

Section 9

Control, Monitoring and Ship's Safety Systems

A. General Requirements

1. Scope

1.1 This Section sets out requirements for the equipment and design of control, monitoring and ship's safety systems necessary for the operation of the ship and the machinery installation and for the safety of the vessel.

1.2 The general requirements stated in this Section also apply to the open and closed-loop control and measuring systems of essential equipment, see [Section 1](#).

1.3 Regarding additional requirements for ships with unmanned engine room see [Chapter 4 – Automation](#).

2. Planning and design

2.1 The requirements laid down for each unit and system depend on their use and the process-technological conditions. The Construction Rules stipulate the minimum requirements for these.

2.2 If special operating conditions call for a particular system design, GL reserve the right to impose additional requirements, depending on the operational and system-specific considerations.

2.3 The design of safety measures, open and closed loop controls and monitoring of equipment shall limit any potential risk in the event of breakdown or defect to a justifiable level of residual risk.

2.4 Where appropriate, the following basic requirements shall be observed:

- compatibility with the environmental and operating conditions
- compliance with accuracy requirements
- recognizability and constancy of the parameter settings, limiting- and actual values
- compatibility of the measuring, open and closed loop controls and monitoring systems with the process and its special requirements
- immunity of system elements to reactive effects in overall system operation

- non-critical behaviour in the event of power failure, restoration and of faults
- unambiguous operation
- maintainability, the ability to recognise faults and test capability
- reproducibility of values

2.5 Automatic interventions shall be provided where damage cannot be avoided by manual intervention.

2.6 If dangers to persons or the safety of the ship arising from normal operation or from faults or malfunctions in machinery or plant, or in control, monitoring and measuring systems, cannot be ruled out, safety devices or safety measures are required.

2.7 If dangers to machinery and systems arising from faults or malfunctions in control, monitoring and measuring systems cannot be ruled out, protective devices or protective measures are required.

2.8 Where mechanical systems or equipment are either completely or partly replaced by electric/electronic equipment, the requirements relating to mechanical systems and equipment according to [Chapter 2 – Machinery Installations](#) shall be met accordingly.

3. Design and construction

3.1 Machinery alarm systems, protection and safety systems, together with open and closed loop control systems for essential equipment shall be constructed in such a way that faults and malfunctions affect only the directly involved function. This also applies to measuring facilities.

3.2 For machinery and systems which are controlled remotely or automatically, control and monitoring facilities shall be provided to permit manual operation.

3.3 In the event of disturbances automatically switched-off plants shall not be released for restarting until having been manually unlocked.

4. Application of computer systems

If computer systems are used, [Section 10](#) has to be observed.

5. Maintenance

5.1 Access shall be provided to systems to allow measurements and repairs to be carried out. Facilities such as simulation circuits, test jacks, pilot lamps, etc. are to be provided to allow functional checks to be carried out and faults to be located.

5.2 The operational capability of other systems shall not be impaired as a result of maintenance procedures.

5.3 Where the replacement of circuit boards in equipment which is switched on may result in the failure of components or in the critical condition of systems, a warning sign shall be fitted to indicate the risk.

5.4 Circuit boards and plug-in connections shall be protected against unintentional mixing up. Alternatively they shall be clearly marked to show where they belong to.

B. Machinery Control and Monitoring Installations

1. Safety devices

1.1 The design of safety devices shall be as simple as possible and shall be reliable and inevitable in operation. Proven safety devices which are not depending on a power source are to be preferred.

1.2 The suitability and function of safety devices shall be demonstrated in the given application.

1.3 Safety devices shall be designed so that potential faults such as, for example, loss of voltage or a broken wire shall not create a hazard to human life, ship or machinery.

These faults and also the tripping of safety devices shall be signalled by an alarm.

1.4 For preference, safety devices shall be designed in conventional technology (hard wired). Alternative technical solutions shall be agreed with GL.

1.5 The adjustment facilities for safety devices shall be designed so that the last setting can be detected.

1.6 Where auxiliary energy is needed for the function of safety devices, this has to be monitored and a failure has to be alarmed.

1.7 Security equipment like short circuit monitoring of generators as well as overspeed monitoring of diesel engines shall run independently from automatic

power control system, to ensure that the equipment can continue operating manually in case of a breakdown.

1.8 Safety devices are subject to mandatory type approval.

2. Safety systems

2.1 Safety systems shall be independent of open and closed loop control and alarm systems. Faults in one system shall not affect other systems.

Deviations from this requirement may be allowed for redundant equipment with the agreement of GL where this would entail no risk to human life and where ship safety would not be compromised.

2.2 Safety systems shall be assigned to systems which need protection.

2.3 Where safety systems are provided with overriding arrangements, these shall be protected against unintentional operation. The actuation of overriding arrangements shall be indicated and recorded.

2.4 The monitored open-circuit principle shall be used for safety systems. Alternatively, the closed circuit principle shall be applied where the provisions of national regulations demand it. (e.g. boiler and oil-fired systems). Equivalent monitoring principles are permitted.

