CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF OFFSHORE FLOATING INSTALLATION

PART VII AUTOMATION, SAFETY AND COMMUNICATION SYSTEMS

CCS OFFSHORE ENGINEERING TECHNOLOGY CENTER

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Contents

CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.1 General requirements

1.1.1.1 This PART applies to the non-self-propelled floating installation which are provided with automation, safety and communication systems.

The propulsion plant of self-propelled floating installation is to be in accordance with the relevant provisions in the *CCS Rules for Classification of Sea-Going Steel Ships*.

The automation, safety and communication systems of column-stabilized platform are to be in accordance with the relevant provisions in the *CCS Rules for Classification of Mobile Offshore Units*.

1.1.1.2 Although the provisions contained in this PART include those of IMO's *International Convention for the Safety of Life at Sea*, particular attention is to be given to any relevant statutory provisions of the Administration of the State in which the unit is registered and of the Administration of the State in whose waters the floating installation is to operate.

1.1.1.3 Floating installation with different levels of automation complying with the requirements of this PART may be assigned the following class notations:

(1) AUT−0 — to be assigned to the floating installation with main machinery installation remotely controlled from the bridge or the main control station, and with machinery space including centralized control station (room) in machinery space periodically unattended.

(2) MCC — to be assigned to the floating installation with centralized control of machinery and electrical installation from machinery space.

1.1.1.4 The safety of the floating installation with the automated systems as specified in this PART is to be same as that of the floating installation with machinery spaces being attended. Means are to be provided to ensure that the machinery and electrical equipment can be manually and effectively operated from a local position in case of failure of the automated systems.

1.1.1.5 This PART specifies only requirements for the design and installation of central control systems of the floating installation. The performance, manufacture and test of related electrical equipment are to comply with the relevant requirements of PART FIVE of the Rules and Chapters 1 and 3, PART FOUR of *CCS Rules for Classification of Sea-Going Steel Ships*. However, the environmental conditions are to comply with Section 2 of this Chapter.

1.1.1.6 The central control systems of floating installation generally include the process control system, emergency shutdown devices (ESD), fire and gas detection and alarm systems (F&G) and the information management system (including production and planning management and spare parts management), etc. The process control system, ESD and F&G are to be completely independent from each other and are to be designed as a whole by means of system integration to achieve decentralized control and centralized management.

1.1.1.7 The central control systems on floating installation may have the following functions:

--- To provide daily work management information for ship management personnel;

--- To provide daily work process handling information for crude oil production personnel so as to ensure safe and continuous production;

--- To provide necessary safety information for ship personnel so as to guarantee personnel safety.

--- To receive and handle real time information so as to avoid potential danger and conduct trend analysis;

--- To achieve data input and output in good order;

--- To provide necessary real time information for company management so as to facilitate management;

--- To achieve secure connection with the Internet on board so as to facilitate the contact with the outside world.

1.1.1.8 The central control systems on floating installation are to be able to guarantee personnel safety, normal production and the safety of treatment facilities and protect the maritime environment from being polluted.

1.1.2 Plans and information

1.1.2.1 When it is intended to build a floating installation to be classed with CCS, the following plans and information are to be submitted in quadruplicate to CCS for approval before commencement of construction. Additional plans and information for machinery and production and process equipment may be required for approval if considered necessary by CCS.

1.1.2.2 The following plans and information, if applicable, are to be submitted to CCS for approval:

(1) Schematic diagrams and arrangements of internal communication systems, including:

① Public address system;

② Telegraph system;

③ Command telephone system;

④ Engineers' call system;

(2) Schematic diagrams and arrangements of alarm systems, including:

① Fire detection and alarm systems;

② Pre-warnings for the release of extinguishing media;

③ General emergency alarm system;

④ Watertight doors closing alarm;

⑤ Electrical diagrams of fire dampers and fire doors;

⑥ Refrigerated room mis-closing alarm system;

(3) Emergency shutoff system

① Block diagram of interfaces and electrical power source;

② Control panel arrangement;

③ Detailed description of manual shutoff, resetting and override devices;

④ Arrangement of control panel, secondary control panel and manual shutoff position of the emergency shutoff system;

⑤ Logical diagram of the emergency shutoff system;

(4) Remote control systems for valves;

(5) Electrical diagram of liquid level indication system;

(6) Electrical diagram of cargo oil ballast;

(7) List of monitored and display points;

(8) List of alarm points (including display position and mode of alarms in the control station/room); list of I/O points

(9) Schematic diagrams of (electric, pneumatic, hydraulic) power sources serving central control systems;

(10) The plans of computer systems submitted are to comply with the relevant requirements specified in Chapter 1, PART SEVEN of *CCS Rules for Construction and Classification of Sea-Going Steel Ships*. Items of safety systems;

1.1.2.3 The following plans and information are to be submitted for information:

(1) Specifications of central control systems of floating installation, including:

① Schematic diagrams and function instructions of automatic and remote control systems;

② Details of monitoring functions in control station (room) (including the control changeover between control stations/rooms);

③ Setting of alarm points, specifications of test method and self-monitoring function for alarm systems.

(2) List of the relevant equipment associated with automatic/remote control.

1.1.2.4 Additional plans and information are to be submitted for approval as deemed necessary by CCS.

1.1.3 Definitions

1.1.3.1 For the purpose of this PART:

(1) Automatic control means self-regulating control carrying out predetermined orders to operate the machinery without action by an operator.

(2) Remote control means control of a device by an operator from a distance through mechanical, electrical, electronic, pneumatic, hydraulic, electromagnetic (radio) or optical means or combination thereof.

(3) Local control means direct manual control by an operator of machinery through a device located on or adjacent to the controlled machinery.

(4) Control station (room) means spaces fitted with monitoring means capable of controlling the safety equipment, production and process equipment, and general machinery and electrical installation. They are mainly divided into three categories as follows in this Chapter:

① Main control station (centralized control station/room) means the space in which monitoring means for all automated installation are concentrated and operations of such installation are monitored under normal conditions;

② Local control station means the control station where machinery and electrical installation are locally controlled on or adjacent to them;

③ Auxiliary control station means control stations other than the above-mentioned two ones.

(5) Safety systems mean systems which will operate automatically for safeguarding the machinery or electrical equipment in question in the following three modes of operation in case of serious faults endangering the main propulsion plant, generating station, production facilities and other essential machinery or electrical equipment:

Mode a: Immediate shutdown, e.g., emergency cutoff of boiler fuel oil and emergency cutoff of electric power supply to consumers. And such machinery or equipment is not to be put into operation again if without the manual resetting;

Mode b: The operation of the machinery is temporarily adjusted to the prevailing conditions, e.g., by reducing the output or speed of the propulsion plant;

Mode c: The normal operating conditions are restored by starting of standby machinery.

(6) Alarm means an audible and/or visual signal of a predetermined out-of-limits parameter for the monitored machinery or system, which could identify the specific fault conditions and positions within machinery spaces.

(7) Group alarm means a common alarm activated by any abnormal conditions of the monitored machinery or system.

(8) Fail-safe principle means that upon failure or malfunction of a component or system, the output automatically reverts to a predetermined design state of least critical consequence.

(9) Override means the special control measures for the skipping of a certain procedure or a certain safeguard action so as to effect compulsory operation to the machinery or electrical equipment for a short period to ensure the safety of the unit or to minimize damage.

(10) Emergency shutdown device means device independent of control system and intended for manual activation in an emergency to stop the operation of machinery and electrical installation.

(11) Redundancy design means standby technical means to be used in case of system or equipment fault, by which a corresponding function can be taken over to continue an action or an original function is restored to continue the operation condition.

(12) Network means a communication net for data transfer and exchange between computers.

(13) Node means a point of interconnection to a data communication link.

(14) Major modification means one of the following cases or a combination thereof which will cause a substantial change to functions or safety features of an onboard computer system (excluding peripherals):

① Change of hardware configuration;

② Update of software;

③ Alteration of network (including topology structure).

1.1.4 Testing

1.1.4.1 The central control systems together with the monitored mechanical and electrical installation are to be subject to mooring tests and/or sea trials in accordance with the test programme approved by CCS.

1.1.4.2 The set values of alarm points of central control systems and the set values of safety system parameters determined as meeting the requirements in the Rules after the testing are to be recorded and kept on board for reference.

Section 2 ENVIRONMENTAL AND OPERATING CONDITIONS

1.2.1 Environmental conditions

1.2.1.1 The control devices and safety communication systems are to operate satisfactorily at an ambient air temperature range as specified in Table 1.2.1.1.

Ambient air temperature range **Table 1.2.1.1**

Location of installation	Temperature (℃)
Open decks, uninsulated deckhouses	-25 ~ +55
Other spaces	+5 ~ +55

1.2.1.2 The central control systems are to operate satisfactorily under the following conditions of relative humidity:

95% ± 3% at temperatures up to +45℃;

70% ± 3% at temperatures higher than +45℃.

1.2.1.3 The central control systems are to operate satisfactorily under the vibration conditions listed in Table 1.2.1.3. Where resonance occurs in the following frequency ranges and exceeds the values specified below, suitable means are to be provided for vibration damping.

