



## REVIEW OF PERIODIC SAFETY TEST PROCEDURES

Procedure Number: E2-17

Revision Date: October 21, 2021

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### **Purpose**

This Plan Review Guideline (PRG) provides guidance regarding the information required to be submitted to the Marine Safety Center (MSC) for reviewing submittals of Periodic Safety Test Procedures (PSTP) in accordance with the applicable regulation and policies.

### **Contact Information**

If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by e-mail or phone. Please refer to Procedure Number E2-17.

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## **1. Applicability**

This Plan Review Guideline (PRG) is applicable for vessels inspected under subchapters D, H, I, L, U or meeting the requirements of SOLAS. Other vessel types required to comply with applicable regulations, or by direction of the local OCMI, may be required to have a PSTP.

## **2. References**

Title 46 CFR Subchapter F, Marine Engineering

Title 46 CFR Subchapter J, Electrical Engineering

[Navigation and Inspection Circular \(NVIC\) 2-89, "Guide for Electrical Installations on Merchant Vessels and Mobile Offshore Drilling Units"](#)

Safety of Life at Sea (SOLAS), Consolidated Edition, 2014, Chapter II-1, Parts D and E

[American Bureau of Shipping \(ABS\), "Rules for Building and Classing Steel Vessels"](#)

[MSC Plan Review Guide, E2-01, Review of Vital System Automation](#)

[MSC Plan Review Guide, E2-05, Design Verification Test Procedures](#)

[MSC Plan Review Guide, E2-18, Qualitative Failure Analysis](#)

[MTN 02-11 CH-1, Review of Vital System Automation & Dynamic Position System Plans](#)

[Navigation and Inspection Circular \(NVIC\) 1-69, "Automated Main and Auxiliary Machinery"](#)

[Navigation and Inspection Circular \(NVIC\) 1-78, "Automation of Offshore Supply Vessels of 100 Gross Tons and Over"](#)

[Navigation and Inspection Circular \(NVIC\) 1-13, CH-1, "Inspection and Certification of Vessels under the Maritime Security Program \(MSP\)"](#)

[CG-ENG-Policy Letter No. 02-19 "Design Guidance for Lithium-Ion Battery Installations Onboard Commercial Vessels"](#)

## **3. Definitions**

- a. Periodically Unattended Machinery Spaces (PUMS): A space which is not at all times manned under all operating conditions. This definition is equivalent to the SOLAS definition. 46 CFR 62.50-30 elaborates that periodically unattended machinery plants include machinery plants and spaces that are automated to the degree that they are self-regulating and self-monitoring and could safely be left periodically unattended. Emphasis is placed on providing systems that act automatically until the crew can take action in the event of a failure or emergency. Requirements are in addition to those of a minimally attended machinery plant.
- b. Minimally Attended Machinery Spaces (MAMS): Plants and spaces that are automated, but not to a degree where the plant could be left unattended. Emphasis is placed on the centralized remote control and monitoring of the plant or space. This definition, from 46 CFR 62.50-20, is not equal to the SOLAS definition of Periodically Unattended.
- c. Alarm: An audible and visual indication of a hazardous or potentially hazardous condition that requires attention.
- d. Automated: The use of automatic or remote control, instruction, or alarms.



- e. Automatic control: Self-regulating in attaining or carrying out an operators specified equipment response or sequence.
- f. Engineering Control Center (ECC): Centralized engineering control, monitoring, and communications location, also called the Engine Control Room (ECM) or other depending on the system. Does not necessarily have to be a separate room, as long as all the required controls and alarms are in one location.
- g. Engineers' Assistance-needed Alarm: This alarm is to notify the engineers of conditions that need attention and sounded on 3 conditions:
  - (1) When manually pressed as required by 46 CFR 113.27-1, applicable to self-propelled Ocean, Great Lakes, or Coastwise vessels (Engineer's Call Button).\*  
\*For minimally or periodically unattended vessels, the additional conditions must activate the Engineers' Assistance-needed alarm.
  - (2) When an alarm at the Engine Control Room is not acknowledged in the period of time necessary for an engineer to respond at the ECC from the machinery spaces or engineers' accommodations, or
  - (3) Failure of the power to the ECC's alarm system.
- h. Deadman's Alarm (personnel): This alarm is for personnel entering machinery spaces and must alarm on the bridge if not routinely acknowledged. There is no regulation on the time limit for this alarm, but SOLAS uses 30 minutes.
- i. Internal Communications: Where emergency or reliable communication is required for locations inside the vessel, then a sound powered phone should be used between these locations. Locations such as navigation bridge, steering, engine room, officer's accommodations, etc.
- j. External Communications: Where emergency or reliable communications is required for locations external to the vessel, portable radios may be used. Locations such as embarkation stations, muster stations, etc.
- k. Flooding Safety: Flooding detection, watertight integrity, and dewatering systems.
- l. Monitor: The use of direct observation, instruction, alarms, or a combination of these to determine equipment operation.
- m. Remote Control: Non-local automatic or manual control.
- n. Safety Trip Control System: A manually or automatically operated system that rapidly shuts down another system or subsystem.
- o. System: A grouping or arrangement of elements that interact to perform a specific function and typically include the following:
  - (1) Fuel or power source
  - (2) Power conversion elements
  - (3) Control elements
  - (4) Power transmission elements