Faults, and also the tripping of safety systems shall be indicated by an alarm and recorded.

2.5 Safety systems shall be designed for preference using conventional technology (hard wired). Alternative technical solutions shall be agreed with GL.

2.6 The power supply shall be monitored and loss of power shall be indicated by an alarm and recorded.

2.7 Safety systems are subject to mandatory type approval.

3. Open loop control

3.1 Main engines and essential equipment shall be provided with effective means for the control of its operation. All controls for essential equipment shall be independent or so designed that failure of one system does not impair the performance of other systems, see also [A.2.4](#), [B.8](#) and [B.9](#).

3.2 Control equipment shall have built-in protection features where incorrect operation would result in serious damage or in the loss of essential functions.

3.3 The consequences of control commands shall be indicated at the respective control station.

3.4 Controls shall correspond with regard to their position and direction of operation to the system being controlled resp. to the direction of motion of the ship.

3.5 It shall be possible to control the essential equipment at or near to the equipment concerned.

3.6 Where controls are possible from several control stations, the following shall be observed:

- Competitive commands shall be prevented by suitable interlocks. The control station in operation shall be recognizable as such.
- Taking over of command shall only be possible with the authorization of the user of the control station which is in operation.
- Precautions shall be taken to prevent changes to desired values due to a change-over in control station.
- Open loop control for speed and power of internal combustion engines (main and auxiliary engines) and electrical actuators are subject to mandatory type approval.

4. Closed loop control

4.1 Closed loop control shall keep the process variables under normal conditions within the specified limits.

4.2 Closed loop controls shall maintain the specified reaction over the full control range. Anticipated variations of the parameters shall be considered during the planning.

4.3 Defects in a control loop shall not impair the function of operationally essential control loops.

4.4 The power supply of operationally essential control loops shall be monitored and power failure shall be signalled by an alarm.

4.5 Open loop control for speed and power of internal combustion engines (main and auxiliary engines) and electrical actuators are subject to mandatory type testing.

5. Alarm systems

5.1 Alarm systems shall indicate unacceptable deviations from operating figures optically and audibly.

5.2 Alarm delays shall be kept within such time limits that any risk to the monitored system is prevented if the limit value is exceeded.

5.3 Optical signals shall be individually indicated. The meaning of the individual indications shall be clearly identifiable by text or symbols.

If a fault is indicated, the optical signal shall remain visible until the fault has been eliminated. It shall be possible to distinguish between an optical signal which has been acknowledged and one that has not been acknowledged.

5.4 It shall be possible to acknowledge audible signals.

The acknowledgement of an alarm shall not inhibit an alarm which has been generated by new causes.

Alarms shall be discernible under all operating conditions. Where this cannot be achieved, for example due to the noise level, additional optical signals, e.g. flashing lights shall be installed.

5.5 Transient faults which are self-correcting without intervention shall be memorized and indicated by optical signals which shall only disappear when the alarm has been acknowledged.

5.6 Alarm systems shall be designed according to the closed-circuit principle or the monitored open-circuit principle. Equivalent monitoring principles are permitted.

5.7 The power supply shall be monitored and a failure shall cause an alarm.

6. Operational devices for main- and auxiliary engines

Operational devices required for the engine room control position in accordance with [Chapter 2 – Machinery Installations, Section 2, I.1.1](#) and [I.1.2](#) for:

- speed/direction of rotation
- lubricating oil pressure
- control air pressure
- fuel pressure

shall be electrically independent of other systems.

7. Reversal alarm system

On ships whose main engines are not remotely controlled from the navigating bridge, the engine telegraph system shall be equipped with a reversal alarm. An audible signal shall sound until the direction of motion demanded by the engine telegraph corresponds with the direction of rotation of the main engine, as indicated by the reversing shaft.

8. Speed/output controls of diesel engines

8.1 General

8.1.1 The governor and the actuator shall be suitable for controlling the engine under the operating conditions laid down in the Rules for Construction and shall be also in line with the requirements specified by the engine manufacturer, see [Chapter 2 – Machinery Installations, Section 2, F](#).

8.1.2 Electrical governors and the associated actuators are subject to mandatory type approval.

8.1.3 In the event of faults in the governor system, the operating condition of the engine shall not become dangerous.

Faults in the governor system shall cause an alarm.

In the case of main propulsion engines, engine speed and power shall not increase.

In the case of auxiliary engines, in the event of faults in the governor system, the fuel admission in the injection pumps shall be set to "0".

8.2 Power supply to the control systems of main propulsion engines

8.2.1 Control systems with an independent back-up system shall be supplied from the main source of electrical power.

8.2.2 Where main propulsion engines can be operated without a supply of electrical power (pumps driven from the main engine), their control systems (if they have no back-up system) shall be supplied from the main source of electrical power with battery back-up for at least 15 minutes.