Vibration **Table 1.2.1.3**

Location of installation	Parameter of vibration	
General spaces	2.0 Hz ~ 13.2 Hz Amplitude ± 1 mm	13.2 Hz ~ 100 Hz Acceleration ± 0.7 g
On reciprocating engines (e.g. diesel engines, air compressors) and other similar spaces	2.0 Hz ~ 25 Hz Amplitude ± 1.6 mm	25 Hz ~ 100 Hz Acceleration ± 0.7 g
Other special locations (e.g. exhaust pipes of diesel engines, particularly medium or high speed engines)	40 Hz ~ 2000 Hz Acceleration ± 10.0 g (temperature 600℃)	

1.2.1.4 The central control systems are to be suitable for the normal conditions encountered on board the floating installation, e.g. salt air, oil-laden atmosphere, mould and dust.

1.2.1.5 The central control systems are to comply with the requirements of inclination and swing specified in Table 1.2.1.1(2) of PART SIX.

1.2.2 Other operating conditions

1.2.2.1 The voltage and frequency are to operate satisfactorily under the conditions specified in 1.2.2 of Section 2 of Chapter 1 of PART SIX of the Rules.

1.2.2.2 The harmonic is to operate satisfactorily under the conditions specified in 1.2.3 of Section 2 of Chapter 1 of PART SIX of the Rules.

1.2.2.3 The electromagnetic compatibility is to meet the requirements specified in 1.3.4 of Section 3 of Chapter 1 of PART SIX of the Rules.

1.2.2.4 The hydraulic and pneumatic equipment of central control systems is to operate satisfactorily under pressure variations in them by ±20% of the rated values and is not to be damaged by transient pressure-rise up to 1.5 times the rated pressure.

CHAPTER 2 BASIC REQUIREMENTS

Section 1 GENERAL PROVISIONS

2.1.1 General requirements

2.1.1.1 This Chapter applies to the design and installation of control devices.

2.1.1.2 The main components comprising the control, alarm and safety systems are to hold the marine product certificates issued by CCS.

2.1.1.3 Where the equipment is required to operate in a controlled environment condition, an alternative means is to be provided to maintain the required environment in the event of a failure of the normal air-conditioning system.

2.1.2 Power supply

2.1.2.1 The control, alarm and safety systems are to be served by feeders from the main power source and the emergency power source (or reserve power source). The safety and alarm systems as well as those control systems requiring continuous supply of power (e.g. the automated system of an electric generating plant and the computer system of a centralized control station) are to be capable of being automatically changed over to a separate standby battery or UPS in the event of failure of the main power supply. The capacity of the battery or UPS is at least to be sufficient for a period of supply of 30 min.

Where such systems could be adversely affected by an interruption in power supply, change-over to the standby power supply is to be achieved without a break.

2.1.2.2 Audible and visual alarms are to be given for the safety, alarm and control systems in the event of a failure of the normal power supply.

2.1.2.3 The control, safety and alarm systems are to be supplied by final separate sub-circuits and protected against short circuit and overload.

2.1.3 Safe communication

2.1.3.1 The sound of signals and alarms used for different purposes are to be readily identifiable by means of different tones and loudness.

2.1.3.2 In spaces where noises are high, audible signals are to be sufficiently loud and supplemented by lighting.

2.1.3.3 All combined automatic audible and visual alarms are to be provided with means to cut off the audible signal, but without cutting off the visual signal.

2.1.3.4 Suitable communication means are to be provided between the main control station, auxiliary control stations, office of the floating installation's manager, office of suppliers and accommodation spaces of operating personnel.

2.1.4 Cable

2.1.4.1 Control cables are to meet the requirements of Section 5 of Chapter 1 of PART FIVE and Section 9 of Chapter 2.

2.1.4.2 Where fire and flammable gas systems and process control systems are completely independent of each other, signals between them are to be hard-wired.

2.1.5 Grounding

2.1.5.1 The grounding of instrumentation and control systems is to meet the requirements of Section 4 of Chapter 1 of PART SIX.

2.1.5.2 The grounding of intrinsically safe instrument circuits is to be separated from the grounding of non-intrinsically-safe instrument circuits.

2.1.6 Electrical instruments and control devices in hazardous areas

2.1.6.1 This is to be implemented in accordance with the relevant requirements in PART SIX.

2.1.7 Fail-safe

2.1.7.1 The central control systems are to be designed according to the "fail-safe" principle. The characteristics of the "fail-safe" operation are to be evaluated on the basis not only the systems and their associated machinery, but also the whole installation including personnel safety.

2.1.7.2 The central control systems are to be so designed that a failure in the operation will not cause other failures and will, so far as possible, lead to the least dangerous condition of the controlled process.

2.1.7.3 The automatic control and remote control systems are to be ensured in continuous, effective and reliable operation conditions.

2.1.8 Independence

2.1.8.1 The central control systems are to be designed or rendered to function independently of each other so that a failure or malfunction in one or two of these systems will not prevent the other system(s) from operating.

2.1.8.2 In any case, a safety system of mode a is to function independently of control and alarm systems so that a failure or malfunction in these systems will not prevent the safety system from operating. For the safety systems of modes b and c, complete independence of other control and alarm systems is not required.

2.1.8.3 Safety systems of different units of the machinery plant are to be independent. Failure in the safety system of one part of the plant is not to interfere with the operation of the safety system in another part of the plant.

2.1.9 Examination and lock-in

The central control systems are to be capable of being examined for their functions. Where the settings of sensitivity, limiting, etc. of the controls, alarms and safety equipment may be regulated, these settings are to be easily examined, identified and locked-in.

2.1.10 Miscellaneous

2.1.10.1 A system of alarm displays and controls is to be provided which readily ensures identification of faults in the machinery and satisfactory supervision of related equipment. This may be provided at a main control station (e.g. bridge control station, engine room centralized control station (room)), or alternatively, at subsidiary control stations (e.g. local control stations, other control stations). In the latter case, a master alarm display is to be provided at the main control station showing which of the subsidiary control stations is indicating a fault condition.

2.1.10.2 Communications of alarms from machinery spaces to the bridge area and accommodation for engineering personnel are to be such that this watch-keeper is made aware when:

(1) A machinery fault has occurred;

(2) The machinery fault is being attended to (e.g. acknowledging, silencing);

(3) The machinery fault has been rectified.

Alternative means of communication between the bridge area, the accommodation for engineering personnel and the machinery spaces (CCS or local control stations) may be used for this function.

2.1.10.3 If a main control station or several subsidiary control stations are provided, transfer of control is to comply with the requirements of 2.5.2 of this Chapter.

Section 2 CONTROL SYSTEMS

2.2.1 General requirements

2.2.1.1 The control system consists of automatic and remote control systems.

2.2.1.2 Control systems are to have sound control properties. Control systems and the controlled machinery and electrical equipment are to be operated in a stable condition within their working ranges so that the operation of the controls will not induce detrimental mechanical or thermal loads. Control systems are also to have necessary accuracy of control.

2.2.1.3 The design of the control system is to be such that a failure in the control system will lead to the least dangerous condition of the controlled process and furthermore, such failure is not to render any reserved automatic and/or manual control, or both, inoperative.

2.2.1.4 Remote or automatic controls are to be provided with sufficient instrumentation at the relevant control stations to ensure effective control and indicate that the system is functioning correctly.

2.2.1.5 In the case of failure in any part of the automatic or remote control system, the system is to be capable of:

(1) Giving alarm signals; or

(2) Replacing immediately faulty component(s) or putting the back-up arrangements into service in time for recovering normal operation; or

(3) Transferring smoothly to local manual control.

2.2.1.6 Local manual control stations are to be provided with instrumentation to ensure effective control of machinery, production and process equipment.

2.2.1.7 When control systems are provided with means to adjust their sensitivity or set point, the arrangements are to be such that the final settings can be readily identified.

2.2.1.8 Control systems for the main propulsion plant (including main engine and controllable pitch propeller), boilers and generating station are to be independent of each other unless necessary for operation. The control system for each independent propulsion engine is to be provided separately.

2.2.2 Hydraulic and pneumatic power sources

2.2.2.1 The hydraulic power source and piping system of control systems are to comply with the relevant provisions in Chapter 2 and Section 12 of Chapter 3 of PART FOUR of the Rules. The standby hydraulic pump is to start and operate automatically when the discharge pressure from the working pumps falls below a predetermined value and an alarm is to be given; where the hydraulic pressure is lower than the required normal working pressure, an alarm is to be given.

2.2.2.2 The pneumatic power source of control systems are to comply with the relevant provisions in Chapter 2 of PART FOUR of the Rules and the following requirements:

(1) Air vessels for pneumatic controls may be supplied from the aerodynamical manifold or from exclusive air compressors;

(2) Where air vessels are supplied from the exclusive air compressors, at least two compressors are to be provided, one of which is standby. The standby air compressor is to start and operate automatically when the air pressure falls below a predetermined value;

(3) Relief valves are to be fitted in the pneumatic control piping, which are to be set to open at an pressure equal to 1.1 times the normal working pressure;

(4) Reducing valves, filters, driers and oil separators of the compressed air in the pneumatic control piping are to be provided so as to ensure dry, clean and oil-free air to the pneumatic controls. The reducing valves, filters and driers are to be, in general, fitted each in duplicate and in parallel. The provision of a single filter and a single drier may be permitted, provided that means are provided to ensure quick maintenance and renewal of the above-mentioned devices without interrupting the normal operation of the pneumatic control system.