- (5) Instrumentation
  - (6) Safety control elements
  - (7) Conditioning elements
- p. Vital system or equipment: Equipment essential to the safety of the vessel, its passengers, and crew. This typically includes, but is not limited to, the following:
- (1) Fire detection, alarm, and extinguishing systems
  - (2) Flooding safety systems
  - (3) Ship service and emergency electrical generators, switchgear, and motor control circuits serving vital electrical loads
  - (4) Emergency equipment and systems listed in 46 CFR 112.15

## **4. General Guidance**

Vital systems or equipment listed and incorporated by 46 CFR 62.10 and 46 CFR 62.35 should be included in the PSTP as applicable; notably:

- a. Main engine(s) and generator(s) shut-downs
- b. Propulsion control - all control stations and manual alternate control
- c. Electric power generation and distribution including power management system, load shedding, and emergency power source
- d. Fire detection and extinguishing systems
- e. Flooding safety, including bilge high level alarms, emergency bilge suction, independent bilge pump and suction
- f. Emergency internal communications, including engineers' assistance needed, deadman's alarm, and engine order telegraph
- g. Steering System
- h. Power operated watertight doors and magnetic hold backs
- i. Remote shutdowns
- j. Vital system standby equipment
- k. Any microprocessor or Programmable Logic Controller (PLC) based vital system
- l. Fuel tank low and high level alarms
- m. Boilers

## **Testing Methods**

- a. Test techniques must not simulate monitored system conditions by misadjustment, artificial signals, improper wiring, tampering, or revision of the system, unless the test would otherwise damage equipment or endanger personnel. See NVIC 1-69 Section J/2.c, 46 CFR 130.480(d), 46 CFR 61.40-10(b), and ACP supplements for more detail.
- b. Unapproved testing methods typically include lowering or raising alarm set-points at the controller or through software, disconnecting a sensor and inducing a signal in place of the sensor, lifting or shorting connection leads to a sensor to activate an alarm signal, etc. Exceptions will be made for sensors that cannot be removed without disassembling, such as Resistance Temperature Detectors (RTD) or exhaust temperature sensors where testing may cause bodily harm to personnel conducting tests. An example not considered an



exception is engine jacket temperature sensors that are in wet wells. Sensors of this type must be removed and the integrity of the sensors tested. This list is not all-inclusive.

- c. An example of an acceptable test of a pressure sensor would be to use an auxiliary pump to pressurize the system past the sensor's set point, creating an alarm condition. An unacceptable test for a pressure sensor is reducing the sensor's alarm set point until the ambient pressure in the system causes an alarm state.

This guide is organized in the following Sections based on the standards to which the PSTP will be reviewed:

- Section 1. Existing vessels built before 1988, NVIC 1-69
- Section 2. OSVs and Misc. Vessels >100 GT: 46 CFR 130.400 or NVIC 1-78
- Section 3. Subchapter F, 46 CFR 62
- Section 4. SOLAS
- Section 5. Alternative Compliance Program (ACP) and Maritime Security Program (MSP)
- Section 6. Lithium Ion Battery Installations

NOTE: Vessels multi-certificated under various subchapters or regulations will need to meet all applicable requirements, with the most stringent requirement taking priority if there is a conflict. For example, an I/L/SOLAS vessel would be reviewed to sections 3 and 4. For additional information on vital automation system design review, see MSC Plan Review Guide, E2-01, Review of Vital System Automation.

