that main propulsion machinery are free from any undue mechanical and thermal stress
- (2) Bypass devices to temporarily override the function of those devices mentioned in (1) above with indicators to show their activation

4.2.3 Alarm Devices on Bridge

1 In cases where bridge control devices are installed, the following alarm devices are to be provided on bridges in addition to those required by the requirements specified in [18.3.3, Part D of the Rules for the Survey and Construction of Steel Ships](#).

- (1) Alarm devices for main propulsion machinery or controllable pitch propellers, electric generating sets and auxiliary machinery
- (2) Bilge alarm devices
- (3) Alarm devices for any prolonged running in those critical speed ranges specified in [Table 3.9](#)

2 In cases where centralized monitoring and control systems for machinery are installed on bridges, all alarm devices are to comply with the following requirements:

- (1) At least the following visual alarms of those alarm devices required by [3.2.2\(6\)](#) are to be provided in positions where they can be easily confirmed from places used to control operating handles of main propulsion machinery.
 - (a) Alarms for automatic stopping
 - (b) Alarms for automatic reduction or demanding reduction of speeds or loads
 - (c) Alarms for failures of remote control systems specified in [18.3.2-3\(1\)](#), [Part D of the Rules for the Survey and Construction of Steel Ships](#)
 - (d) Alarms for low starting air pressures specified in [18.3.2-4\(3\)](#), [Part D of the Rules for the Survey and Construction of Steel Ships](#)
 - (e) Alarms for failures of remote starting specified in [Table 3.1](#)
 - (f) Alarms for any prolonged running in those critical speed ranges specified in [Table 3.9](#)
- (2) Visual alarms of those alarm devices required by [3.2.2\(6\)](#) and [\(9\)](#), excluding those specified in [\(1\)](#) above, are to be arranged so that working conditions of machinery can be perceived at a glance from places used to control operating handles of main propulsion machinery. In cases where it is impracticable to comply with this requirement, additional visual alarms which may be of group indication are to be provided.

3 Visual alarms of alarm devices for main propulsion machinery or controllable pitch propellers, electric generating sets and auxiliary machinery may be displayed as group alarms. However, any visual alarms for automatic stopping and for speed or load reductions (either automatic or demanding) of main propulsion machinery are to be displayed individually.

4 In cases where the alarm devices for demanding reduction of speeds or loads are provided for main propulsion machinery, the individually displayed visual alarms specified in [-3](#) may be substituted for devices deemed appropriate by the Society.

4.2.4 Centralized Monitoring and Control Station on Bridge

In cases where centralized monitoring and control stations on bridges have been installed, the shapes, sizes, arrangements, etc. of such stations are to comply with the following requirements:

- (1) They are to be located on the same deck floor and not to be provided with any partition walls (steel walls, wooden walls, glass walls, etc.) inside of the station except in cases where specially approved by the Society.
- (2) Any audible alarms and voice orders issued from positions inside of such stations are to be capable of being clearly and distinctly heard from any position inside such stations.

4.3 Safety Measures, etc.

4.3.1 Air Compressors

Automatic control devices are to be provided for the following air compressors so as to maintain the pressure in any air reservoirs in predetermined ranges.

- (1) Starting air compressors
- (2) Controlling air compressors used for charging air to control air reservoirs

4.3.2 Means of Communication

In the case of ships with centralized monitoring and control stations on bridges, means of vocal communication which are operable even in the event of any failures of main electrical power supplies are to be provided for any centralized monitoring and control stations on bridges, local control positions (or sub-control stations, if provided.) of main propulsion machinery or controllable pitch propellers, and engineers' accommodations. For the other ships, this means is to be provided among the wheelhouse, the centralized control station, the local control position of main propulsion machinery or controllable pitch propellers, and the engineers' accommodation.

4.3.3 Alarm Systems

Alarm systems are to comply with the following requirements:

- (1) Alarm systems are to be provided with automatic changeover arrangements for switching power supplies from normal power sources to independent standby power sources in the event of any normal power failures.
- (2) Any failures of those normal or standby power sources specified in **(1)** above are to be indicated by independent alarms.
- (3) Alarm devices (visual alarms may be displayed as group alarms) for main propulsion machinery, electric generating sets, and auxiliary machinery essential for main propulsion are to be provided in engineer accommodations.
- (4) Alarm devices provided in engineer accommodations are to comply with the following requirements:
 - (a) Alarms are to be provided in engineer public rooms.
 - (b) Alarms are also to be provided in the respective cabins of engineers with connections to such cabins through selector switches, to ensure that any alarms can be provided to at least those cabins of any engineers on watch.
 - (c) Alarm devices are to be capable of activating those engineer alarms required by **1.3.8, Part D of the Rules for the Survey and Construction of Steel Ships** if confirmation of such alarms has not been completed within a predetermined amount of time.
- (5) Audible alarm devices which indicate any possible failures in the machinery and equipment specified in **1.1.5(12)(a)** through **(g)** are to be provided in spaces where they are installed.
- (6) In the cases of ships provided with centralized monitoring and control stations on bridges, local silencing of audible alarms from engineer accommodations is not to cause any silencing of those audible alarms required by **(5)** above and any canceling of those audible and visual alarms in the centralized monitoring and control stations on bridges. For all other ships, local silencing of audible alarms from bridges or engineer accommodations is not to cause any silencing of those audible alarms required by **(5)** above and any canceling of those audible and visual alarms in centralized control stations.
- (7) Alarm systems are to have functions to notify those persons on watch on bridges of the following items upon any failures of the machinery and equipment specified in **1.1.5(12)(a)** through **(g)** during their unattended operation.
 - (a) Occurrence of any such failures
 - (b) Acknowledgement of any such failures
 - (c) Restoration from any such failures

Chapter 5 SPECIFIC AUTOMATION EQUIPMENT

5.1 General

5.1.1 Scope

The requirements in this Chapter apply to all of the specific automation equipment to be installed on **M0•A**-ships, **M0•B**-ships, **M0•C**-ships or **M0•D**-ships.