2.2.2.3 The oil discharge system is to be provided with instruments to continuously monitor the oil discharge pressure, hose connection condition and tension at the connection.

2.2.2.4 The control systems are to be provided with necessary interlocking functions to avoid oil spilling or misoperation (for example, shut down the entire system in case of hose disconnection).

2.2.2.5 Normal or emergency release is not to generate oil leakage, explosion sources or any form of overload or any damage.

2.2.2.6 Emergency release is to be capable of both remote control and local manual control. Local control is not to be affected by remote control.

Section 3 SAFETY SYSTEMS

2.3.1 General requirements

2.3.1.1 In case of serious faults endangering the main propulsion plant, generating station, production facilities and other essential equipment, the safety systems are to operate automatically for safeguarding the machinery or electrical equipment in question in the three modes of operation required in 1.1.2.1 (5) of this Chapter and alarms are to be given in the relevant control stations.

2.3.1.2 Where the machinery and electrical equipment is stopped due to the action of safety system, such equipment is not to be restarted automatically before a manual reset has been made.

2.3.1.3 The safety systems are to be designed to operate independently of the control and alarm systems, such that a failure or malfunction in the control and alarm systems will not prevent the safety system from operating.

2.3.1.4 Safety systems for various plants are to be arranged so that failure of the safety system of one part of the plant will not interfere with the operation of the safety system in another part of the plant.

2.3.1.5 When a safety system is activated, an audible and visual alarm is to be provided in the control station to indicate the cause of the safety action.

2.3.1.6 When safety systems are provided with means to adjust their set point, the arrangements are to be such that the final settings can be readily identified.

2.3.1.7 In order to avoid undesirable interruption in the operation of machinery, the system is to intervene sequentially after the operation of alarm system by the following means so as to reduce the hazards as far as possible:

(1) Starting and use of standby units;

(2) Load reduction or shutdown.

2.3.2 Means of overriding

2.3.2.1 For the purpose of ensuring the safety of floating installation, the main propulsion machinery systems, such as main diesel engines, steam turbines, gas turbines and electric propulsion plant, and the emergency shutdown system are in general to be provided with arrangements for overriding.

2.3.2.2 An indication is to be given and a suitable alarm is to be activated when an overriding action is operated.

2.3.2.3 The arrangement and configuration of overriding push buttons is to be such that inadvertent operation is precluded.

2.3.3 Pneumatic power source and piping system

2.3.3.1 The pneumatic power source and piping system of safety systems are to be in compliance with the provisions of 2.2.3 of this Chapter, and the pneumatic pipe system is to be as far as practicable separated from the control systems.

Section 4 ALARM SYSTEMS (INCLUDING DISPLAYS)

2.4.1 General requirements

2.4.1.1 An alarm system, which will provide warning of faults in the machinery, production and process equipment, and the safety and control systems are to be installed.

2.4.1.2 All faults of the controlled and monitored machinery or electrical equipment and their control and monitoring systems are to be indicated with alarm signals at the relevant control stations (rooms) to advise duty personnel of a fault condition.

2.4.1.3 All alarms are to be both audible and visual. Visual signals are to be clearly visible. The color used for visual signals is to be, in general, red for vital faults and yellow for general ones.

Audible signal is to be of an adequate sound level. Alarms associated with machinery faults are to be clearly distinguishable from other alarms (e.g. fire alarm, telephone signal) in light color and sound tone.

2.4.1.4 The alarm system is to be capable of indicating all faults occurred at the same time, and the operation and/or acknowledgement of any alarm is not to inhibit the operation and/or acknowledgement of other alarms occurred at the same time.

2.4.1.5 When alarms are acknowledged, the audible alarms are to be silenced and at the same time the visual alarms are to be altered, for example, from flashing to a steady light, but the visual alarms are to be retained until faults are being rectified and the alarm system is automatically reset to its normal operating condition. The silencing push button for the audible alarms in machinery spaces is permitted to be arranged only at the control room.

2.4.1.6 Where a single alarm has been shown in the centralized control station/room or main control station of engine room, the alarm signal is also to be shown in other relevant auxiliary control stations and may be displayed by means of group alarm.

2.4.1.7 The alarm system is to be designed as far as practicable to function independently of control and safety systems such that a failure or malfunction in these systems will not prevent the alarm system from operating.

2.4.1.8 When alarm systems are provided with means to adjust their set point, the arrangements are to be such that the final settings can be readily identified.

2.4.2 Self-monitoring, inspection and lock-in of alarm systems

2.4.2.1 The alarm system is to be designed with self-monitoring properties, i.e., any fault in the alarm system itself will cause it to detect automatically and fall into the alarm (or indication) condition. The extent and depth of self-monitoring is to be determined in connection with the measures taken for maintenance and renewal. In so far as practicable, any fault in the alarm system will cause it to fail to the alarm condition.

2.4.2.2 The alarm system is to be capable of blockading meaningless signals during certain processes. Manual blockading is to be indicated.

2.4.3 Display

2.4.3.1 Instruments and displays can be used to display parameters. Parameters can be displayed separately or selectively; parameters can be displayed by text or graphics, but the display shall be clear. The light color of indicator light signal is generally green or white. The display and display requirements for computers shall meet the IEC Electrical Installation in Ships - Part 504: Special Issue - Automation, Control Devices and Instrumentation (IEC 60092-504).

2.4.3.2 Alarms displayed on display units are to be displayed in the order in which they occur. Alarms requiring shutdown or slowdown action are to be given visual prominence.

Section 5 CONTROL STATIONS (ROOMS)

2.5.1 Arrangement of control stations (rooms)

2.5.1.1 The central control room is to be located within non-hazardous areas with least vibrations and noises.

2.5.1.2 The engine room centralized control station (room) is to be located as far as possible in a position of least vibrations and of low noise level.

2.5.1.3 The centralized control station within the machinery spaces is to be of the sound-proof construction, with the window glass of the shatter-resistant type. The centralized control station is to have two means of access located as far remote from each other as practicable, and one of which is to be as far as possible situated near the escape trunk of the machinery spaces or the special purpose escape trunk.

2.5.1.4 The central control room (station) is to be able to monitor the following systems:

(1) Fire detection and alarm system

(2) Flammable gas detection and alarm system

(3) Emergency shutdown system

(4) General alarm system

(5) Fire-extinguishing system

(6) Production and utility system

(7) Stowage control system

(8) Aft oil discharge system

(9) Export metering system

2.5.1.5 The control and monitoring equipment, signal displays, control levers, switches and push buttons within the control stations (rooms) are to be arranged with due attention to thorough ergonomics for the convenience of operation, surveillance, maintenance and the safety of the operators.

2.5.1.6 The local control stations are to comply with the relevant requirements of 1.1.1.5 and 2.5.2 of this PART. It is to be possible for the main propulsion machinery to be controlled from a local position even in the case of failure or malfunction in any part of the automatic or remote control systems of any other control station or the propulsion machinery.

2.5.1.7 The remote control stations are to be provided with devices for displaying the on and off state of remote control valves.

2.5.2 Transfer of control

2.5.2.1 Transfer of control between control stations is to be possible to the machinery and electrical equipment under common control from such stations, either when these machinery and electrical equipment are in normal operation or in case of their failures. Such changeover is not to seriously affect the operating conditions of the machinery and electrical equipment.

2.5.2.2 Control of machinery and associated equipment is to be possible only from one station at a time.

2.5.2.3 Provision is to be made at the main control station and any other auxiliary control station from which the main propulsion and auxiliary machinery or associated equipment may be controlled to indicate which station is in control. The system is to be provided with interlocks or other suitable means to ensure effective transfer of control.

2.5.2.4 Changeover between control stations is to be so arranged that it may be affected only with the acceptance of the station taking control.

2.5.2.5 Provision is to be made at all control stations (rooms) to indicate which station is in control.

2.5.2.6 Where machinery and electrical equipment may be controlled from two or more control stations (rooms), control is to be possible only from one control station at one time. At all control stations, interconnected control positions for the controllers for main propulsion machinery are permitted.

2.5.2.7 For a self-propelled unit, propulsion plant orders from the navigating bridge are to be indicated at all control positions for the machinery.

2.5.2.8 Where the manual control gear of the main propulsion plant or other machinery and electrical equipment is extended directly to the centralized control station by means of mechanical linkage, the provision of corresponding LCS may be exempted.

2.5.2.9 Provision is to be made at the main control station, or auxiliary control stations as appropriate, for the operation of an engineers' alarm which is to be clearly audible in the engineers' accommodation, mess room, meeting room, etc.

Section 6 COMPUTER SYSTEMS

2.6.1 General requirements

2.6.1.1 This Section applies to the computer systems, including programmable electronic systems, installed onboard classed units, which provide control, alarm, monitor or safety functions compliance with classification requirements; however, this Section does not apply to loading computers and radio communication, navigation aids, etc. that already have specific performance standards from IMO.