## **Section 1. Existing vessels built before 1988, using NVIC 1-69**

This section is to assist in the review of existing vessels that were built before the current 46 CFR 62 was written, and with a level of automation to replace personnel or eliminate watch standers. Therefore, it is critical that the submitter clearly identifies which systems were existing and which were installed after 1988. Systems installed after 1988 will be reviewed to section 3 as applicable. The following is a summary of the required tests in NVIC 1-69 for diesel engines only. For steam propulsion plants and for full details of each requirement, refer to NVIC 1-69.

- a. Alternate Control:
  - (1) All automatic or remote control components, systems, or power supplies are subject to testing of an alternate means of control. Manual operation is an acceptable alternate means of control.
  - (2) The equipment in the machinery spaces should be suitably arranged for the testing of primary and alternate means of control, including transfer of control from primary to alternate means.
  
- b. Alarm and Call Systems:
  - (1) The engineers' assistance-needed alarm, engineering trouble alarm, and engineers' call system are all subject to testing.
  - (2) The assistance-needed alarm shall be operated by contact markers and produce a distinct alarm from the general alarm. The assistance-needed alarm should be located in the passage ways and lounge area of licensed engineer's quarters and should be



audible in the required spaces with doors closed. The alarm should be powered from the general alarm power supply.

- (3) For unattended machinery spaces, assistance needed alarm shall automatically be sounded on a power failure of the engineering trouble alarm and when the engineering trouble alarm is not acknowledged from the engine control station. Engineer's trouble alarm shall be extended to the engineer's quarters and lounge area or the bridge as necessitated by the particular system, machinery, and manning level.
- (4) A call system must be provided at the engine control station to selectively call any licensed engineer's or unlicensed watch stander's quarters.
- (5) Vessels with a single engineering watch stander shall have a dead-man type alarm which sounds on the bridge unless routinely acknowledged in machinery control or space.

c. Pilothouse Control:

- (1) A means for controlling the direction and speed of the propulsion machinery should be provided both in the pilothouse and in the engine room.
- (2) The engine room station should be able to override any remote station. When a remote station is subject to engine room override, an override alarm at the affected remote station should activate.
- (3) Transfer of control from one station to another, except engine room override, should be possible only after acknowledgement by the receiving station. An indicator should show which station has control.
- (4) Failure of propulsion control system including power supply, should alarm in pilothouse and on the engineering trouble alarm system.
- (5) If the control system automatically shuts down propulsion machinery, the engineering trouble alarm should activate, in addition to the pilothouse control station and each remote propulsion control station when the remote station is in control. The controlling station should not regain control without a manual reset.
- (6) In the event of an emergency shut down for propulsion machinery, alarms shall sound at the engine control station and machinery location for attended machinery spaces. For unattended machinery spaces, the alarm should sound in the pilothouse.
- (7) An engine order telegraph is required by 46 CFR 113.35 (use 1968 version of subchapter J).

d. Machinery Control:

- (1) Two lube oil pumps should be provided, with automatic transfer between pumps upon loss of oil pressure. For unattended machinery spaces, provisions for backup in case of loss of ship's power shall be made, i.e. using battery powered pumps.
- (2) The controls to charge fire pumps should be located on the engine room control panel. For unattended machinery spaces, at least one fire pump shall be controlled from the bridge in addition to the engine room control panel. The bridge shall also be able to operate the associated fire pump suction and discharge valves, and have a display gauge for fire main pressure. Inadequate fire main pressure shall be alarmed.
- (3) Automatic bilge pumps are to be provided for engine room and shaft alley bilges. They shall be equipped with an alarm and auto shutdown in the event oil is detected in the pump discharge. Manual operation may override the oil detection induced shutdown. In manned spaces, bilge pump control at the engine control station with water level indicator or high water alarm may be substituted. In unattended