The automation battery, if of sufficient capacity, may be used for this purpose.

8.2.3 Where main propulsion engines can only be operated with a supply of electrical power (electrically driven pumps), their control systems shall be fed from the main source of electrical power.

8.2.4 Dedicated power supplies shall be provided for each control system of plants comprising a number of main propulsion engines.

8.2.5 Batteries shall not be discharged by the control system following an engine shutdown.

8.3 Power supply to the control systems of generator sets

8.3.1 Each control system shall be provided with a separate supply from the main source of electrical power with battery back-up for at least 15 minutes.

8.3.2 If there are more than two auxiliary engines, a total of two back-up batteries is sufficient.

8.3.3 If the auxiliary engines are started electrically, a combination of the back-up battery with the starter battery is permissible.

The automation battery may be used as a second back-up battery to boost the input voltage.

8.3.4 No supply or battery back-up is required for a control system with its own power source.

8.3.5 No battery back-up is needed if a back-up system is provided.

8.3.6 Batteries shall not be discharged by the control system following an engine shutdown.

9. Integration of systems for essential equipment

9.1 The integration of functions of independent equipment shall not decrease the reliability of the single equipment.

9.2 A defect in one of the subsystems (individual module, unit or subsystem) of the integrated system shall not affect the function of other subsystems.

9.3 Any failure in the transfer of data of autonomous subsystems which are linked together shall not impair their independent function.

9.4 Essential equipment shall also be capable of being operated independently of integrated systems.

C. Ship Control Systems

1. Remote control of the main engine

Where the remote control of the main engine from the bridge is envisaged, the requirements according to [Chapter 4 – Automation, Section 5, A.](#) shall be observed.

2. Engine telegraph systems

2.1 General

At least two mutually independent command transmission units shall be provided for the commands from the bridge to the position in the engine room or machinery control room from which speed and direction of thrust of the propellers is normally controlled. One of these units shall be an engine telegraph system.

The second appropriate means of command transmission shall be independent of the main engine telegraph system.

Suitable means of communication shall be provided from the bridge and the engine room to all other positions from which speed and thrust of the propeller can be varied.

2.2 Main engine telegraph system

2.2.1 The controls of the transmitters and receivers shall be safeguarded by suitable means (e.g. notching) against inadvertently move.

2.2.2 Engine telegraphs shall be of the two-way systems type in which the signal given by the receiver is also immediately discernible at the transmitter.

2.2.3 In the case of installations with several control positions the acknowledged command shall be indicated at all control positions. Where control positions are selected by switching, additionally indication shall be provided of which one is in use.

2.2.4 Transmitters and receivers shall be equipped with call-up devices which remain in operation from the start of the command transmission until it is correctly acknowledged. The audible signal shall be hearable at all points in the engine room. If necessary, optical signals shall be provided in addition to the audible signals.

2.2.5 Power supply shall be provided from the main source of electrical power.

2.3 Emergency engine telegraph system

2.3.1 The function of the emergency engine telegraph system shall conform to that of the main system in accordance with 2.2.1 and 2.2.2.

Power supply shall be provided from the emergency source of electrical power.

2.3.2 Instead of the emergency engine telegraph system a telephone system may be fitted.

3. Indicators on the bridge

3.1 All instruments and indicators important to the control of the ship shall be legible at all times.

3.2 All indicators and illuminations for instruments shall be provided with dimmers.

3.3 All illumination and lighting of instruments shall be adjustable down to zero, except the lighting of warning and alarm indicators and the control of the dimmers which shall remain readable.

3.4 Each instrument shall be fitted with an individual light adjustment. In addition, groups of instruments normally working together may be equipped with common light adjustment.

4. Rudder angle indicators

4.1 The ship's main control station shall be equipped with a rudder angle indicator whose transmitter is actuated by the rudderstock.

4.2 All the equipment forming part of the rudder angle indicator system shall be independent of the steering gear control.

4.3 The rudder angle indicator shall be legible from all control stations on the bridge. The display shall be continuous.

4.4 If the rudder angle is not clearly apparent at the emergency manual steering gear control position in the steering gear compartment, an additional rudder angle indicator shall be fitted.

4.5 The above requirements also apply, as and where appropriate, to rudder propeller systems. The indicators shall be so designed that they indicate the thrust direction of motion of the ship.

4.6 If the steering gear shall be also supplied from the emergency source of electrical power, the rudder angle indicator shall be supplied from the main and emergency source of electrical power (see also Section 7, A.2.3).

5. Voice communication and signalling systems

5.1 Important voice communications

The voice communications specified below shall be designed to ensure fully satisfactory vocal intercommunication under all operating conditions.

The systems shall be designed to provide individual links, although this feature may be dispensed with if it is ensured that the bridge can cut into existing conversations at all times.