2.6.1.2 The computer systems are to comply with the relevant requirements of Chapter 2, PART SEVEN of CCS Rules for Classification of Sea-Going Steel Ships.

Section 7 SENSORS

2.7.1 General requirements

2.7.1.1 The sensors are to give stable and normal operational performance over a long period of time.

The measuring range and frequency characteristics (if applicable) of sensors are to be consistent with the expected maximum variation range and variation of velocity of the parameters being detected. The sensors are to have appropriate accuracy and sensitivity.

2.7.1.2 The sensors are to have sound compatibility with the environmental conditions at their positions. The sensors are to be mechanically robust and durable, having good mechanical protection, reliable electrical connections and good insulated property.

2.7.1.3 The sensors are to be so positioned that they can properly reflect the monitored parameters and are readily accessible for testing and renewal. In order to carry out the maintenance and renewal conveniently, a protective cover is to be fitted for sensors. Where the sensors are located in the positions inaccessible for renewal, a standby sensor is to be fitted.

2.7.1.4 An independent sensor is to be provided for Mode a protective action (1.1.2.1(5) of this

Chapter); if not specially required, for Mode b protective action, a common sensor with display and alarm is permitted to use; for Mode c protective action, a common sensor with it own alarm is permitted to use.

CHAPTER 3 PROCESS CONTROL SYSTEMS

Section 1 MAIN FUNCTIONS AND PURPOSES

3.1.1 Functional requirements

The process control systems on floating installation may be used to:

(1) Monitor the production process of floating installation, conduct parameter setting, analysis and adjustment, and monitor and diagnose the working conditions of systems and instruments;

(2) Monitor the production process of wellhead platforms, and achieve telemetering, remote control and remote signaling for wellhead platforms;

(3) Monitor the working conditions of auxiliary systems and utility systems on floating installation;

(4) Dynamically display the production process, main technological parameters and the working conditions of major equipment, display abnormalities in the production and safety of floating installation and wellhead platforms in the form of audible and visual alarm;

(5) Monitor the production process, set and modify set points and adjust parameters on line, and perform various control functions.

3.1.2 Central control systems of floating installation

For the central control systems of floating installation, technologies and utility facilities of floating installation are to be considered whilst attentions are to be given to the correlation between the technologies and utility systems of wellhead platform and the floating installation (when floating installation are related to wellhead platforms) to ensure the safe and smooth production of the whole oil field, protect the safety of personnel and equipment and prevent environment pollution.

Section 2 VESSEL MANAGEMENT SYSTEMS

3.2.1 Vessel management systems

The vessel management systems are generally provided to input daily ship management information into the computer information system, which include power management system, remote control system for valves, liquid level indication system, cargo oil pump control system, detection and alarm system, loading computer system, and digital camera monitoring system, etc. They are able to help ship management personnel to conduct safe, effective, reliable and timely management on ship sub-systems.

Crude oil loading/unloading and ballast control systems are to have independent operation and control functions. Their working condition information is to be transmitted to central control systems for centralized monitoring. In case of fire or emergency shutdown, the shutdown command from central control systems is to be executed.

1. The liquid level indication system is to be at least capable of:

Remote measurement of liquid level:

Monitor the changes of liquid level, temperature and pressure of liquid tanks;

Automatically measure the crude oil density, calculate the liquid volume, weight and density, and measure the ship draught and atmospheric temperature and pressure.

Control of valves and pumps: The system automatically or manually controls the valve positions and pumps of relevant tanks according to the loading computer calculation results and the cargo oil/ballast plan to achieve functions of cargo oil management, crude oil transportation, ship load adjustment and stowage, etc.

2. Loading computer system

The loading computer system is to be able to provide different stability data of ship draught, hull center of gravity, stability and displacement under different loading conditions by analog calculation and on-line calculation to achieve functions of calculation, operation, recording, display and control during the process of crude oil loading/unloading and ballast.

3. Remote control system for valves

To facilitate cargo oil management, system operation safety and reliability are to be ensured at the design of remote control system for valves. The state information of valves is to be automatically transmitted to the control systems for displaying.

Section 3 PRODUCTION MODULE CONTROL SYSTEMS

3.3.1 The production module process control systems mainly provide dynamic production process information for production management personnel from the crude oil processing module, display main technological parameters, monitor the working conditions of main production modules, deal with alarm events and provide human-machine interaction functions such as on-line parameter modification for production module management personnel.

3.3.2 For specific requirements on production module process control systems, refer to the relevant regulations as specified in GB/T 21109-2007 *Functional Safety — Safety Instrumented Systems for the Process Industry Sector.*

3.3.3 Means are to be provided at oil discharge control stations (rooms) for monitoring oil discharge operation, oil discharge shutdown and remote control emergency release.

3.3.4 The oil discharge control, monitoring and release systems are to meet the requirements of Chapter 5 of PART FOUR.

Section 4 EXTERNAL INTERFACES

3.4.1 Where the central control systems have interfaces with the following systems:

3.4.1.1 Interface with generating station management system.

Monitoring programmes are to be provided for monitoring the working condition of ship generating station, preventing generator overload and avoiding power outage on board. PMS is required to provide generating station operation data such as generator on/off status, generator load signal, etc.

3.4.1.2 Interface with dynamic positioning control system

According to different mooring patterns of floating installation, interfaces with single point mooring system, internal turret mooring system and dynamic positioning control system are to be provided.

3.4.1.3 Interface with shore

For safe connection between the central control systems and the ashore computer network, the central control systems communicate with the shore via the maritime satellite station, and transmit ship data and information to the ashore computer network via the satellite ship station. At the same time, appropriate measures are to be taken to ensure that the operations of central control systems will not be affected by any failures in these interfaces and their subsequent equipment under any conditions.

CHAPTER 4 EMERGENCY SHUTDOWN

Section 1 REQUIREMENTS FOR ARRANGEMENT OF EMERGENCY SHUTDOWN

4.1.1 General requirements

4.1.1.1 Shutdown of oil supply

(1) Every oil fuel suction pipe from a storage, settling or daily service tank above the double bottom is to be fitted with a cock or valve, which is to be capable of being shut down from outside of the space where the tank is situated in case of fire in such space. In the special case of deep tanks situated in any shaft or pipe tunnel, valves are to be fitted on such tanks, but control in the event of fire may be affected by means of additional valves fitted on pipes or lines outside the tunnel.

(2) Fuel oil transfer pumps, oil fuel pumps and other similar fuel pumps are to be fitted with a remote control outside the spaces where the pumps are situated, so that they may be shut down in the event of fire in such spaces.

4.1.1.2 Shutdown of ventilation

(1) Facilities are to be fitted to stop the ventilation fans in accommodation spaces, service spaces, control stations, machinery spaces and operation spaces, and to close all the doorways to these spaces, the ventilators, funnel spaces and other openings. In the event of fire, the facilities can be controlled from outside of these spaces.

(2) Machinery spaces, gallery, main control room (central control station) or hazardous areas are to be fitted with independent power ventilation shutdown devices.

4.1.1.3 For emergency conditions of floating installation, in view of exceptional conditions in which the explosion hazard may extend outside the areas normally classified as hazardous, special arrangements are to be provided to facilitate the selective disconnection or shutdown of the following systems and devices. Disconnection or shutdown is to be possible from the locations to be manned outside hazardous area (such as main control room):

(1) ventilation systems, except fans necessary for supplying combustion air to prime movers for the production of electrical power;

(2) main generator prime movers, including their ventilation systems;

(3) emergency generator prime movers;

(4) all electrical equipment outside Zone 1 areas, except where of a certified safe type for Zone 1 applications;

(5) any emergency equipment other than that referred to in 4.1.1.4..

4.1.1.1 At least the following facilities are to be operable after an emergency shutdown:

(1) emergency lighting in alleyways, stairways, exits and personnel lift cars within accommodation spaces for half an hour;

(2) emergency lighting for all control stations or control positions in machinery spaces for half an

hour;

(3) emergency lighting for survival craft embarkation stations for half an hour;

(4) general alarm system;

(5) public address system;

(6) battery-supplied radio communication installation.

4.1.1.5 Equipment which is located in spaces other than enclosed spaces and arranged to be operated after complete shutdown is to be suitable for installation in Zone 2 locations.

4.1.2 Additional requirements for floating oil production units:

4.1.2.1 Emergency shutdown systems are to be provided to shut down the well and processing stations of oil, gas and water processing systems including subsea pipelines and stop all production operations.

4.1.2.2 The emergency shutdown system may be divided into separate subsystems and when necessary, the electrical power plant and fire safety system are to be operable after an emergency shutdown.

4.1.2.3 Fusible plugs of the fire detection loop may be integrated into the control loop for emergency shutdown.

4.1.3 Additional requirements for floating oil storage units:

Floating oil storage units are to be provided with an emergency shutdown system for crude oil inlet and outlet.

4.1.4 Shutdown levels

The floating installation are to provided with the following shutdown levels and corresponding shutdown functions which are to be determined based on the specific conditions.

(1) Unit shutdown

A single set of equipment or a series of equipment may be shut down at this level. Unit shutdown may be realized automatically and manually.

(2) Production shutdown

A part or all of equipment in production and crude oil import & export pipelines may be shut down at this level.