5.2 Specific Automation Equipment

5.2.1 Class A Specific Automation Equipment*

In the cases of **M0•A**-ships, all of the specific automation equipment specified in **5.3.1**, **5.3.2**, **5.3.4** through **5.3.7**, **5.3.11** and **5.3.17** (except sub-paragraph (2)) are to be provided. However, in cases where considered appropriate by the Society, taking into account the service or the purpose, etc. of ships, some equipment may be omitted.

5.2.2 Class B Specific Automation Equipment*

In the case of **M0•B**-ships, all of the specific automation equipment specified in **5.3.1**, **5.3.2**, **5.3.4** through **5.3.12** and **5.3.17** are to be provided. However, in cases where considered appropriate by the Society taking into account the service or the purpose, etc. of ships, some equipment may be omitted.

5.2.3 Class C Specific Automation Equipment*

In the cases of **M0•C**-ships, all of the specific automation equipment specified in **5.3.1**, **5.3.3** through **5.3.15** and **5.3.17** are to be provided. However, in cases where considered appropriate by the Society taking into account the service or the purpose, etc. of ships, some equipment may be omitted.

5.2.4 Class D Specific Automation Equipment*

In the case of **M0•D**-ships, all of the specific automation equipment specified in **5.3.1**, **5.3.3** through **5.3.17** is to be provided. However, in cases where considered appropriate by the Society taking into account the service or the purpose, etc. of the ship, some equipment may be omitted.

5.3 Standards for Specific Automation Equipment

5.3.1 Remote-controlled Fuel Oil Filling Arrangements*

Remote-controlled fuel oil filling arrangements, in cases where taking on fuel oil (limited to those cases where filling fuel oil for main propulsion machinery (including main boilers)), are to be provided with the following items located as close to each other as practicable. However, the provision of item (3) may be omitted when the Society considers it acceptable in consideration of fuel oil tank and valve arrangements.

- (1) Level monitoring systems of fuel oil tanks
- (2) Limit level alarm systems of fuel oil tanks
- (3) Control systems of valves required to be operated for filling fuel oil
- (4) Other control systems necessary for filling fuel oil

5.3.2 Remote-controlled Mooring Arrangements*

In cases where mooring winches are remotely controlled, remote-controlled mooring arrangements are to be capable of effectively controlling three or more mooring lines respectively both the bows and sterns of ships.

5.3.3 Independent Remote-controlled Mooring Arrangements*

Independent remote-controlled mooring arrangements are to be capable of controlling all drums of mooring winches independently from their remote-control positions, in addition to those requirements given in **5.3.2**.

5.3.4 Automatic Steering System

In cases where the steering gear is operated with automatic pilots, automatic steering systems are to comply with the following requirements:

- (1) By interlocking with magnetic compasses or gyrocompasses, the headings of ships are to be maintained automatically at preset courses.
- (2) In cases where steering methods are changed over from manual to automatic steering, headings of ships are to be capable of being automatically brought to preset courses.
- (3) Operation is to be able to be performed easily and accurately.
- (4) Except for course setting controls, actuation of any other controls is not to significantly affect the course of any ships.
- (5) Means are to be incorporated to prevent any unnecessary activation of rudders due to normal yaw motion.
- (6) Indication that automatic pilots are running is to be provided.
- (7) Means are to be provided to enable rudder angle limitation and to indicate when rudders reach their preset angle limits.
- (8) Audible and visual alarms are to be issued on navigation bridges in cases where headings of ships have deviated in a way exceeding the preset amounts of course deviation.
- (9) Audible and visual alarms are to be issued on navigating bridges in order to indicate any failure in power supplies to automatic pilots and those alarm systems specified in (8) above.
- (10) Any other items considered necessary by the Society.

5.3.5 Remote-controlled Handling System for Liquid Cargo in Bulk*

1 Remote-controlled handling systems for liquid cargo in bulk are to be provided with the following centralized functions in cases where the operation of such cargo pumps is performed by remote control:

- (1) Speed controls or start/stop controls for cargo pumps
- (2) Controls for any equipment necessary for cargo loading/unloading
- (3) Monitoring of levels of cargo in cargo tanks
- (4) Monitoring of alarms for cargo pumps
- (5) Monitoring of alarms for prime movers for cargo pumps
- (6) Monitoring of high temperature alarms for stuffing boxes provided at bulkhead penetrations of cargo pump rooms
- (7) Monitoring of alarms for other control systems considered necessary by the Society

2 Alarm systems of cargo pumps and their prime movers specified in -1 above are to be capable of issuing alarms in the following cases:

- (1) In the case of steam turbines driving cargo pumps
 - (a) In cases where turbine speed increases abnormally and shut-off devices are being operated automatically.
 - (b) In cases where exhaust steam pressures increase abnormally.
- (2) In the case of prime movers driving cargo pumps installed in dangerous areas
 - (a) In cases where temperatures of bearings or lubricating oils increase abnormally.
 - (b) In cases where lubricating oil pressures fall abnormally (only in the case of forced lubrication systems).
- (3) In the case of cargo pumps installed in dangerous areas
 - (a) In cases where temperatures of bearings or lubricating oils increase abnormally.
 - (b) In cases where lubricating oil pressures fall abnormally (only in the case of forced lubrication systems).
 - (c) In cases where temperatures of cargo pump casings increase abnormally.