5.1.1 The following voice communications are required:

- a) Bridge-Engine control room
- b) Bridge-Engine room

Required is a two-way call-up and intercommunication systems between the bridge and all the control positions in the engine room from which the main propulsion plant can be controlled. The call-up devices in the engine room shall be so designed that they are discernible from any position in the engine room, even when operating at full power. Additional optical means may be used for this purpose.

This voice communication is not required if a main and emergency telegraph is available, see 2.1.

- c) Bridge-Steering gear compartment

An intercommunication system is required between the bridge and the steering gear control position in the steering gear compartment.

- d) Engine control room-Bridge-Engineers' accommodation area

A voice communication is required between the a. m. areas.

This may be a telephone system, an intercommunication system or a public address system, provided that the bridge can in any event cut into existing communications.

5.1.2 If the voice communication system requires an electrical power supply, this supply shall be from the main switchboard and the emergency switchboard.

5.2 Voice communications in an emergency

5.2.1 An intercommunication system shall be provided which enables commands to be transmitted between strategically important locations, the assembly point, the emergency control stations, the shaller stations and the launching stations of lifesaving equipment.

5.2.2 This system may comprise portable or permanently installed equipment, and shall also be operable in the event of a failure of the main power supply.

5.2.3 If portable equipment is provided the number of VHF transceivers shall be at least:

- 2 on cargo ships ≥ 300 GRT
- 3 on cargo ships ≥ 500 GRT

5.3 Engineers' alarm (Engineers' call)

From the engine room or from the engine control room it shall be possible to transmit an alarm into the accommodation area of the technical officers or the crew members responsible for the machinery.

For ships with automated machinery, [Chapter 4 – Automation, Section 4](#) is to be observed additionally.

5.4 CO₂-alarm systems

For the general design and construction of CO₂ alarm systems, see [Chapter 2 – Machinery Installations, Section 12, G. and H.](#)

5.4.1 For machinery spaces, boiler, cargo pump rooms and similar spaces acoustic alarms of horn or siren sound is to be provided which shall be independent of the discharge of CO₂. The audible warning is to be automatically actuated a suitable time before flooding occurs and is to be clearly distinguishable from all other alarm signals.

As adequate shall be considered the period of time necessary to evacuate the space to be flooded but not less than 20 s. The system is to be designed such that flooding is not possible before this period of time has elapsed.

Opening the door of the release station shall trip the CO₂ alarm in the protected space.

The alarm shall continue to sound as long as the flooding valves are open. A visual alarm is also to be installed where necessary.

An automatically trip of emergency shutdown facilities by the CO₂-alarm is not permitted (see also [Chapter 2 – Machinery Installations, Section 12, B. 10.1](#)).

5.4.2 Where adjoining and interconnecting spaces (e.g. machinery space, purifier room, machinery control room) have separate flooding systems, any danger to persons shall be excluded by suitable alarms in the adjoining spaces.

5.4.3 Alarm systems are also to be provided in ro-ro spaces, spaces for the transport of reefer containers and spaces to which personnel normally have access. In small spaces, e.g. small compressor rooms, paint stores, etc., alarms may be dispensed with on application.

5.4.4 CO₂-alarm systems shall be supplied from the emergency switchboard.

5.4.5 If the alarm is operated pneumatically, a permanent supply of compressed air for the alarm system is to be ensured.

5.4.6 Alarm systems for the cargo area of tankers see [Section 15](#).

5.5 Lift alarm

5.5.1 Lifts with internal controls shall be equipped with an audible emergency calling device which can be actuated from the lift cabin. The alarm shall be transferred to a permanently manned location.

5.5.2 The emergency calling system shall be supplied from the emergency source of electrical power.

5.6 Refrigerating hold closure alarm

A closure alarm shall be provided to a permanently-manned location.

D. Ship Safety Systems

1. General emergency alarm

1.1 General

1.1.1 Ships of more than 500 GRT shall be provided with an alarm system to alert the passengers and/or the crew or to call them to the assembly points. It shall be possible to release the alarm from the bridge and, except for the ship's whistle, also from other strategic important locations. The lifeboat station, when also musters station, fire control station or cargo control station shall be considered as strategic points.

1.1.2 Means for announcement shall be provided in a sufficient number to ensure that all persons inside the accommodation and normal crew working spaces are alerted.

Note

Regarding the required sound pressure level the IMO LSA Code (Resolution MSC.48/66) shall be observed.

1.1.3 In noisy rooms, additional optical means of alarm may be required.

1.1.4 Once released, the alarm shall sound continuously until it is switched off manually or is temporarily interrupted for an announcement through the public address system.

1.1.5 Entertainment systems shall be automatically turned off if the general emergency alarm is announced.

1.1.6 Cables for general emergency alarm installations and for loudspeaker systems shall be fire-resistant acc. to [Section 12, D.15](#).

1.1.7 The general emergency alarm shall be powered from the ship's main supply and the emergency source of electrical power.