Production shutdown may be activated by important monitoring signals from production system, low air pressure signals from instruments, high or low pressure signals from production pipelines, fault signals from power supply systems and fault signals from thermal medium systems.

(3) Fire shutdown

In case that abnormal conditions detected by fire or flammable gas detection systems are confirmed automatically or manually, fire shutdown may be activated manually.

Fire shutdown is to result in production shutdown, but fire-fighting facilities, communication equipment, helicopter deck boundary light, obstruction light, fog light, fog horn, and emergency lighting, power generation and supply equipment are to keep running.

(4) Final shutdown

In case of force majeure, final shutdown is to be executed prior to personnel’s evacuation from floating installation. Final shutdown can only be activated manually.

4.1.5 Shutdown of the whole floating installation — final shutdown

The whole unit is to be capable of being shut down from:

(1) survival craft embarkation stations;

(2) helicopter deck;

(3) emergency evacuation position;

(4) main control station;

(5) bridge gangway between floating installation (if fitted);

(6) other locations deemed necessary.

Section 2 TECHNICAL REQUIREMENTS FOR EMERGENCY SHUTDOWN

4.2.1 General requirements

4.2.1.1 The emergency shutdown is to be so designed that the inadvertent shutdown due to incorrect operation or failure is minimized.

4.2.1.2 The emergency shutdown systems are to be arranged according to the fail-safe principle. The assessment of characteristics of fail-safe operations is to be based on the complete installation, not merely on the emergency shutdown systems and associated machinery and process.

4.2.1.3 The emergency shutdown is to be carried out according to a predefined logic. The defined logic and response time are to take the interaction between systems and dynamic effects into account.

4.2.1.4 The shutdown logic is to respond according to different levels of emergency and the logic is to be simple as far as practicable.

4.2.1.5 The emergency shutdown of oil production system is not to lead to unfavorable interlocking effects. The processing station (facility) may be maintained in a safe condition by means of other protective systems. The shutdown system is to be such that any ongoing operation will be safely ended upon initiated shutdown.

4.2.1.6 The shutdown at a higher level is to automatically cover the shutdown at lower level(s).

4.2.1.7 Emergency shutdown valves are to be of heat-resisting and corrosion-proof material.

4.2.2 Operation of emergency shutdown systems

4.2.2.1 The emergency shutdown systems are to be manually operated. Alternatively, they may be automatically actuated for the fusible plug loop in the fire detection system where malfunction will not occur. Each manually operated button is to be provided with means against malfunction.

4.2.2.2 Each shutdown station is capable of indicating the shutdown function, and the shutdown position.

4.2.2.3 The emergency shutdown systems are to be provided with manual resetting.

4.2.2.4 The override of emergency shutdown systems, if fitted, is to prevent incorrect operation. The overriding actions are to be visually indicated at the main control station.

4.2.3 Power sources and alarms

4.2.3.1 The cables of emergency shutdown systems are to be selected according to the relevant requirements in Chapter 2 of PART SIX of the Rules and run as far away from all dangerous sources as practicable.

4.2.3.2 The emergency shutdown systems are to be provided with means for automatically changing over to a reserve power source in the event of failure of the main source.

4.2.3.3 Any fault in the power source of emergency shutdown systems is to initiate an audible and visual alarm.

4.2.3.4 The batteries for pneumatic and hydraulic systems are to have sufficient capacity so that no recharging will be needed during sequential shutdown.

4.2.3.5 Alarm and display are to be available in the central control room in case of process shutdown.

CHAPTER 5 FIRE AND DETECTION SYSTEMS

Section 1 GENERAL REQUIREMENTS

5.1.1 Objective

The objective specified in this Chapter is to automatically and manually monitor fires in spaces of fire risk, initiate alarms in case of fires to remind relevant personnel of taking subsequent measures, or automatically activate shut-down action and start fire-extinguishing system.

5.1.2 Functional requirements

To achieve the objectives specified in this Section, the fire detection system is to have the following functions:

(1) System is to be capable of automatically monitoring each fire place, and detecting initial stage of fires in so far as practicable. The detectors are to be selected adaptable to the environment characteristics of the space and potential fire phenomena;

(2) In case a fire is detected, the system is to be capable of being operated immediately, displaying the fire places and giving audible and visual alarms;

(3) System is to be capable of automatically monitoring its circuit failures;

(4) A reliable detection system is to be capable of automatically activating the shutdown process and automatically starting the fire-extinguishing system;

(5) The fire detection system is to be designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in units. All electrical and electronic equipment on the bridge (central control room) or in the vicinity of the bridge (centralized control room) are to be tested for electromagnetic compatibility;

(6) Manually operated call points are to be readily available.

5.1.3 Definitions

5.1.3.1 Section means a group of fire detectors and manually operated call points as reported in the indicating unit(s).

5.1.3.2 Section identification capability means a system with the capability of identifying the section in which a detector or manually operated call point has activated.

5.1.3.3 Individually identifiable means a system with the capability to identify the exact location and type of detector or manually activated call point which has activated, and which can differentiate the signal of that device from all others.

Section 2 TECHNICAL REQUIREMENTS

5.2.1 System design

The fire-detection system is to be designed to:

(1) control and monitor input signals from all connected fire and smoke detectors and manual call points;

(2) provide output signals to the navigation bridge, continuously manned central control station or onboard safety centre to notify the crew of fire and fault conditions;

(3) monitor power supplies and circuits necessary for the operation of the system for loss of power and fault conditions; and

(4) the system may be arranged with output signals to other fire safety systems including:

① paging systems, fire alarm or public address systems;

② fan stops;

③ fire doors;

④ fire dampers;

⑤ spray systems;

⑥ low-location lighting systems;

⑦ fixed local application fire-extinguishing systems;

⑧ closed circuit television (CCTV) systems; and

⑨ other fire safety systems.

5.2.2 Connection to unit's decision-management system

The fire detection system may be connected to the decision management system, provided that:

(1) the decision management system is proven to be compatible with the fire detection system;

(2) the decision management system can be disconnected without losing any of the functions required by this Chapter for the fire detection system; and

(3) any malfunction of the interfaced and connected equipment is not to propagate under any circumstance to the fire detection system.

5.2.3 Zone address identification capability

Fire detection systems with a zone address identification capability are to be so arranged that:

(1) means are provided to ensure that any fault (e.g. power break, short circuit, earth) occurring in the loop will not render the whole loop ineffective;

(2) all arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g. electrical, electronic, informatics);

(3) the initial fire alarm will not prevent any other detector from initiating further fire alarms; and

(4) no loop will pass through a space twice or more. When this is not practical (e.g. for large public spaces), the part of the loop which by necessity passes through the space for a second time is to be installed at the maximum possible distance from the other parts of the loop.

5.2.4 Sources of power supply

5.2.4.1 There are to be not less than two sources of power supply for the fire detection system, one of which is to be an emergency source of power. The supply is to be provided by separate feeders reserved solely for that purpose. Such feeders are to run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system.

5.2.4.2 There is to be sufficient power to permit the continued operation of the system with all detectors activated, but need not be more than 100.

5.2.5 Detectors

5.2.5.1 Detectors are to be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be considered provided that they are no less sensitive than such detectors.

5.2.5.2 Smoke detectors required in all stairways, corridors and escape routes within accommodation spaces are to be certified to operate before the smoke concentration exceeds 12.5% obscuration per meter, but not until the smoke concentration exceeds 2% obscuration per meter, when tested according to standards EN 54:2001 and IEC 60092-505:2001. Smoke detectors to be installed in other spaces are to operate within proper sensitivity limits having regard to the avoidance of detector insensitivity or oversensitivity.

5.2.5.3 Heat detectors are to be certified to operate before the temperature exceeds 78℃, but not until the temperature exceeds 54℃, when the temperature is raised to those limits at a rate less than 1℃ per minute, when tested according to standards EN 54:2001 and IEC 60092-505:2001. At higher rates of temperature rise, the heat detector is to operate within proper temperature limits.

5.2.5.4 The operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130℃, and up to 140℃ in saunas.

5.2.5.5 Flame detectors are to be tested according to EN 54:2001 and IEC 60092-505:2001.

5.2.5.6 All detectors are to be of a type such that they can be tested for correct operation and restored to normal operation mode without the renewal of any component.

5.2.5.7 Detectors installed in hazardous areas are to be certified explosion-proof types.

5.2.6 Sections

5.2.6.1 Detectors and manually operated call points are to be grouped into sections.

5.2.6.2 A section of fire detectors which covers a control station, a service space or an accommodation space is not to include a machinery space of category A. For fixed fire detection systems with remotely and individually identifiable fire detectors, a section covering fire detectors in accommodation, service spaces and control stations is not to include fire detectors in machinery spaces of category A.

5.2.6.3 Where the fire detection system does not include means of remotely identifying each detector individually, no section covering more than one deck within accommodation spaces, service spaces and control stations is normally to be permitted except a section which covers an enclosed stairway. In order to avoid delay in identifying the source of fire, the number of enclosed spaces included in each section is to be limited. If the system is fitted with remotely and individually identifiable fire detectors, the sections may cover several decks and serve any number of enclosed spaces.