5.3.6 Remote-controlled Ballasting/Deballasting Arrangements*

1 Remote-controlled ballasting/deballasting arrangements are to be provided with the following centralized functions in cases where the operation of such ballast pumps is performed by remote control:

- (1) Speed controls or start/stop of ballast pumps
- (2) Controls for any equipment necessary for ballasting/deballasting operations
- (3) Monitoring of levels of ballast water in the ballast tanks
- (4) Monitoring of alarms for ballast pumps
- (5) Monitoring of alarms for any prime movers of ballast pumps
- (6) Monitoring of high temperature alarms for stuffing boxes provided at bulkhead penetrations of cargo pump rooms

2 Alarm systems for ballast pumps and their prime movers specified in -1 above are to be capable of issuing alarms in the following cases:

- (1) In the case of steam turbines driving ballast pumps
 - (a) In cases where turbine speeds increase abnormally and shut-off devices are operated automatically.
 - (b) In cases where exhaust steam pressures increase abnormally.
- (2) In the case of prime movers driving ballast pumps installed in dangerous areas
 - (a) In cases where temperatures of bearings or lubricating oils increase abnormally.
 - (b) In cases where lubricating oil pressures fall abnormally (only in the case of forced lubrication systems).
- (3) In the case of ballast pumps installed in dangerous areas
 - (a) In cases where temperatures of bearings or lubricating oils increase abnormally.
 - (b) In cases where lubricating oil pressures fall abnormally (only in the case of forced lubrication systems).

5.3.7 Power-operated Opening/Closing Appliances*

Power-operated opening/closing appliances are to comply with the following requirements for the operation of opening and closing bow doors, stern doors, side doors, ramp ways attached permanently, or hatch covers (excluding pontoon type) provided on weather decks (hereinafter referred to as the "side doors, etc." in the Rules).

- (1) Opening and closing operations of side doors, etc. are to be readily made at the control positions of such opening and closing operations.
- (2) Opening conditions and closing conditions of side doors, etc. are to be verified at the control positions of such opening and closing operations.
- (3) In cases where deemed necessary by the Society, means to ensure safety during opening and closing operations are to be provided.

5.3.8 Monitoring Device of Refrigerating Containers

Monitoring devices of refrigerating containers are to be capable of carrying out the following functions for carrying refrigerating containers loaded with refrigerated cargo:

- (1) Monitoring of the operating conditions of refrigerating machinery
- (2) Monitoring of the working conditions of defrosting devices
- (3) Monitoring of the alarms and the range of inside temperatures of refrigerating containers

5.3.9 Emergency Towing Rope Winches*

Emergency towing rope winches are to be capable of operating easily to heave emergency towing ropes, which are arranged at times of berthing.

5.3.10 Cargo Hose Handling Winches*

Cargo hose handling winches are to be capable of being easily controlled in the case of connecting or disconnecting cargo hoses.

5.3.11 Automatic Recording Devices*

Automatic recording devices are to be capable of automatically recording the operating conditions of main propulsion machinery.

5.3.12 Centralized Machinery Monitoring Systems*

Centralized machinery monitoring systems are to be capable of clearly indicating at navigation bridges lubricating oil pressures, cooling water temperatures and any other necessary information in order to monitor the conditions of main propulsion machinery, prime movers for driving generators (excluding emergency generators), main boilers, essential auxiliary boilers and other machinery which affects the propulsion of ships.

5.3.13 Centralized Machinery Control Systems*

Centralized machinery control systems are to be capable of effectively controlling main propulsion machinery, prime movers for driving generators (excluding emergency generators), main boilers, essential auxiliary boilers and devices which are necessary in order to operate such machinery from navigation bridges.

5.3.14 Power-operated Pilot Ladder Winding Appliance

Power-operated pilot ladder winding appliances are to be capable of easy operation in winding ladders for pilots at their control positions.

5.3.15 Fixed Deck Washing Arrangements*

Fixed deck washing arrangements are to comply with the following requirements:

- (1) Fixed deck washing arrangements are to be capable of washing decks and hatch covers.
- (2) Deck washing machines are to have enough strength against their working pressures and enough corrosion resistance to sea water.
- (3) Pipes for washing water are to be firmly fixed to hulls.

5.3.16 Bridge Wing Control Devices

Bridge wing control devices are to comply with the following requirements:

- (1) Bridge wing control devices are to be capable of effectively controlling main propulsion machinery or controllable pitch propellers and steering systems at bridge wings.
- (2) Bridge wing control devices are to comply with those requirements for bridge control devices specified in **18.3.3, Part D of the Rules for the Survey and Construction of Steel Ships**, except in cases where such bridge control devices or centralized monitoring and control systems for machinery installed on bridges can be used as bridge wing control devices.
- (3) Bridge wing control devices are to be provided with rudder angle indicators. However, this requirement may not apply in cases where rudder angle indicators which are easily read from control stations on bridge wings are installed.

5.3.17 Navigational Equipment and Radio Communication Equipment*

Type approval is to be required for equipment listed below in accordance with those standards considered acceptable by the Society.

However, equipment approved by the Government of the State whose flag the ship is entitled to fly under, other Contracting Governments of the *SOLAS* Convention or any parties approved by those Governments mentioned above or complying with those International Standards recognized by the Society may be exempted from these requirements as deemed appropriate by the Society.

