

Rules and Regulations

Interpretation of the Mandatory Requirements for UMS Ships

Various regulatory authorities at the international level issue rules and regulations for the installation and operation of control equipment onboard ships.

The IMO (International Maritime Organization) has mandatory regulations for ships operating with periodically unattended machinery spaces and these are contained in the International Convention for the Safety of Life At Sea (SOLAS).

Further mandatory regulations may be imposed by the National Administration with which the ship is registered and these usually take the form of an interpretation of SOLAS regulations.

The international classification societies, such as Lloyd's Register of Shipping, Det Norske Veritas, American Bureau of Shipping, Bureau Veritas and Germanischer Lloyd, issue detailed rules specifying the minimum controls, alarms and safeguards that need to be fitted for the ship to be assigned a classification notation.

The classification societies meet through the forum of IACS (International Association of Classification Societies) to ensure that there is no significant difference between their minimum requirements and that the SOLAS regulations will also be complied with through the classification process.

It is important to appreciate that when a ship is assigned the UMS notation (or equivalent); the flag authority will normally permit some dispensation on the engineering manning level.

This dispensation is only permitted while the UMS notation remains valid and accordingly the classification societies periodically survey the controls, alarms and safety systems through the ship's service life. If defects were found in the control engineering installations, which affect the UMS notation, it would be suspended.

UMS stands for "Unmanned or Unattended Machinery Spaces"; these ships generally have lesser manpower due to sophistication and hence need more stringent methods of ensuring seaworthiness of ships.

Control of Propulsion Equipment from the Bridge

A control system to operate the main machinery must be provided on the bridge. The bridge watch keeper must have easy access to the emergency control system.

Centralized Control

A centralized control room that is easily accessible is to be provided with the adequate instrumentation and equipment. The equipment installed therein shall be capable of monitoring and operating all main and auxiliary machinery.

Automatic Fire Detection and Alarm System

A detection and alarm system, which operates very rapidly, should also be capable of giving an early warning of fire in the machinery spaces especially for the following:

- (a) The Boiler
- (b) The Scavenge air belt of the Main Engine
- (c) The Crankcase of the Main Engine

Oil mist detectors are to be installed for engines of 2250 kW and above, or when the engine bore exceeds 300mm – especially in hazardous areas. These detectors are numerous, well sited and respond quickly.

Comprehensive Machinery Alarm System

This system should be capable of displaying (by means of a mimic panel) any abnormality of the machinery, both on the Bridge, as well as in the Accommodation spaces, including the Duty Engineer's cabin, the Chief Engineer's cabin and all public rooms.

The power supply for this alarm system should have a back-up from the emergency switchboard, in case of a blackout, and there should be an alarm, to indicate this condition.

A Fire Control Station

In addition to conventional portable extinguishers, it is mandatory to have a fire station that is remotely located from the machinery space. The station must facilitate the control of emergency pumps, generators, valves, ventilators, extinguishing media, etc.

Automatic High Bilge Level Alarms and Pumping Systems

In order to ensure protection against flooding, bilge wells are to be monitored for excessive levels under normal angles of heel and trim. For auto bilge pumps, a 'long-run' alarm should be provided. This indicates excessive filling of the bilge, since the pump is generally not able to cope with the ingress of water.

The controls for the bilge pump and remote valves should be easily approachable and above the possible level of flooding. Sensing devices in bilges with alarms and hand or automatic pump control is provided.

Automatically Started Emergency Generator for Essential Services

This generator is almost always connected to separate emergency bus bars in a dedicated switchboard, located away from the main generating station. The primary function of such a generator is to automatically overcome electrical blackout or a dead ship conditions within (a maximum of) 45 seconds.

Local (Manual) Control of Essential Services

Local controllers operate certain machinery that cannot be controlled automatically or which is best controlled manually.

Automatic Control System for the Boiler

The boiler system is controlled automatically with the help of a level controller and amplifier; in addition there is a combustion control system with many safety features incorporated to prevent fires.

Safety Systems

- ✓ The arrangements should ensure safety in all conditions, which should be equivalent to running with manned machinery spaces.
- ✓ Adequately designed safety systems are to be provided for the automatic shutdown of the main engine, auxiliary engines or the boiler, in case of any serious malfunction.
- ✓ Auxiliary engines used for power generation must be capable of automatic starting and loading in case of failure of the running machine. This can be done by means of a stand-by feature.
- ✓ In the case of electrical power systems, means should be provided for shedding excessive load, e.g. a preferential trip, which will shed the load that is considered non-essential for the immediate running of the main engine (e.g. galley power, deck machinery, etc.).
- ✓ All pumps essential for the running of the main engine must be provided in duplicate and an auto stand-by facility shall also be provided. The stand-by pump shall be capable of automatically starting, on detection of failure of the running pump, e.g. by means of a pressure switch. Each pump must be capable of performing the duty independently.
- ✓ Steering gear for U.M.S. operation must be of the type, such that it can automatically isolate and regain steering control, in case of a single failure, by automatic operation of the Isolating valves, e.g., the safe-matic steering system.