5.2.7 Positioning of detectors

5.2.7.1 Detectors are to be located for optimum performance. Positions near beams and ventilation ducts or other positions where patterns of air flow could adversely affect performance or positions where impact or physical damage is likely, are to be avoided. Detectors which are located on the overhead are to be a minimum distance of 0.5 m away from bulkheads, except in corridors, lockers and stairways.

5.2.7.2 The maximum spacing of detectors is to be in accordance with Table 4.2.7.2. Different spacing to that specified in the Table may be required or permitted, if based upon test data which demonstrate the characteristics of the detectors.

Spacing of Detectors **Table 5.2.7.2**

Type of detectors	Maximum floor area per detector	Maximum distance apart between detector centers	Maximum distance away from bulkheads
Heat	37 ㎡	9 m	4.5 m
Smoke	74 ㎡	11 m	5.5 m

5.2.7.3 Detectors in stairways are to be located at least at the top level of the stair and at every second level beneath.

5.2.8 Arrangement of electric wiring

5.2.8.1 Electrical wiring for the loop is to be fire-retarding type specified in IEC60332-1.

5.2.8.2 Electrical wiring which forms part of the system is to be so arranged as to avoid galleys, machinery spaces of category A, and other enclosed spaces of high fire risk except where it is necessary to provide for fire detection or fire alarm in such spaces or to connect to the appropriate power supply.

5.2.8.3 A loop of fire detection systems with a zone address identification capability is not to be damaged at more than one point by a fire.

5.2.9 Control and indication

5.2.9.1 The activation of any detector or manually operated call point is to initiate a visual and audible fire signal at the control panel and indicating units. If no particular attention is paid to the signals within 2 min, an audible alarm is to be automatically given throughout the crew accommodation and service spaces, control stations and machinery spaces of category A. This audible alarm system need not be an integral part of the detection system.

5.2.9.2 The control panel is to be located on the navigating bridge or in the continuously manned central control station. The control panel is to be tested as per EN 54:2001 and IEC 60092-505:2001.

5.2.9.3 Indicating units are, as a minimum, capable of denoting the section in which a detector has been activated or manually operated call point has been operated. At least one unit is to be so located that it is easily accessible to responsible members of the crew at all times. One set of indicating unit is to be located on the navigating bridge if the control panel is located in the central fire control station.

5.2.9.4 Clear information is to be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.

5.2.9.5 Power supplies and electric circuits necessary for the operation of the system are to be monitored for loss of power or fault conditions as appropriate. Occurrence of a fault condition is to initiate a visual and audible fault signal at the control panel which is to be distinct from a fire signal:

(1) a single open or power break fault caused by a broken wire;

(2) a single ground fault caused by the contact of a wiring conductor to a metal component; and

(3) a single wire to wire fault caused by the contact of two or more wiring conductors.

5.2.9.6 Means to manually acknowledge all alarm and fault signals is to be provided at the control panel. The audible alarm on the control panel and indicating units may be manually silenced. The control panel is to clearly distinguish normal, alarm, acknowledged alarm, fault and silenced conditions, respectively.

5.2.9.7 The system is to be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

5.2.10 Testing

5.2.10.1 The function of fire detection systems is to be tested under various conditions of ventilation after installation.

5.2.10.2 The function of fire detection systems is to be periodically tested and in compliance with the test requirements by means of equipment producing hot air at the appropriate temperature, or smoke or aerosol particles having the appropriate range of concentration or particle size, or other phenomena associated with incipient fires to which the detector is designed to respond.

5.2.10.3 The unit is to be provided with suitable instructions and component spares for testing and maintenance.

Section 3 REQUIREMENTS FOR PROVISION OF DEVICES

5.3.1 General requirements

5.3.1.1 Detectors are to be selected according to the early and main phenomena associated with incipient fires to which the detector is designed to respond.

5.3.1.2 In selecting the type of detectors, their suitability to the environment in which they are to be located is to be taken into account.

5.3.1.3 Optical detectors are to be fitted in such a position and angle that they are not exposed to radiation effects of flares.

5.3.2 Provision of detectors in spaces

5.3.2.1 Service spaces and accommodation spaces are to be provided with automatic fire detection systems.

5.3.2.2 Smoke detectors are to be installed in all cabins, stairways, corridors and means of escape within accommodation spaces. Thermal detectors are preferably to be installed in galley and other spaces producing vapor and smoke.

5.3.2.3 Thermal detectors are to be provided in the electric room and control stations.

5.3.2.4 Utility machinery spaces not continuously attended by watch-keepers are to be provided with a fire detection system in compliance with the following:

(1) The system is to be so designed and the detectors are to be so positioned as to detect rapidly the onset of fire in any part of machinery spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures; Except in spaces of restricted height and where their use is specially appropriate, detection systems using only thermal detectors are not permitted.

(2) The detection system is to initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigation bridge and by a responsible engineer officer. When the navigation bridge is unmanned, the audible alarm is to be given in a place where a responsible member of the crew is on duty.

5.3.2.5 In the open wellhead area, or mud processing area, flame or thermal detectors are preferably to be provided.

5.3.2.6 Oil, gas and water processing areas are to be provided with a fusible-plug-loop type temperature detection system and a smoke detection system.

5.3.3 Manually operated call points

5.3.3.1 Manually operated call points are to be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point is to be located at each exit. Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point.

5.3.3.2 Manually operated call points are also to be installed in machinery spaces, wellhead area, oil and gas processing area and crude oil storage area as well as other places considered necessary.

5.3.3.3 Measures are to be taken against mis-operation of manual alarm system.

Section 4 SHUTDOWN AND RELEASE FUNCTIONS

5.4.1 Automatic shutdown

5.4.1.1 Fusible-plug fire detection loop installed in oil, gas and water processing areas may automatically shut down piping and equipment serving as a source of fuel for fire and give an alarm.

5.4.1.2 The fire detection system may be provided with means of automatically closing fire doors or similar closing features on the control panel.

5.4.2 Automatic release of fire-extinguishing medium

An automatic release of fire-extinguishing medium is not permitted for fire detection systems, except in the following cases:

(1) highly reliable detection systems (e.g. fusible-plug loop) may automatically activate a fire-extinguishing medium system not harmful to human body (e.g. water spraying);

(2) in spaces not accessible to any person during navigation or operation (e.g. gas turbine housing).

CHAPTER 6 DETENTION OF FLAMMABLE GASES AND HYDROGEN SULFIDE GAS

Section 1 FIXED DETECTION AND ALARM SYSTEMS

6.1.1 Objective

The objective specified in this Chapter is to detect flammable gases and hydrogen sulfide gas, and give warning and alarms for dangerous concentration.

6.1.2 Functional requirements

To achieve the objective specified in this Chapter, the detection system is to have the following functions:

(1) A fixed gas detection system is to be capable of continuous and automatic monitoring of the leakage of flammable gases and hydrogen sulfide gas.

(2) The set value of warning of the concentration is not to be higher than 25% of the lower explosive limit of flammable gas. Set value for high-concentration alarms is not to be higher than 60% of the lower explosive limit of flammable gas. High-concentration alarm is to be capable of sending audio and visual signals to indicate the danger and shut off any source of oil gas leakage and any source liable to cause an explosion.

(3) In spaces fitted with hydrogen sulfide detectors, low-concentration alarms are to be given respectively at a concentration of 10 ppm, and high-concentration alarms are given at a concentration not more than 300 ppm. In case of high-concentration alarms, the warning to escape from the unit is to be sent out.

(4) In case the hydrogen sulfide gas alarm in main control station does not receive any respond in 2 minutes, the toxic (hydrogen sulfide gas) alarm and helicopter deck status lights will automatically be started.

(5) Detectors are to be connected with the audio and visual alarm system fitted with indicators in the main control room. The system is to clearly indicate the position of flammable gas and hydrogen sulfide gas.

(6) The system is to be capable of automatically monitoring circuit failures.

(7) The system is to be designed to withstand normal voltage changes and instant fluctuations, ambient temperature changes, vibration, dampness, shocks, impacts and corrosion.

(8) Not less than two sets of electrical power sources are to be available for the fire detection system, one of which is an emergency power source.

6.1.3 Control and indication

6.1.3.1 The main control station is to be provided with audible and visual alarms to indicate the location of abnormal accumulation of flammable gases and hydrogen sulfide gas. Such stations are to be so manned and equipped that any alarm given by the system will be received by the watch-keeper(s).

6.1.3.2 Diagrams or texts are to be displayed at each indicating device of the system showing the spaces covered, and suitable instructions for testing and maintenance are to be available.

6.1.4 Arrangement of feeders

6.1.4.1 The power is to be supplied by separate feeders reserved solely for that purpose and connected to an automatic change-over switch on the console at or adjacent to the detection system. The feeders are to be so arranged as to avoid enclosed spaces of high fire risk except in so far as it is necessary for detection in the space or for connection to appropriate switchboards.

6.1.4.2 Detectors and cables passing through hazardous areas are to be of an approved explosion-proof type and suitable for use in the hazardous zones where they are installed.