- (1) Global Positioning System (GPS) Receiver Equipment
- (2) Automatic Radar Plotting Aids (ARPAs)
- (3) Maritime Satellite Communication Equipment

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GUIDANCE FOR AUTOMATIC AND REMOTE CONTROL SYSTEMS

Chapter 1 GENERAL

1.1 General

1.1.3 Modification of Requirements

“In cases where considered appropriate” specified in **1.1.3 of the Rules** means those cases where examinations are carried out in accordance with measures specially approved by the Society. However, this regulation is not to be applied to surveys required by international regulations or the requirements of flag states.

1.2 System Design

1.2.1 System Design

In cases where the requirements specified in **1.2.1(1) of the Rules** are applied, common sensors for indication, alarm and slow down of reciprocating internal combustion engines may be accepted. However, two separate sensors for alarm and slow down are to be provided in cases where temperatures of cylinder cooling water are detected at common outlets based upon those requirements specified in **3.3.2-1(2)(j) of the Rules**.

1.2.3 Computers and Computerized Systems

The wording “deemed appropriate by the Society” specified in **1.2.3(1) of the Rules** means as follows:

- (1) In cases where secondary systems or back-up computers are installed for control systems or safety systems, they may be in accordance with those requirements specified in **18.2.7-2(3)(a) or (b), Part D of the Rules for the Survey and Construction of Steel Ships** respectively. In such cases, secondary control systems for all of the machinery and equipment specified in **1.1.5(12)(a) through (d) of the Rules** are to have functions equivalent to those operated by computerized automatic and remote control systems.
- (2) In cases where secondary systems or back-up computers are installed for their respective control systems, safety systems and alarm systems, the independence of all individual devices and equipment in such systems as well as independence from any other systems may not be required.

1.3 Prevention of Flooding and Fire Safety Measures

1.3.1 Prevention of Flooding

1 The “bilge injection system” specified in **1.3.1-4 of the Rules** refers to the “emergency bilge suction system” specified in **-6 and -7, Part D of the Rules for the Survey and Construction of Steel Ships**. However, **1.3.1-4 of the Rules** does not need to be applied to the controls of valves serving emergency bilge suction provided that they comply with the following **(1) to (3)**:

- (1) emergency bilge valves are normally maintained in a closed position;
 - (2) non-return devices are installed in emergency bilge piping; and,
 - (3) emergency bilge suction piping is located inboard of shell valves fitted with control arrangements satisfying the requirements in **1.3.1-4 of the Rules**
- 2** A calculation sheet is to be submitted which proves compliance with the requirements specified in **1.3.1-4 of the Rules**.
- 3** The following **(1) to (3)** are to be complied by the calculation sheet referred to in **-2** above.
- (1) It is to be shown that the time it takes for the completion of valve operation after the high level alarm specified in **1.3.1-1 of the Rules** activates is less than the time it takes for influx of water into the engine room to reach the operating position of the subject valves.

- (2) The time it takes for the influx of water into the engine room to reach the operating position of the subject valves is to be determined based on the assumption of a breach in the largest diameter sea water line in the engine room. However, in the event such calculations are difficult to perform, 10 minutes is to be regarded as adequate time.
- (3) The time it takes to reach and close the subject valves is to be determined by multiplying the inverse of the normal speed of travel of a person onboard ($1.0m/sec$) times the distance from the navigation bridge to the operating location of the subject valves.

Chapter 2 SURVEYS OF AUTOMATIC AND REMOTE CONTROL SYSTEMS

2.1 General

2.1.2 Survey Intervals

The wording “the Society may approve 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

2.2.1 Drawings and Data

- 1 The data specified in **2.2.1(1) of the Rules** is to be submitted using, as far as possible, those forms designated by the Society.
- 2 The drawings and data specified in **2.2.1(2)(b) of the Rules** are as follows:
 - (1) Remote-controlled fuel oil filling arrangements
 - (a) Schematic diagrams of fuel oil filling piping systems (with arrangements of tanks, valves, pumps and tank capacities)
 - (b) Schematic diagrams of remote monitoring and alarm systems of liquid levels in tanks
 - (c) Schematic diagrams of valve operating and remote control systems
 - (d) Arrangement of instruments on remote monitoring and alarm panels and remote valve control panels
 - (2) Remote-controlled mooring arrangements
 - (a) Arrangements of mooring systems (with locations of remote control stands and arrangements of mooring lines)
 - (b) Schematic diagrams of power sources for mooring systems
 - (c) Schematic diagrams of remote controls for mooring systems
 - (3) Independent remote-controlled mooring arrangements
 - (a) Arrangements of mooring systems (with locations of remote control stands and arrangements of mooring lines)
 - (b) Schematic diagrams of power sources for mooring systems
 - (c) Schematic diagrams of remote controls for mooring systems
 - (4) Automatic steering systems
 - (a) Structural plans of systems for steering
 - (b) Arrangements of instruments on steering stands and alarm panels
 - (c) Explanatory notes on system functions
 - (5) Remote-controlled handling systems for liquid cargos in bulk
 - (a) Schematic diagrams of liquid cargo piping systems (with arrangements of cargo tanks, valves, pumps and tank capacities)
 - (b) Arrangements of equipment in centralized cargo control stations
 - (c) Arrangements of instruments on remote monitoring and alarm panels, and remote control panels for pumps, valves, etc., installed in centralized cargo control stations
 - (d) Schematic diagrams of tank liquid level remote monitoring systems
 - (e) Schematic diagrams of operating and remote control systems for valves
 - (6) Remote-controlled ballasting/deballasting arrangements
 - (a) Schematic diagrams for ballasting/deballasting piping systems (with arrangements of ballast tanks, valves, pumps and sea chests, and including any exclusive heel adjusting pipe lines)
 - (b) Arrangements of instruments on remote monitoring and alarm panels for ballasting/deballasting and remote control panels for pumps and valves
 - (c) Schematic diagrams of tank liquid level remote monitoring systems
 - (d) Schematic diagrams of operating and remote control systems for valves
 - (7) Power driven opening/closing arrangements