2. Public address system (PA system)

2.1 In addition to the general emergency alarm system, a public address system is required which can be operated from the bridge and other strategic important locations. The lifeboat station, fire control station or cargo control station shall be considered as strategic points. The public address system shall be audible throughout the accommodation area, at the crew's normal working places and at the strategic important locations.

2.2 If the public address system is used to announce the general emergency alarm, the following requirements shall be fulfilled:

- The requirements for the general emergency alarm shall be fulfilled.
- At least two loudspeaker circuits supplied from separate amplifiers, shall be installed in each fire zone, respectively in its subdivisions.

The loudspeaker circuits shall 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.

- The system shall be so arranged to minimize the effect of a single failure, by the use of at least 2 amplifiers, segregated supply with fuse protection, segregated cable routes and segregated arrangement.
- Where loudspeakers with built-in volume controls are used, the volume controls shall be disabled by the release of the alarm signal.
- It shall be possible to transmit the undistorted and clearly audible alarm signal at all times. Other simultaneous transmissions shall be automatically interrupted.

2.3 It shall be possible to operate all loudspeakers at the same time.

2.4 The loudspeaker system shall be designed under observance of the minimum required sound level.

In a case of emergency the announcements in all areas shall be understandable and above the ambient noise.

Announcement via microphone shall be free of acoustical feedback and other disturbances.

3. Fire detection and fire alarm systems

3.1 General

See also [Chapter 2 – Machinery Installations, Section 12](#).

3.1.1 Fire detectors and central fire alarm panels are subject to mandatory type approval.

3.1.2 The central fire alarm panel shall be located on the bridge or in the main fire control station.

The operational readiness of the central fire alarm panel shall be indicated on the panel.

3.1.3 Identifying devices, central fire alarm panel or fire indicator board shall indicate the section in which a fire detector has been activated. At least one indicating unit shall be so located that it is at all times accessible to responsible crew members.

One indicating unit shall be placed on the bridge if the central fire alarm panel is not located there.

3.1.4 On the fire indicating units or on the central fire alarm panel, clear information shall be provided showing which rooms are monitored, and where the individual sections are located.

3.1.5 The fire detection system shall be self-monitored. Faults, such as a supply failure, short circuit or wire break in detection loops, the removal of a detector from its base and earth fault in detection loops with all-pole insulation shall be optically and audibly signalled at the central fire alarm panel. Fault alarms shall be acknowledgeable and, wherever possible, distinguishable from a fire alarm.

The emission of audible and optical alarms shall continue until they are acknowledged at the central fire alarm panel. Is only a repeater installed on the bridge, the acknowledgement of the local indication shall be independent from the central fire alarm panel. Acknowledgement of the audible fire alarm shall be made before acknowledgement of the optical fire alarm. The acknowledgements of audible and optical fire alarm signals shall be independent of each other. Acknowledgement shall not disconnect the detection loop, nor shall it suppress further alarm signals in other detection loops.

3.1.6 The central station shall be provided with means for testing and disconnecting of individual detectors or detector loops. When a particular detec-

tor/detector loop is disconnected, this shall be clearly recognizable.

Means for such recognition shall be provided for each loop.

The failure or disconnection of one detector loop shall not affect the operation of another detector loop.

The simultaneous response of detectors shall not impair the operation of the system.

3.1.7 The fire alarm system shall be supplied from the main- and emergency source of electrical power. Should one supply fail, automatic change-over to the other power supply shall take place in, or close to, the central fire alarm panel. The change-over shall be signalled optically and audibly.

If an interior battery is used as an emergency power supply, it shall meet the standards from [Section 3, C](#).

3.1.8 If a fire signal is not acknowledged within two minutes, an audible alarm shall be automatically released in all crew accommodation areas, service rooms, control stations and category A machinery spaces. This alarm system need not to be integrated into the fire detection system. The general emergency alarm signalling appliances may be used for this purpose.

3.1.9 Fire detection systems shall not be used for other purposes, except for the automatic closure of fire doors, shut-off fans or similar functions.

Automatic stopping of engine room fans and appropriate flaps is not permitted.

3.1.10 Automatic fire detectors shall respond to heat, smoke or other combustion products, flames or a combination of these factors. Detectors which are activated by other factors may be approved, provided they are not less sensitive than the aforementioned detectors.

Heat detectors shall be actuated at a temperature of between 54 °C and 78 °C when the temperature rises to those limits at a rate of rise less than 1 °C per minute. In case of a faster temperature rise a higher threshold value may be permitted by agreement with GL. In rooms with specially high ambient temperatures (e.g. drying rooms), a detector response temperature exceeding the maximum room temperature by 30 °C is permissible.

3.1.11 If the fire detection system is not designed for remote and individual identification of detectors, it is not permitted that one zone may monitor more than one deck within the accommodation, service rooms and control stations, except of a zone which monitors closed staircases. To avoid delay to locate the fire, the number of closed rooms monitored in any one zone is limited to a maximum of 50.