6.1.5 Provision and fitting of detectors

6.1.5.1 Flammable gas detectors are to be provided for the following spaces and areas:

(1) enclosed spaces classified as hazardous areas Zone 1 or 2 and their discharge outlets;

(2) ventilation inlets of enclosed non-hazardous spaces adjacent to hazardous areas;

(3) within enclosures of combustion equipment fuelled by natural gas or crude oil;

(4) ventilation ducts in which natural gas or crude oil fuel pipes are installed;

(5) air intakes of the living quarter specified in 4.2.1.4 of Chapter 2 of PART FOUR;

(6) locations deemed by CCS as necessary for special monitoring.

6.1.5.2 Sulfide hydrogen gas detectors are to be provided for the following spaces and areas:

(1) possible sulfide hydrogen leakage points in the production system and oil, gas and water processing system and storage installation.

(3) air intakes of the living quarter specified in 4.2.1.4 of Chapter 2 of PART FOUR.

6.1.5.3 The number of gas detectors to be fitted in each space is to be determined according to the size of the space and possible leakage sources, but not less than two.

6.1.5.4 The gas detectors are to be so arranged that any gas leakage will be detected as early as possible, having regard to characteristic specific gravity of the gas to be detected, location of any possible leakage source, geometry of the space, and airflow direction.

Section 2 PORTABLE GAS DETECTORS

6.2.1 Technical requirements

6.2.1.1 Portable detectors are to be readily available.

6.2.1.2 For units provided with inert gas systems, the flammable gas detectors are to be capable of not only measuring the concentration of flammable gases in the atmosphere, but also in the inerted atmosphere.

6.2.2 Provision of detectors

At least two portable flammable gas detectors are to be provided for each unit where flammable gas leakage may exist, and at least two sulfide hydrogen gas detectors are to be provided for each unit where sulfide hydrogen gas leakage may exist.

Section 3 HYDROGEN SULFIDE PROTECTIVE BREATHING APPARATUS

Hydrogen sulfide protective breathing apparatuses are to comply with the relevant requirements of Chapter 12 of PART EIGHT.

CHAPTER 7 COMMUNICATION AND SAFETY SYSTEMS

Section 1 GENERAL PROVISIONS

7.1.1 General requirements

7.1.1.1 The sound signals given by different internal communication devices are to be readily identifiable by means of different tones.

7.1.1.2 Where internal communication and alarm circuits are directly connected to power or lighting circuits or supplied from another source having a voltage above 50 V, the relevant requirements for power or lighting circuits in Chapter 2 of PART SIX of the Rules are to be complied with.

Section 2 SAFETY-RELATED MESSAGES BROADCASTING SYSTEMS

7.2.1 Personnel warning systems

7.2.1.1 Personnel warning systems, where provided, are to comply with 7.2.1.2 to 7.2.1.7 below.

7.2.1.2 Visual indicators of the floating installation's condition are to be provided at the following locations:

— entrance of all working spaces;

— entrance of all accommodation spaces;

— recreational space and mess room;

— helicopter deck;

— main control station; (including the fire control station)

—main offices (such as the leader's);

7.2.1.3 The displays of the visual indicators are to be appropriate to any potential danger possibly present in any condition from "normal" to "abandon". The signals used are to be limited to: general emergency, toxic gas (hydrogen sulphide), combustible gas, fire alarm, and abandon unit signals. These signals are to be described in the muster list and operations manual.

7.2.1.4 The visual indicators are to be controlled in the main control station and the fire control station (if fitted).

7.2.1.5 The display of the visual indicators for a fire or gas alarm on the floating installation is to be automatically initiated by the signals given by the fire and gas detection system.

7.2.1.6 The power source of the visual indication system of the floating installation's condition is to be automatically changed over to a reserve source in the event of loss of its normal power source.

7.2.1.7 A separate audible and visual indication is to be given in the event of any fault of any power source of the visual indication system.

7.2.2 Public address systems

7.2.2.1 A public address system is to be provided to effectively broadcast messages to accommodation spaces, services spaces, passageways, public spaces, control stations and decks. The public address system is to comply with the following:

(1) Capable of broadcasting messages from the main control station and fire control station and/or navigation bridge (if fitted) or other essential locations (e.g. emergency response centre, engine control room, ballast control station, office of suppliers, rotary turret, temporary shelter, survival craft muster and embarkation station and helicopter deck);

(2) Unnecessary for the receivers to take any measures to accept the broadcast message;

(3) Protected against unauthorized use;

(4) The amplifiers are to have sufficient output power so that all loudspeakers used for the purpose of emergency announcement can be operated at the same time;

(5) The system is to be arranged to prevent feedback or other interference;

(6) With the floating installation in normal conditions (including transit condition), the minimum sound pressure levels for broadcasting emergency announcements are to be:

① in interior space 75 dB(A) and at least 20 dB(A) above the speech interference level;

② in exterior space 80 dB(A) and at least 15 dB(A) above the speech interference level;

(7) The system is powered by main electrical power source and emergency electrical power source. The power supply is to be automatically changed over to the emergency power source in the event of loss of the main power source.

(8) The controls of the system in the main control station and the navigation bridge (if fitted), is to be capable of interrupting any broadcast of the system from any other positions onboard;

(9) At least two amplifiers are to be provided, each of them separately supplied and fused;

(10) At least two loudspeaker circuits supplied form separate amplifiers, are to be installed in each fire zone, and the cables are to be laid separately along the whole length as far as possible;

(11) Independent short-circuit protection is to be provided for each loudspeaker.

7.2.2.2 A public address system may be used as general emergency alarm system to announce fire alarms if the following requirements and the requirements for general emergency alarm systems are complied with:

(1) 7.2.2.2 (4), (5) and (6) above and Section 3 of this Chapter are complied with;

(2) It is to be possible to transmit clearly audible alarm signals at all times. Other simultaneous entertainment transmissions are to be automatically interrupted;

(3) Where loudspeakers with built-in volume controls are used, the volume controls are to be disabled by the release of the alarm signal so as to ensure the transmission of the alarm signal with maximum volume at all times;

(4) The power supply of multiple amplifiers is to be such that the failure of one amplifier will not result in the failure of remaining amplifiers;

(5) Where several loudspeaker circuits are connected to one amplifier, the short circuit of one loudspeaker is not to impair normal operation of remaining loudspeakers;

(6) The loudspeaker circuits are to be so arranged that an announcement at a reduced acoustic irradiation is maintained in the event of a failure of an amplifier or loudspeaker circuit;

(7) More than one device is provided for generating the sound signals for the emergency alarms.

7.2.2.3 Where more than one alarm is to be sounded through the public address system, they are to have recognizably different characteristics and additionally be arranged, so that any single electrical failure which prevents the sounding of any one alarm will not affect the sounding of the remaining alarms.

Section 3 GENERAL EMERGENCY ALARM SYSTEMS

7.3.1 In order to give general emergency alarm signals, a general emergency alarm system comprising a whistle or siren and additional electric bell or klaxon or other equivalent equipment is to be provided.

7.3.2 The system is to be audible throughout all the accommodation and normal crew working spaces, including weather decks. The minimum sound pressure levels for the emergency alarm tone in exterior spaces are to be 80 dB(A) and at least 10 dB(A) above ambient noise levels existing during normal equipment operation with the floating installation in moderate weather. The sound pressure levels at the sleeping position in cabins and in cabin bathrooms are to be at least 75 dB(A) and at least 10 dB(A) above ambient noise levels.

7.3.3 The general emergency alarm system is to be operable from the main control station, navigation bridge (if fitted), fire control station and a position adjacent to the alarm signal distribution board. Once initiated, the system is to sound continuously until it is switched off manually or is interrupted by the public address system.

7.3.4 Where the general emergency alarm system is under working condition, acoustic system for entertainment is to be interrupted automatically.

7.3.5 The general emergency alarm system is to be powered by two separate feeders respectively from the main switchboard and the emergency switchboard, provided with an automatic change-over device on or adjacent to the main alarm signal distribution board. The power supply is to be automatically changed over to the emergency electrical power source in the event of failure of the main power source.

7.3.6 Each electric bell or klaxon or other equivalent audible equipment is to be provided with independent short-circuit protection.

7.3.7 The frequency of sound signals are to be between 200 Hz ~ 2500 Hz, except electrically operated bells.

7.3.8 In compartments where noises are high, such as engine room, lighting or flashing alarms are to be additionally provided.

7.3.9 Public address systems or other suitable communications are to be supplemented for the general emergency alarm system.

Section 4 PROTECTION AGAINST FLOODING

7.4.1 General requirements

7.4.1.1 The operation control of watertight doors and hatch covers is to be provided with an alarm indication and control system. For semi-submersible (column-stabilized) floating installation, flooding alarms are to be additionally provided.

7.4.1.2 The alarm indication and control of semi-submersible (column-stabilized) floating installation is to be provided on the central control panel of the ballast control station.

7.4.1.3 The alarm indication and control of surface-type units is to be provided in the ballast control station, main control station, navigation bridge or operation points (if applicable).

7.4.1.4 Doors and hatch covers fitted for watertight integrity of internal passageways and used during floating operation of the floating installation are to be capable of being remotely controlled. The detailed requirements for alarm, indication and control are to be in compliance with the relevant provisions for electrically or hydraulically operated watertight doors and hatch covers.