- (a) Arrangements of the systems, including their control positions
 - (b) Schematic diagrams of power sources
 - (c) Schematic diagrams of control sources (only in cases where separately provided from power sources)
 - (d) Detailed drawings for indicators or alarms, etc. to ensure safety in opening/closing operations, if provided.
- (8) Monitoring devices of refrigerating containers
- (a) Arrangements of instruments on monitoring panels
 - (b) Electrical diagrams of monitoring panels
 - (c) Lists of monitoring and alarm items
- (9) Emergency towing rope winches
- (a) Arrangements of emergency towing rope winches
 - (b) Schematic diagrams of power sources
 - (c) Schematic diagrams of control sources (only in cases where separately provided from power sources)
- (10) Cargo hose handling winches
- (a) Arrangements of cargo hose handling winches
 - (b) Schematic diagrams of power sources
 - (c) Schematic diagrams of control sources (only in cases where separately provided from power sources)
- (11) Automatic main propulsion machinery recording devices
- (a) Service instructions for automatic main propulsion machinery recording devices of operating conditions (with notation on the constitution of systems, intervals of regular recordings, and details of recording functions including those for regular recording, alarm recording and arbitrary recording)
 - (b) Lists of items for regular recording
- (12) Centralized machinery monitoring systems
- (a) Arrangements of instruments on monitoring panels
 - (b) Lists of monitoring and alarm items
- (13) Centralized machinery control systems
- (a) Arrangements of instruments on control panels
 - (b) Lists of monitoring, alarm and control items
- (14) Power-operated pilot ladder winding appliances
- (a) Arrangements of winding appliances
 - (b) Schematic diagrams of power sources
 - (c) Schematic diagrams of control sources (only in cases where separately provided from power sources)
- (15) Fixed deck washing arrangements
- (a) Arrangements of washing appliances
 - (b) Schematic diagrams of washing water piping systems
 - (c) Schematic diagrams of power sources for washing appliances and control systems
- (16) Bridge wing control devices
- (a) Arrangements of bridge wing control devices
 - (b) Schematic diagrams of power sources of bridge wing control devices

2.2.2 Shop Tests

As a case “where considered necessary by the Society” specified in **2.2.2 of the Rules**, the devices and equipment specified in **Table D18.7.1-1, Part D of the Guidance for the Survey and Construction of Steel Ships** are generally to be subject to the environmental tests.

2.2.4 Tests after Installation On Board

1 As a case “where deemed necessary by the Society” specified in **2.2.4 of the Rules**, the following are to be confirmed in general.

- (1) Rotational speeds of propellers and directions of thrust are to be maintained as they were in the event of the failure of those remote control devices for main propulsion machinery or controllable pitch propellers specified in **18.3.2, Part D of the Rules for the Survey and Construction of Steel Ships**.
- (2) Burning is to be ceased in the event of the failure of any of the automatic and remote control systems for boilers specified in

18.4, Part D of the Rules for the Survey and Construction of Steel Ships.

- (3) Burning is to be ceased in the event of the failure of any of the automatic and remote control systems for thermal oil installations specified in **18.6, Part D of the Rules for the Survey and Construction of Steel Ships**.

2 The wording “failure” specified in **-1** above means in general the following:

- (1) Power failure of control systems
- (2) Malfunction of computers for control use

2.2.5 Sea Trials

1 Centralized monitoring and control systems for machinery

- (1) Regarding those test procedures specified in **2.2.5-1(1)(b) of the Rules**, test procedures carried out using centralized monitoring and control systems for machinery installed on bridges or bridge control devices are, as standard practice, to be in accordance with those requirements in the following **-2**.
- (2) In cases where operation tests were carried out using centralized monitoring and control systems installed on bridges or bridge control devices for entire output ranges, allowances may be made for those test procedures specified in **2.2.5-1(1)(a) of the Rules**.

2 Monitoring and control systems for periodically unattended machinery spaces

- (1) The tests specified in **2.2.5-2(1) of the Rules** are to be carried out under the condition of unattended machinery operation for more than 4 *hours*. In addition, according to circumstances, the Surveyor may allow persons for safety purposes and persons in charge of measurements to enter machinery spaces.
- (2) Regarding those test procedures specified in **2.2.5-2(2) of the Rules**, test procedures carried out using centralized monitoring and control systems for machinery installed on bridges or bridge control devices are, as standard practice, to be in accordance with those procedures shown in **Fig.2.2.5-1** (for ships in which reciprocating internal combustion engines are used as main propulsion machinery) or **Fig.2.2.5-2** (for ships in which steam turbines are used as main propulsion machinery). In addition, make sure to confirm machinery conditions of steam turbine ships when transferring between harbour mode and ocean mode.
- (3) In cases where two engines are coupled with one shaft, the following tests are to be carried out in addition to those tests specified in **2.2.5-2(2) of the Rules**.
 - (a) While both engines are running at their maximum output, one engine is to be stopped by adequate means such as the emergency stop button in order to verify the engine can be stopped in safe condition and no abnormal conditions occur on the other engine. Tests are to be carried out on both of engines.
 - (b) While one engine is running, the other engine is to be put into parallel running, if the propulsion systems are designed to be operated by such sequence.
 - (c) While two engines are running at 85% or more of their maximum output, the clutch attached to one engine for the controllable pitch propeller is to be released in order to verify no abnormal conditions occur on the other engine. Tests are to be carried out on both of two engines.
- (4) Regarding those tests for controllable pitch propellers specified in **2.2.5-2(2) of the Rules**, those test procedures given in **(2)** above are to be applied.