- machinery spaces, the automatic bilge pumps shall be backed-up by bilge level alarms that sound in the event the pumps fail or are inadequate to control flooding. Bilge pumps in unattended machinery spaces shall be monitored to detect excessive operation.
- e. Vessels with unattended machinery, pumps, systems, or components essential for operation of the propulsion or ship's service electrical systems, (e.g. feed pumps, condensate pumps, vacuum pumps, cooling water) shall be fitted in duplicate and shall automatically start on failure of the operating unit.
  - f. Where required, machinery space watertight doors should be class 3 doors when the engine room control station is designed for fewer than two people. Operating controls for the door should be on the engine room console and are required on the bridge.
  - g. Instrumentation and alarms:
    - (1) There should be adequate instrumentation and alarms at a centralized control station to monitor and control operation of propulsion, electrical, and emergency systems.
    - (2) Alarms should be both audible and visual.
  - h. In addition to the guide in NVIC 1-69 and as required by 46 CFR 56.50-50 (1970-1987 version unchanged), an independent bilge suction and pump and emergency bilge suction should be included in the PSTP. This is to ensure that the valve(s) are still operational and will work in an emergency. The PSTP may include steps to only demonstrate exercising the valve and not actual suction of the bilge.
  - i. Testing of the sound powered phones should also be included to demonstrate that there is reliable communication between locations as required by 46 CFR 113.30-5 (use 1968 version of subchapter J) between wheelhouse, engine room, steering gear room, if outside the engine room, and after steering station, if required.
  - j. Table 1 of NVIC 1-69 is a recommended list of the minimum instruments and alarms that should be provided at the engine room control station for diesel and steam engine propulsion systems and auxiliaries. Other propulsion systems will be considered individually. Alternate instrumentation may be used; however, all systems listed should be effectively monitored. For continuously manned control stations, continuous displays may substitute for alarms.

## **Section 2. OSVs and Misc. Vessels: 46 CFR 130.400 and/or NVIC 1-78**

This section is to assist in the review of vessels that are not required to comply with Section 3, 46 CFR 62 but may be required by the local Officer in Charge of Marine Inspections (OCMI). Examples are subchapter I, L, and U vessels less than 500 GT.

- a. OSV <100 GT are not required to have a PSTP. However, if the vessel is also inspected under the requirements of SOLAS and periodically unattended, then a PSTP is required and will be reviewed to section 4.





- b. OSVs: 46 CFR 130.400 and NVIC 1-78 are very similar in requirements. In addition to requirements listed in 46 CFR 130.400, NVIC 1-78 requires:
  - (1) An audible and visual alarm for low starting air pressure.
  - (2) An Engine Order Telegraph installed in the engine room accessible to or visible from a central location 46 CFR 113.35.
  - (3) Machinery Space: Instruments to monitor (visual display) and alarms (audible and visual) to indicate abnormal operation within the listed systems in Enclosure (1) of NVIC 1-78, Section 2.h are required. In 46 CFR 130.460(c), there are similar requirements except that equipment-mounted gauges or meters are acceptable to comply with the centralized display. NVIC 1-78 does not include this substitution for the display, therefore OSVs complying with NVIC 1-78 cannot use gauges or meters as a means of audible and visual display for the required alarms.

### **Section 3. Subchapter F, 46 CFR 62**

This section is to assist in the review of vessels required to meet 46 CFR 62; self-propelled vessels of 500 GT that are certificated under subchapters D, I, or U and to self-propelled vessels of 100 GT and more that are certificated under subchapter H, and to OSVs of at least 6,000 GT ITC (500 GRT if GT ITC is not assigned).

This section will be further broken down into the following sub-sections:

- a. Requirements for all vessels
- b. Minimally attended machinery spaces (MAMS)
- c. Periodically unattended machinery spaces (PUMS)

Note: Periodically unattended machinery spaces should not be confused with minimally attended machinery plants. As noted in 46 CFR 62.50-20, minimally attended machinery plants include vessel machinery plants and spaces that are automated, but not to a degree where the plant could be left unattended. Emphasis is placed on the centralized remote control and monitoring of the machinery plant and machinery spaces.

- a. Per 46 CFR 61.40-6(a) the PSTP must demonstrate proper operation of primary and alternate controls, alarms, power sources, transfer override arrangement, interlocks and safety controls. The submitter should verify that the document is complete, technically accurate, and reflects the machinery installation on the vessel.
- b. Per 46 CFR 61.40-10(a), test procedures must be shown in a step-by-step or check-off list format and should include signature/initial validation boxes for each test. Each test instruction must specify:
  - (1) Equipment status or initial conditions of component being tested
  - (2) Tools, instruments, other equipment necessary to perform the tests. When testing pressure or temperature sensors, an independent gauge should be included to verify the accuracy of the installed gauge.
  - (3) Safety precautions
  - (4) Safety control and alarm set-points
  - (5) Procedures to be followed
  - (6) Expected test results



- c. Please see the section under Testing Methods for details on unapproved test methods. Other test techniques that do not meet the above descriptions should be approved by the Commandant (CG-ENG), per 46 CFR 61.40-10(b).
- d. Programmable control or alarm system logic must not be altered after testing without the approval of the OCMI. See 46 CFR 62.25-25.
- e. An approved copy of the PSTP must be retained aboard the vessel. See 46 CFR 61.40-1(b)(c).