7.4.1.5 Doors and hatch covers fitted for watertight integrity of internal passageways and normally closed under floating condition of the floating installation are to be provided with alarm indication according to 3.4.4 below.

7.4.1.6 The bilge sensors and level indicators required for semi-submersible (column-stabilized) floating installation are to comply with 3.4.5 below.

7.4.2 Electrically operated watertight doors and hatch covers

7.4.2.1 The electrically operated watertight doors and hatch covers (watertight doors and hatch covers are referred to hereinafter as watertight doors) are to be arranged in accordance with 3.4.2.2 to 7.4.2.10 below.

7.4.2.2 The power source required for electrically operated watertight doors is to be independent of any other power circuit and supplied from the emergency switchboard or a dedicated distribution board suitably located above the final damage waterline. The associated control, indication and alarm circuits are also to be supplied from the emergency switchboard or a dedicated distribution board suitably located above the final damage waterline.

7.4.2.3 A single electrical failure in the power operating or control system of an electrically operated watertight door is not to result in a closed door opening or interrupt manual operation of any door.

7.4.2.4 Availability of power supply is to be continuously monitored at a point in the electrical circuit as near as practicable to operating equipment for watertight doors. Loss of any such power supply is to activate an audible and visual alarm at the central operating console and the indication panel.

7.4.2.5 Electrical power, control, indication and alarm circuits are to be protected against fault in such a way that a failure in one door circuit will not cause a failure in any other door circuit. Short circuit or other faults in the alarm or indicator circuit of a watertight door are not to result in a loss of power operation of that door. Arrangements are to be such that leakage of water into the electrical equipment located below the final damage waterline will not cause the door to open.

7.4.2.6 The enclosures of electrical components necessarily situated below the final damage waterline are to have suitable protection against the ingress of water[①].

7.4.2.7 Electrical control equipment of watertight doors, including cables, are to be kept as close as practicable to the bulkhead in which the watertight doors are fitted, in order to minimize the likelihood of them being involved in any damage which the floating installation may sustain.

7.4.2.8 An audible alarm, distinct from any other alarm in the area, is to be provided, which will sound whenever the watertight is closed remotely by power and is to sound for at least 5 s but not more than 10 s before the door begins to move and is to continue sounding until the door is completely closed. In areas of ambient noise exceeding 85 dB(A), the audible alarm is to be supplemented by an intermittent visual signal.

7.4.2.9 The central operating console is to have a master mode switch with the following two modes of control:

(1) Local control mode for normal conditions, which is to allow any watertight door to be locally opened and locally closed after use without automatic closure;

(2) Door closed mode for emergency conditions, which is to automatically close any watertight door that is open and permit doors to be opened locally and to automatically reclose the doors upon release of the local control mechanism.

7.4.2.10 The master mode switch is to be arranged such that it is normally in the position of local control, with its emergency function clearly indicated.

① Refer to IEC publication 60529:

1) Electrical motors, associated circuits and control components: IPX7;

2) Door position indicators and associated circuit components: IPX8. The water pressure testing of their enclosure is to be based on the pressure that may occur at the location of the component during flooding for a period of 36 h;

3) Door movement warning signals: IPX6.

7.4.2.11 The central operating console is to be provided with a diagram showing the location of each watertight door, with visual indicators to show whether each watertight door is open or closed. A red light is to indicate a door fully open and a green light is to indicate a door fully closed. When a door is closed remotely, the red light is to indicate the intermediate position by flashing. The indicating circuit is to be independent of the control circuit for each watertight door.

7.4.3 Hydraulically operated watertight doors and hatch covers

7.4.3.1 Hydraulically operated watertight doors and hatch covers are to be so fitted that they are functionally equivalent as required in 7.4.2.2 to 7.4.2.10 above.

7.4.3.2 The electrical indication for hydraulically operated watertight doors and hatch covers is to meet the requirements of 7.4.2.2 to 7.4.2.10 above.

7.4.3.3 Where a single hydraulic power source is to supply more than 4 doors and hatch covers, two hydraulic pumps are to be provided.

7.4.4 Indicators for doors, hatch covers and other closing appliances

7.4.4.1 The indicators required in 7.4.1.5 and 7.4.1.6 above are to meet the requirements of 7.4.4.2 to 7.4.4.3 above.

7.4.4.2 The indication system is to be designed according to the “fail-safe” principle. A green light is to indicate that a door, hatch cover or any other closing appliance is closed while a red light is to indicate that it is not completely and securely closed.

7.4.4.3 The power source of the indication system is to be independent of any power source for operating and securing doors and hatch covers.

7.4.5 Bilge level and flooding level alarm and indication

7.4.5.1 Semi-submersible (column-stabilized) floating installation are to be provided with a high bilge level alarm and a flooding level alarm in accordance with 7.4.5.2 to 7.4.5.4 below.

7.4.5.2 The appropriate central operating console in the ballast control station is to be fitted with a high bilge level alarm and a high flooding level alarm.

7.4.5.3 For all large compartments, which may affect intact and damage stability and watertightness of which needs to be maintained, high bilge level alarms and high flooding level alarms are to be fitted. This requirement may be exempted for any tank of which the level is indicated in the ballast control station.

7.4.5.4 The machinery spaces and crude oil tanks below the waterline are to be provided with a high bilge level alarm. For semi-submersible (column-stabilized) floating installation, the engine rooms and pump-rooms in them are to be provided with two independent systems for high bilge water level detection, which could give an audible and visual alarm at the centralized ballast control station.

7.4.5.5 Semi-submersible (column-stabilized) floating installation are to be provided with leakage detection system for underwater bracing, which could give an audible and visual alarm at the centralized ballast control station.

Section 5 OTHER ALARM AND SAFETY DEVICES

7.5.1 Fire and gas alarm, indication and control systems

Fire and gas alarm, indication and control systems are to comply with Chapter 5 of PART SEVEN.

7.5.2 Flammable gas detection and alarm devices

Flammable gas detection and alarm devices are to comply with Chapter 6 of PART SEVEN.

7.5.3 Watertight door indication and alarm devices

The indicators for closing and opening watertight doors and the audible alarms for closing watertight doors are to additionally comply with the IMO *Code for the Construction and Equipment of Mobile Offshore Floating Drilling Units*.

7.5.4 Pre-discharge alarms of fire extinguishing systems

7.5.4.1 In any spaces where persons normally work or to which persons have access, an automatic audible alarm is to be provided for the discharge of fire-extinguishing medium. The system is to be operated at least 20 s before the medium is released.

7.5.4.2 The alarm system is to be supplied by the emergency source of electrical power.

7.5.5 Elevator alarms

7.5.5.1 Elevators having an internal control are to be fitted with an emergency audible call-up device capable of being operated in the car and the alarm signal is to be transmitted to the positions where persons are normally present.

7.5.5.2 The emergency audible call-up device is to be independent from the power and control circuits of the elevator and supplied by the emergency source of electrical power.

7.5.6 Alarms for closing refrigerated spaces

7.5.6.1 Where the doors to refrigerated spaces cannot be opened from the inside, an alarm capable of being activated within the spaces upon inadvertent closing of such doors is to be fitted and the alarm transmitted to normally manned positions.

Section 6 INTERNAL COMMUNICATION SYSTEMS

7.6.1 Telephone system

7.6.1.1 An internal communication system is to be provided for intercommunication between all spaces in which actions are required in an emergency. The communication system is to be independent of the electrical system of the floating installation and supplied in general by batteries, and a cut into existing conversations is to be possible.

7.6.1.2 Suitable communication system is to be provided between the main control station, auxiliary control stations, office of the floating installation's manager/leader, office of suppliers and accommodation spaces of operating personnel.

7.6.1.3 Efficient means of communication are to be fitted between the control room, the navigation bridge (if fitted) and position(s) installed with facilities for operation of radio equipment.

7.6.1.4 Reliable communication equipment is to be fitted in the elevator to keep contact with the external. The source of electrical power for the communication equipment is to be independent of the electrical system of the floating installation and normally supplied by the accumulator batteries.

7.6.2 Communications in an emergency

7.6.2.1 An intercommunication system is to be provided which enables commands to be transmitted between muster and embarkation stations for survival craft and main control station and/or navigation bridge (if fitted).

7.6.2.2 The communication system may comprise portable or permanently installed equipment, and is to be operable in the case of a failure of the main power supply.

7.6.3 Additional requirements for semi-submersible (column-stabilized) floating installation

7.6.3.1 For semi-submersible (column-stabilized) offshore floating installation: A permanently installed means of communication, independent of the floating installation's main source of electrical power, is to be provided between the centralized ballast control station and spaces that contain ballast pumps or valves, or other spaces that may contain equipment necessary for the operation of the ballast system.

7.6.3.2 For semi-submersible (column-stabilized) and surface-type floating installation: Reliable means are to be provided to communicate between locations critical to the anchoring operation.

Section 7 EXTERNAL COMMUNICATION SYSTEMS

7.7.1 Communication with other platforms

7.7.1.1 If technological and utility system correlations exist between floating installation and other wellhead platforms, communication with other wellhead platforms may be provided.

7.7.2 Communication with helicopters

7.7.2.1 Communication with helicopters is to meet the requirements of No. 151 Decree of the Civil Aviation Administration of China.