Fig 2.2.5-1 Trial Procedures for Ships in which Reciprocating Internal Combustion Engines are used as Main Propulsion

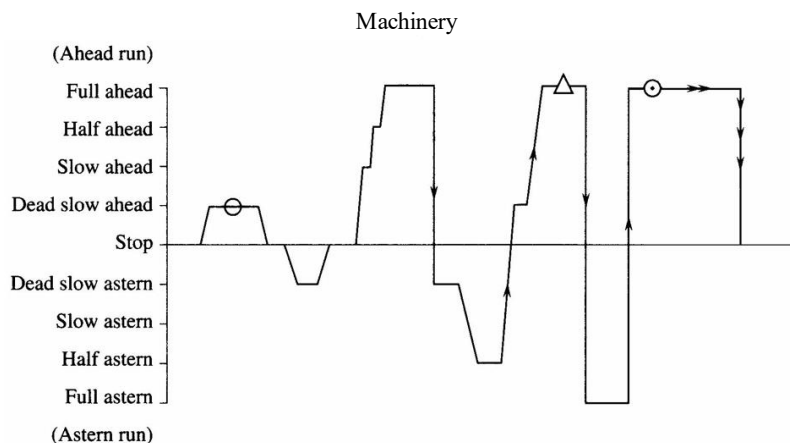
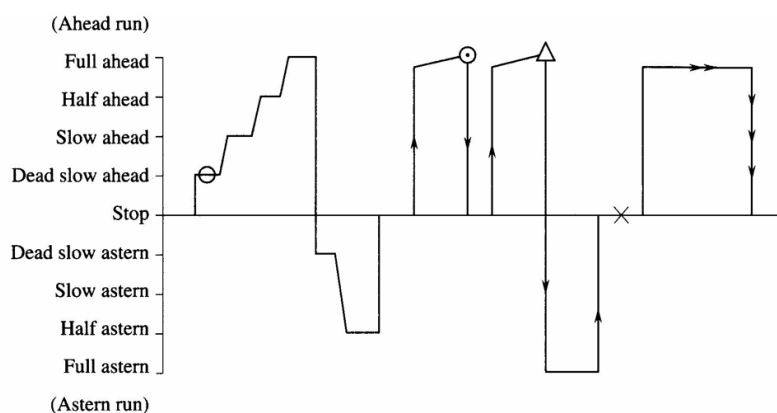


Fig 2.2.5-2 Trial Procedures for Ships in which Steam Turbines are used as Main Propulsion Machinery



Remarks:

- (1) ⊗ signifies putting over the rudder to hard port or hard starboard while proceeding at dead slow ahead.
- (2) → signifies to operate as quick as practicable.
- (3) →→ signifies to cut off the power supply (electric, pneumatic or hydraulic) for the remote control systems and to confirm that the preset speed and direction of the propeller thrust for main propulsion machinery or controllable pitch propellers will be maintained and any abnormal condition will not take place.
- (4) →→→ signifies to stop the main propulsion machinery to that of the normal service condition.
- (5) ⊙ signifies to raise the output of main propulsion machinery to that of the normal service condition.
- (6) △ signifies to raise the ship's speed to that of the normal service condition.
- (7) × signifies to stop the rotating of the main shaft.
- (8) To confirm the soundness of the driving performance of the main propulsion machinery after it has been stabilized.

Chapter 5 SPECIFIC AUTOMATION EQUIPMENT

5.2 Specific Automation Equipment

5.2.1 Class A Specific Automation Equipment

The wording “where considered appropriate by the Society” specified in **5.2.1 of the Rules** means that the following equipment may be omitted:

- (1) In the case of oil tankers, ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk, any of the power-operated opening/closing appliances specified in **5.3.7 of the Rules**
- (2) In the case of ships other than those mentioned in (1) above, any of the remote-controlled handling systems for liquid cargo in bulk specified in **5.3.5 of the Rules**
- (3) In the case of ships in which no ballasting/deballasting is necessary during cargo handling, any of the remote-controlled ballasting/deballasting arrangements specified in **5.3.6 of the Rules**
- (4) In the case of ships other than those engaged on voyages exclusively in sea area A3, any Maritime Satellite Communication Systems

5.2.2 Class B Specific Automation Equipment

The wording “where considered appropriate by the Society” specified in **5.2.2 of the Rules** means that the following equipment may be omitted:

- (1) In the case of oil tankers, ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk:
 - (a) Power-operated opening/closing appliances specified in **5.3.7 of the Rules**
 - (b) Monitoring devices for refrigerated containers specified in **5.3.8 of the Rules**
- (2) In the case of container carriers:
 - (a) Remote-controlled handling systems for liquid cargo in bulk specified in **5.3.5 of the Rules**
 - (b) Emergency towing rope winches specified in **5.3.9 of the Rules**
 - (c) Cargo hose handling winches specified in **5.3.10 of the Rules**
- (3) In the case of ships other than those mentioned in (1) and (2) above:
 - (a) Any of the equipment specified in (2) above
 - (b) Monitoring devices for refrigerated containers specified in **5.3.8 of the Rules**
- (4) In the case of any ships mentioned in **5.2.1(3)** or **5.2.1(4)**, any of the equipment specified in those sections respectively