If the fire detection system is designed for remote and individual identification of detectors, the zones may monitor several decks and any number of closed rooms.

3.1.12 Smoke detectors shall be used in passageways, stairways and escape routes. Heat detectors shall normally be used only in cabins in the accommodation area.

3.1.13 Flame detectors shall only be used in addition to the detectors mandatory required.

3.1.14 All fire detectors shall be so designed that they remain serviceable, without the replacement of components, when passed regular testing.

3.1.15 If it is not recognizable at the central fire alarm panel which detector has responded, an optical indication shall be provided on each detector itself. This indication shall remain displayed until the loop has been reset on the central fire alarm panel.

3.1.16 The detectors are to be mounted in such a way that they can operate properly. Mounting places near ventilators, where the operation of detectors may be impaired or where mechanical damage is expected, shall be avoided.

Detectors mounted to the ceiling shall generally be placed at least 0,5 m away from bulkheads.

The maximum monitored area, respectively the maximum distance between detectors shall not exceed the following values:

- Heat detectors 37 m² or distance not more than 9 m
- Smoke detectors 74 m² or distance not more than 11 m

The distance from bulkheads shall not exceed:

- 4,5 m for heat detectors
- 5,5 m for smoke detectors

3.1.17 Manually operated call points shall be provided in the accommodation area, the service areas and control stations.

A manually operated call point shall be fitted at every exit. Manually operated call points shall be readily accessible on every deck in the passageways, i.e. no part of the passageway shall be more than 20 m far from a manually operated call point.

3.1.18 A detection section monitoring a control station or a service area or an accommodation area shall not simultaneously monitor a category A machinery space.

3.1.19 Fire detectors shall be arranged in sections or detector loops. Activation of a fire detector shall initiate an optical and audible alarm in the central fire alarm panel and at the additional indicating devices.

3.1.20 Cables forming part of the fire detection system shall be so arranged as to avoid to touch galleys, category A machinery spaces and other closed spaces with a high fire risk, except if it is necessary to

transmit a fire signal from these spaces, to initiate a fire alarm in these spaces, or to make the connection to the appropriate source of electrical power.

Fire detection systems with a loop-wise indication shall be so designed that

- a loop cannot be damaged at more than one point by a fire
- equipment is available which ensures that a fault in the loop (e.g. wire break, short circuit, earth fault) does not cause failure of the entire control unit
- all possible precautions have been taken to allow the function of the system to be restored in the event of a failure (electrical, electronic, affecting data processing)
- the first fire alarm indicated does not prevent the indication of further alarms by other fire detectors in other loops.

3.2 Fire detection systems with remotely and individually identified detectors

3.2.1 The fire detection system shall meet the requirements set out in 3.1 correspondingly.

3.2.2 Where addressable detectors are used, each such detector shall be indicated at the central fire alarm panel, and the audible alarm according to regulations shall be initiated.

3.2.3 Where the detectors in the alarm mode are not all simultaneously indicated at the central fire alarm panel, the central panel shall have the means of scanning all the detectors which have responded in order to establish clearly whether other detectors are in the alarm mode besides the one indicated.

3.2.4 A detection loop shall comprise not more than one fire zone or one watertight division.

3.2.5 If the fire detection system comprises remotely and individually identified detectors the loops may monitor several decks and any number of closed rooms.

3.2.6 The detector loop shall be so arranged within a fire section/part of a fire subdivision that in the event of damage, e.g. wire break, a short circuit or a fire, only the affected deck becomes faulty.

The spatial arrangement of the loops shall be submitted for approval.

3.3 Fire detection and alarm systems for cargo ships

In the Rules set out in Chapter 2 – Machinery Installations, Section 12, C. the following fire detection and alarm systems shall be provided in accordance with the type of construction of the accommodation areas:

3.3.1 Structural fire protection method IC

A smoke detecting system, including manually operated call points, shall be provided for corridors, staircases and escape routes within the accommodation areas.

3.3.2 Structural fire protection method IIC

An automatic sprinkler system, including alarm devices in accordance with Chapter 2 – Machinery Installations, Section 12, C.3.2, shall be provided for accommodation and service rooms (for flow- and fire signals, see also 3.4).

A smoke detecting system is additionally to be provided for corridors, staircases and escape routes within the accommodation areas.

Rooms in which no fire hazard exists, e.g. void spaces, sanitary rooms etc., need not to be monitored.

3.3.3 Structural fire protection method IIIC

An automatic fire alarm and detection system, including manually operated call points, shall be provided for the entire accommodation area with the exception of those spaces in which no fire hazard exists.

3.4 Fire detection and alarm systems on ships with water spray systems (Sprinkler)

The Rules in Chapter 2 – Machinery Installations, Section 12, L. shall be observed.

3.4.1 Ships which shall be equipped with an automatic water spray system (Sprinkler) in accordance with SOLAS shall be additionally provided with a fire detection and alarm system with automatic smoke detectors and manually operated call points with displays on the navigating bridge in accordance with 3.1.