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- ✓ There should be two separate steering gear pumps, which can independently help to steer the vessel, and one of them must have its power supply through the emergency switchboard, such that it will continue to work, in spite of a blackout, by drawing its power from the emergency supply.
 - ✓ There must be an approved system for ensuring safety of the personnel entering the machinery spaces, during U.M.S. operation, for responding to alarms or carrying out essential repairs; for example, there is a dead man alarm system (the alarm operates by means of a timer, which is activated when the duty engineer enters the machinery space. It must be manually reset, after a pre-determined time interval, by means of reset switches located in the engine room. In case of incapacitation of the Duty Engineer, failure to reset the timer will sound the alarm on the Bridge, and someone can be deputed to investigate and take requisite action).

Regular Testing and Maintenance of Instrumentation / Monitoring Systems

There should be periodic inspections or rounds, before and after the unmanning of the machinery spaces.

The modern trend is towards a centralized control room, using a totally integrated system for all aspects of ship operation, including engineering, cargo, navigation and general administration.

In any system, most controlled elements will have one or more of the following points of operation:

- a) Local manual control
- b) Remote manual control
- c) Automatic control.

Local control implies that the point of control is in the immediate area of the device, whereas for remote control the point of control is at some distance away from the device, such as in a control room. The operation of a bilge suction valve in the engine room by its hand wheel is an example of local manual control. If the valve was fitted with an extended spindle through to the deck above and was operated from that point, it would be remote manual control. In both these cases, a human operator would operate the valve.

If the bilge valve was fitted with a hydraulic motor to operate the valve, and the valve opened and closed according to the position of a float controller in the bilge well, this would be an automatic control system. The human element is eliminated in this case.

Summary of SOLAS Regulations Related to Marine Control Engineering

These excerpts of the SOLAS regulations in the previous article (1.7) have been summarized for academic purposes only and are not verbatim.

Relevant Classification Societies' Requirements and other relevant regulations must be referred and adhered to onboard ships in order to ensure compliance.

Main Machinery Control

In vessels that have capabilities of remote control of propulsion machinery from the navigation bridge and the machinery spaces, the speed, direction of thrust and the pitch of the propeller, where applicable, must have means to permit full control from the navigation bridge at all times and under all sailing conditions. In the case of multiple propellers that are designed to operate simultaneously, they may be controlled by one control device.

Remote control must be possible from only one location at a time, with an indicator to show which location is in control. The transfer of control should be in the main machinery control room and is to have means to prevent thrust from changing whilst transferring control from one location to another. Any failure of the remote control station should activate an alarm. A local control mode is also mandatory.

The means to permit manual overriding of automatic control should also be provided. The main propulsion machinery is to have an emergency stopping device on the navigation bridge that is independent of the navigation bridge control system.

All orders from the navigation bridge are to be indicated in the main machinery control room or at the manoeuvring platform as appropriate.

Propeller speed and direction of rotation indicators in the case of fixed pitch propellers or propeller speed and pitch position indicators in the case of controllable pitch propellers are to be provided on the navigation bridge.

Automatic Shutdown

In the event of serious malfunctions in machinery or boiler operations that present any immediate danger, the malfunctioning part of the plant must be automatically shut down while also activating an alarm. The propulsion system should also be automatically shut down in case of serious damage, complete breakdown or an explosion is imminent.

Manual overrides for the main propulsion machinery should only be provided to prevent unintended operation. In such cases, there should be an annunciator to indicate the activation of the manual override.

Special Requirements for Boilers

The quality of the feed water for boilers must be capable of being supervised and controlled. As far as is practicable, the entry of oil or other contaminants, which may adversely affect the boiler should be prevented.

Every boiler that is essential for the safety of the ship must have at least two water level indicators, one of which is to be a gauge glass.

Boiler air supply casings, exhausts (uptakes) and scavenging air belts of propulsion machinery are to have early-stage warning devices to detect potential fires and give alarms.

Internal combustion engines of 2,250 kW and above or having cylinders of more than 300 mm bore must be installed with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

Alarm Systems

An alarm system to indicate any fault requiring attention must be capable of sounding an audible alarm in the main machinery control room or at the propulsion machinery control position, and indicate visually each separate alarm function at a suitable position.

The alarm system must have a connection to the engineers' public rooms and to each engineer's cabin through a selector switch, to ensure connection to at least one of those cabins.

In case any situation arises - that requires action by or the attention of the officer on watch on the navigation bridge, an audible and visual alarm is to be activated; as far as practicable it must be fail-safe.

Continuous power supply with means to change-over to a stand-by source, is to be provided for the alarm system. An alarm should be activated if the normal power supply of the alarm system fails.

The alarm system must have features to indicate more than one fault simultaneously and the acceptance of any alarm should not inhibit another alarm condition.

Accept buttons can be used to turn off the audible warning. However, visual indications of individual alarms are to remain active until the fault has been rectified.

Water Level Detection in Bulk Carriers

Each cargo hold is to be fitted with water level detectors capable of activating audible and visual alarms for situations when the water level above the inner bottom in any hold reaches a height of 0.5m and also at a height not less than 15% of the depth of cargo hold but not more than 2m. Visual should be capable a clearly and separately indicating both conditions.

In the case of any dry or void space greater than 0.1% of the ship's maximum displacement volume, that extends forward of the foremost cargo hold (except the chain locker), an alarm should be activated on the navigation bridge if the water level rises 0.1m above the respective deck.

Alarm overrides can be used for cargo holds that are used for water ballasting purposes.