5.2.3 Class C Specific Automation Equipment

The wording “where considered appropriate by the Society” specified in **5.2.3 of the Rules** means that the following equipment may be omitted:

- (1) In the case of oil tankers, ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk:
 - (a) Power-operated opening/closing appliances specified in **5.3.7 of the Rules**
 - (b) Monitoring devices for refrigerated containers specified in **5.3.8 of the Rules**
 - (c) Fixed deck washing arrangements specified in **5.3.15 of the Rules**
- (2) In the case of container carriers;
 - (a) Remote-controlled handling systems for liquid cargo in bulk specified in **5.3.5 of the Rules**
 - (b) Emergency towing rope winches specified in **5.3.9 of the Rules**
 - (c) Cargo hose handling winches specified in **5.3.10 of the Rules**
 - (d) Fixed deck washing arrangements specified in **5.3.15 of the Rules**
- (3) In the case of ore carriers or coal carriers in bulk;
 - (a) Remote-controlled handling systems for liquid cargo in bulk specified in **5.3.5 of the Rules**
 - (b) Monitoring devices for refrigerated containers specified in **5.3.8 of the Rules**
 - (c) Emergency towing rope winches specified in **5.3.9 of the Rules**
 - (d) Cargo hose handling winches specified in **5.3.10 of the Rules**

- (4) In the case of other than those mentioned in (1) to (3) above;
 - (a) Any of the equipment specified in (3) above
 - (b) Fixed deck washing arrangements specified in **5.3.15 of the Rules**
- (5) In the case of any ships mentioned in **5.2.1(3)** or **5.2.1(4)**, any of the equipment specified in those sections respectively

5.2.4 Class D Specific Automation Equipment

The wording “where considered appropriate by the Society” specified in **5.2.4 of the Rules** means any of the equipment specified in **5.2.3** may be omitted.

5.3 Standards for Specific Automation Equipment

5.3.1 Remote-controlled Fuel Oil Filling Arrangements

1 The wording “when the Society considers acceptable” specified in **5.3.1 of the Rules** means either of the following cases.

- (1) In cases where no valve operations are necessary throughout fuel oil filling operations, by initial valve handlings prior to such fuel oil filling operations.
- (2) In cases where the number of fuel oil tanks and valves requiring hand operation is four or less respectively, and any arrangements of tank level indicators and valves are such that fuel oil filling operations can be easily performed without using any remote control devices.
- (3) In cases where any valves requiring hand operation are collected on decks in well arrangements.

2 The wording “other control systems necessary for filling fuel oil” specified in **5.3.1(4) of the Rules** means those revolution control devices or start/stop devices for fuel oil transfer pumps necessary for fuel oil filling operations.

5.3.2 Remote-controlled Mooring Arrangements

The wording “effectively controlling” specified in **5.3.2 of the Rules** means speed controls (including start/stop controls) in both the paying out and heaving in of mooring lines.

5.3.3 Independent Remote-controlled Mooring Arrangements

1 The wording “controlling all drums of mooring winches independently” specified in **5.3.3 of the Rules** means to use any of the following arrangements:

- (1) Arrangements having one winch to which has a single exclusive drum
- (2) Arrangements capable of remote-controlling any clutches and brakes and capable of changing over from remote-controls to local controls in cases where one winch has multiple drums

2 In cases where more than five drums are provided respectively at the bows and sterns of ships, it may be acceptable to control at least five drums independently at the bow and stern.

5.3.5 Remote-controlled Handling System for Liquid Cargo in Bulk

The wording “controls for any equipment necessary for cargo loading/unloading” specified in **5.3.5-1(2) of the Rules** means the control of any valves fitted onto piping systems necessary for cargo loading/unloading.

5.3.6 Remote-controlled Ballasting/Deballasting Arrangements

The wording “controls for any equipment necessary for ballasting/deballasting” specified in **5.3.6-1(2) of the Rules** means the control of any valves fitted onto piping systems necessary for ballasting/deballasting.

5.3.7 Power-operated Opening/Closing Appliances

The wording “in cases where deemed necessary by the Society” specified in **5.3.7(3) of the Rules** means the following cases:

- (1) In cases where no visual verification of open/close conditions is available at operating positions:
 - Indicators showing such open/close conditions are to be provided.
- (2) In cases where no visual verification of safe operation is available at operating positions:
 - Audible alarms or yellow rotating warning lights are to be provided to ensure safety at times of open/close operations.

5.3.9 Emergency Towing Rope Winches

1 Removable type air motors may be accepted for those prime movers of emergency towing rope winches specified in **5.3.9 of the Rules**.

2 The wording “operating easily” specified in **5.3.9 of the Rules** means operating by one-man control.

5.3.10 Cargo Hose Handling Winches

The wording “easily controlled” specified in **5.3.10 of the Rules** means operating by one-man control.

5.3.11 Automatic Recording Devices

1 The wording “automatically recording” specified in **5.3.11 of the Rules** means that automatic main propulsion machinery recording devices are to have functions for taking records once every 4 *hours* (corresponding to one watch period).

2 The wording “operating conditions” specified in **5.3.11 of the Rules** means that, at least, the following items are to be included.

- (1) Lubricating oil pressure at main bearing inlets
- (2) Cooling water temperature at cylinder outlets
- (3) Steam pressure of main boilers
- (4) Exhaust gas temperature at each cylinder outlets
- (5) Revolutions per minute of main propulsion machinery or propeller shafts

5.3.12 Centralized Machinery Monitoring Systems

The wording “necessary information” specified in **5.3.12 of the Rules** means the information shown below. However, in such cases where such “necessary information” for devices installed on navigating bridges not required by any requirements other than this **5.3.12** may be dispensed with:

- (1) Monitoring of alarms for abnormal conditions on those items given in **Table 5.3.12-1** through **Table 5.3.12-5**.
- (2) Indications of those items given in **Table 5.3.12-1** through **Table 5.3.12-5**. However, in cases where one pump or heat exchanger gives two or more items, indication of only one item may be accepted.