3.4.2 Where the accommodation and public rooms are fitted with sprinkler systems, the alarm devices shall meet the following requirements:

Each section of sprinklers shall include means of releasing automatically a visual and audible alarm signal at one or more indicating units whenever sprinkler comes into operation. Such units shall indicate in which section a sprinkler has come to operation and shall be centralized on the navigation bridge and in addition, visible and audible alarms from the unit shall be located in a position other than on the navigation bridge, so as to ensure that the indication of the fire is immediately received by the crew.

With regard to self-monitoring and to the electrical power supply, the alarm system shall be designed corresponding to a fire detection system according to 3.1.

3.5 Fire detection and alarm systems for unattended machinery spaces

3.5.1 For unmanned machinery spaces of category A in accordance with Chapter 4 – Automation, an automatic fire detection system shall be provided

which detects a fire already in its initial stage, e.g. systems with smoke detectors.

General requirements see 3.1 and 3.2.

3.5.2 The fire alarm shall be optical and audible recognized on the bridge, in the accommodation and mess areas of the engineer officers or the crew member responsible for the machinery plant and also in the machinery space and it shall be distinguishable from other alarms. The fire alarm shall be executed in machinery space without any time delay.

3.5.3 The position and number of detectors shall be specified under consideration of machinery space ventilation, so that all endangered areas are safely covered. This particularly applies to areas in which boilers, thermal oil systems, waste and sludge incinerators, generators, switchboards, refrigeration machinery and purifiers are installed and also for the engine casing and at the exhaust gas side in exhaust gas-fired thermal oil plants and in exhaust gas-fired boilers with finned pipes.

3.5.4 Each detection loop shall not enclose more than one fire subdivision or one watertight compartment or, wherever possible, more than two superimposed decks. This applies only to non-addressable detectors, which do not allow the remote and individual identification of each detector. Separate detection loops shall be used where facilities are provided for the separate flooding of different machinery spaces with gas fire extinguishing media (e.g. CO₂).

3.5.5 The number of detectors in each loop shall not exceed 10. This applies only to non-addressable detectors, which do not allow the remote and individual identification of each detector.

3.5.6 In workshops and rooms where detectors are liable to be actuated, e.g. by welding, they may be temporarily made ineffective. The detectors shall automatically become operative again after a preset time.

3.6 Fire detection and fire alarm systems for cargo holds

3.6.1 For smoke detection system 3. is to be observed.

3.6.2 Sample extraction smoke detection system

3.6.2.1 Each sample extraction smoke detection system shall operate continuously. Systems operating on the scanning principle may be approved, provided that the interval between the detection cycles at the same measuring point is not excessive long.

3.6.2.2 The two power supplies required for the operation of the suction-type smoke detection system shall be monitored for failure. Each power failure shall release an optical and audible signal in the control unit and on the bridge, distinguishable from the smoke detection signal.

3.6.2.3 The control unit shall be located on the bridge or in the main fire control station.

3.6.2.4 The detection of smoke or other combustion products shall release an optical and audible signal in the control unit and on the bridge.

3.6.2.5 The monitored spaces shall be clearly identified at, or close to, the control unit.

3.6.2.6 Proof is required that the response sensitivity of the suction-type smoke detection system is below 6,65 % obscuration per metre.

3.6.2.7 Two switchover extraction fans are to be provided, each of them shall be sufficient for the duty involved.

3.6.2.8 If explosive gas-/air mixtures or vapours can be sucked in by the smoke detection system, explosion protection shall be provided, see Sections 16 and 17.

3.6.2.9 Suction-type smoke detection systems are subject to mandatory type testing.

3.6.2.10 The monitoring device shall enable the observation of smoke in the individual sampling pipes.

3.6.2.11 The air flow through the individual sampling pipes shall be monitored. As far as possible, provision shall be made that equal quantities of air to be drawn from each connected sampling unit.

4. Fixed water-based local application fire-fighting systems (FWBLAFFS)

4.1 The Construction Rules of Chapter 2 – Machinery Installations, Section 12, L.3 shall be observed.

Flame detectors, remotely controlled valves, control electronics and fire detection systems used for FWBLAFFS are subject to mandatory type testing.

4.2 The fire detection system shall be selfmonitored. Faults, such as a supply failure, short circuit or wire break in detection loops, the removal of a detector from its base and earth fault in detection loops with all-pole insulation shall be optically and audibly signalled at the central fire alarm panel. Fault alarms shall be acknowledgeable and, wherever possible, distinguishable from a fire alarm.

The emission of audible and optical alarms shall continue until they are acknowledged at the central fire alarms panel. Acknowledgement of the audible fire alarm shall be made before acknowledgement of the optical fire alarm. The acknowledgements of audible and optical fire alarm signals shall be independent of each other. Acknowledgement shall not disconnect the detection loop, nor shall it suppress further alarm signals in other detection loops.

In case the evaluation unit is part of the ship's main fire alarm panel, detectors and control units shall be separated from the main fire alarm system by using separate loops only for the purpose of FWBLAFFS.

4.3 In case of periodically unattended machinery space the FWBLAFFS shall have both automatic and manual release capabilities.

The automatic release shall have a manual stop function in case of a spurious release. The manual release shall be independent from the fire alarm panel.

For continuously manned machinery space only a manual release capability is required.

4.4 The manual release shall be located at easily accessible positions, adjacent to the protected area. Additional to this local release it shall be possible to release the FWBLAFFS from a safe position outside the engine room.

The installation inside the space should not be liable to be cut off by a fire in the protected areas.

4.5 Detector initiating philosophy

4.5.1 Fire detectors shall be flame detectors. The viewing angle shall be adjusted to the monitored area only.

4.5.2 For each monitored area two detectors are needed to detect a fire before initiating the release. Activation of a single detector shall cause an alarm. The detectors shall operate with a maximum delay time of 10 seconds.

4.5.3 Other configuration of detectors concerning type and release philosophy shall be agreed with GL.

4.6 The outputs, which activate the valves, shall be designed so that potential faults such as loss of voltage or a broken wire for example shall not create a spurious release.

4.7 Activation of any local application system shall give a visual and distinct audible alarm in the machinery space and at a continuously manned station. This alarm shall indicate the specific system activated.

4.8 Ingress protection - IP degrees

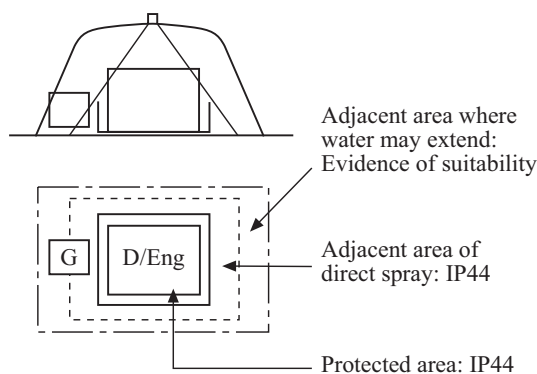


Fig. 9.1

Definitions:

Protected space: Is a machinery space where a FWBLAFFS is installed.

Protected areas: Areas within a protected space which is required to be protected by FWBLAFFS.

Adjacent areas: Areas, other than protected areas, exposed to direct spray or areas, other than those above, where water may extend.

Unless it is essential for safety or operational purposes, electrical and electronic equipment and components are not to be located within areas of areas protected by FWBLAFFS and in adjacent areas, where water may extend. Where it is necessary to install equipment within such areas, the following precautions are to be taken:

4.8.1 Operation controls and other electrical equipment in reach of the FWBLAFFS in the protected area and those within adjacent areas exposed to direct spray shall have as a minimum the degree of protection IP44.

4.8.2 IP-degree lower than IP44 for the mentioned electrical equipment within adjacent areas not exposed to direct spray may be approved with suitable evidence taking into account the design and equipment layout, e.g. position of inlet ventilation openings, filters, baffles, etc. to prevent or restrict the ingress of water mist/spray into the equipment. The cooling airflow for the equipment is to be assured.

4.8.3 The electrical components of the pressure source for the system shall have a minimum IP-grade of IP54.

4.9 Components of the system such as pumps and valves requiring an external power source shall be supplied by the main power source.

4.10 The FWBLAFFS shall provide means for testing the automatic release without delivering water into the protected areas. Each protected area shall be periodically tested.

4.11 Operating and maintenance instructions for the system and the cleaning interval for the optical parts of the detectors shall be displayed at each operating position and verified in practical operation.

5. Watertight doors and openings in cargo ships (Watertight door control system)

For watertight doors and openings relevant to the stability of the ship in the damaged state, control and monitoring devices shall be provided as follows.

5.1 The Rules Chapter 2 – Machinery Installations, Section 14, F.5 shall be observed.

5.2 Optical indicators showing whether the door is closed or open shall be provided at the remote control position. Closing of the door shall be announced on the spot by an audible signal.

5.3 Access doors and access hatch covers normally closed at sea shall be provided with means of monitoring. Indicators shall show locally and on the bridge, whether these doors or hatch covers are open or closed.

5.4 A failure of control system shall be signalled optical and acoustically on the bridge.

5.5 The operating console on the bridge shall be provided with a system schema from which the ar-

rangement of the watertight doors in the ship can be recognised.

6. Bilge level monitoring

For the extent and design of the bilge level monitoring see [Chapter 2 – Machinery Installations, Section 1, E.5.](#)

7. Voyage Data Recorder (VDR)

7.1 The Voyage Data Recorder should be supplied from the main- and emergency switchboard, see [Section 4, I.9.1 and 9.3.](#)

7.2 Data or alarms for the Voyage Data Recorder have to be free of reactive effects to ship operation.