5.3.13 Centralized Machinery Control Systems

1 The wording “devices which are necessary” specified in **5.3.13 of the Rules** means those devices shown below:

- (1) Sea water suction valves
- (2) Ventilators for machinery spaces
- (3) Automatic synchronous making devices and automatic load sharing devices for generators
- (4) Automatic load shifting devices and load tripping devices for generators

2 The wording “effectively controlling” specified in **5.3.13 of the Rules** means to control the following functions. However, in such cases, any functions not provided or required to be remote-controlled from navigating bridges by any requirements other than this **5.3.13** may be dispensed with.

- (1) With respect to the controls of main propulsion reciprocating internal combustion engines
 - (a) Starting/stopping of starting air compressors
 - (b) Opening/closing of stop valves for starting air reservoirs
 - (c) Starting/stopping of auxiliary blowers
 - (d) Starting/stopping of fuel oil supply pumps
 - (e) Starting/stopping of fuel oil boost pumps
 - (f) Starting/stopping of lubricating oil pumps
 - (g) Starting/stopping of crosshead lubricating oil pumps
 - (h) Starting/stopping of piston cooling water (oil) pumps
 - (i) Starting/stopping of cylinder cooling water pumps
 - (j) Starting/stopping of cooling sea water pumps
- (2) With respect to the control of reciprocating internal combustion engines driving generators (except emergency generators, the same being referred to hereinafter)
 - (a) Starting/stopping of diesel engines
 - (b) Control of fuel oil changeover devices
 - (c) Starting/stopping of cooling sea water pumps
 - (d) Selection of automatic starting engines
- (3) With respect to the control of steam turbines driving generators
 - (a) Starting/stopping of circulating pumps
 - (b) Change over of steam supplies between exhaust gas economizers and boilers in cases where steam turbine generators are usually driven by steam from exhaust gas economizers during navigation

- (4) With respect to the control of essential auxiliary boilers
 - (a) Starting/stopping of soot blowers for exhaust gas economizers in cases where steam turbine generators are driven by steam from exhaust gas economizers
 - (b) Starting/stopping of boiler water circulating pumps
- (5) With respect to the control of any other machinery which are necessary
 - (a) Opening/closing of sea suction valves in cases where high and low sea water suctions are provided
 - (b) Starting/stopping of ventilators for machinery spaces
 - (c) Operating of automatic synchronous making devices and automatic load sharing devices
 - (d) Operating of automatic load shifting devices and load tripping devices

5.3.15 Fixed Deck Washing Arrangements

The wording “enough strength against their working pressures” specified in **5.3.15(2) of the Rules** means that washing machines of fixed deck washing arrangements are to be hydrostatically tested at 1.5 times their design pressures.

5.3.17 Navigational Equipment and Radio Communication Equipment

The wording “International Standards recognized by the Society” specified in **5.3.17 of the Rules** means the following standards:

- (1) Global Positioning System (GPS) Receiver Equipment:
IMO Res. A.694(17), A.819(19)
- (2) Automatic Radar Plotting Aids (ARPA):
IMO Res. A.422(XI), A.694(17), A.823(19)
- (3) Maritime Satellite Communication Equipment:
IMO Res. A.570(14), A.663(16), A.694(17), A.698(17), A.807(19), A.808(19), MSC. 68(68) Annex.4

Table 5.3.12-1 Indications and Alarm Items of Reciprocating Internal Combustion Engines

Item		For main propulsion machinery	For generator engines
Temperature	Cylinder cooling water	Cylinder outlets	-
	Piston cooling water (oil)	Cylinder outlets	-
	Lubricating oil (main)	Inlets	-
	Fuel oil	Inlets	-
	Exhaust gas	Cylinder outlets	Inlets of turbo-chargers or cylinder outlets
	Scavenging air	Air cooler outlets	-
Pressure	Cylinder cooling water	Inlets	-
	Piston cooling water (oil)	Inlets	-
	Fuel oil valve cooling water (oil)	Inlets	-
	Lubricating oil (main)	Inlets	-
	Fuel oil	Inlets	-
	Cooling seawater	Pump outlets	-

Table 5.3.12-2 Indications and Alarm Items of Steam Turbines

Item		For main propulsion machinery	For generator engines
Temperature	Lubricating oil	Inlets and bearing outlets	-
Pressure	Lubricating oil	Inlets	-
	Exhaust steam	Condensers	-

Table 5.3.12-3 Indications and Alarm Items of Shaftings

Item		For main propulsion machinery	For generator engines
Temperature	Reduction gear lubricating oil	Inlets	-
Pressure	Reduction gear lubricating oil	Inlets	-

Table 5.3.12-4 Indications and Alarm Items of Boilers and Thermal Oil Heaters

Item		Main boilers	Auxiliary boilers	Thermal oil heater
Temperature	Fuel oil	Inlets	-	-
	Exhaust gas	Outlets	-	-
	Superheated steam, thermal oil	Outlets	-	Outlets
Pressure	Fuel oil	Inlets	-	-
	Steam	Outlets	Outlets	-

Table 5.3.12-5 Indications and Alarm Items of Other Machinery Installations

Item	Points of indication
Items as deemed necessary by the Society according to the construction and purpose of the relevant machinery installation.	Points as required by the Society