## Requirements for all Vessels - by System

### Alarms (General description of alarms 46 CFR 62.25-20)

- a. All alarms must clearly distinguish between:
  - (1) Normal, alarm, and acknowledged alarm conditions.
  - (2) Fire, general alarm, fire extinguishing system, vital machinery, flood, engineers' assistance-needed and non-vital alarms.
- b. When an automatic transfer to a backup or redundant system or power source takes place, the transfer must be alarmed in the machinery spaces.
- c. Flooding safety, fire, loss of power, and engineers' assistance-needed alarms extended from the machinery spaces to a remote location must not have a duty crewmember selector.
- d. The minimum instrumentation and alarms required for the different systems are listed in Table 46 CFR 62.35-50 and Section 4-9-4, Table 7A and 8 of (2003) ABS Rules for Building and Classing Steel Vessels. All instrumentation and alarms must comply with 46 CFR 62.25-20.
- e. As per 46 CFR 62.30-5, all automatic control, remote control safety control, instrumentation, and alarm systems must be of a failsafe design with two sources of power. A failure of the normal source of power must actuate an alarm in the machinery spaces. One source must be from the emergency power source unless one of the sources is:
  - (1) Derived from the power supply of the system being controlled or monitored.
  - (2) A power take-off of that system.
  - (3) An independent power source equivalent to the emergency power source.

### Maneuvering and Steering Gear

- a. Audible and visual alarms must activate in the pilothouse per 46 CFR 58.25-25(d) for:
  - (1) Failure of the electric power of the steering control system.
  - (2) Failure of power unit to steering gear.
  - (3) Low oil level in oil reservoir of hydraulic power-operated steering gear.



- b. Audible and visual alarms must activate in the machinery space per 46 CFR 58.25-25(e) for:
  - (1) Failure of any phase of a three-phase power supply.
  - (2) Overload of steering gear motor.
  - (3) Low oil level in oil reservoir of hydraulic power-operated steering gear.
- c. For vessels greater than 500 GT, both main and auxiliary steering gear power unit(s) must be operable by controls from the steering compartment and not rendered inoperable by failure of the controls in the pilothouse per 46 CFR 58.25-70.
- d. For vessels greater than 1,600 GT, a steering-failure alarm in the pilothouse must activate when the actual position of the rudder differs by 5 or more degrees, as per 46 CFR 113.43-3 and 46 CFR 58.25-25(c).

## Flooding Safety

Automatic bilge pumps, where provided, must:

- a. Have high level alarms that annunciate in the machinery spaces and at a manned control location, and are independent of the pump controls per 46 CFR 62.35-10(a)(1).
- b. Be monitored to detect excessive operation in a specified time period per 46 CFR 62.35-10(a)(2).
- c. Independent bilge suction and pump installations must meet 46 CFR 56.50-50(e).

## Fire Safety

- a. Testing procedures for fire detection systems should include the type of detectors, the location, and the testing medium used to test in checklist format, to verify that the step-by-step instruction specifies the equipment status and apparatus necessary to perform the tests, as required by 46 CFR 61.40-10(a).
- b. All required fire pump remote control locations must include the controls necessary to charge the fire-main and have a pressure indicator or low pressure alarm, per 46 CFR 62.35-15.
- c. Power ventilation systems must have remote stopping systems. Power ventilation is broken into two groups, "power ventilation systems except machinery space," and "machinery space ventilation," see 46 CFR 111.103.

## Engines and Propulsion

- a. Main propulsion machinery must be provided with an automatic shut-off in accordance with 46 CFR 62 and 46 CFR 58.05-10. ABS Steel Vessel Rules may be used for the design, construction and testing of main/auxiliary machinery. ABS Steel Vessel Rules (SVR) requires independent over-speed devices on prime movers rated at 99+ kW.



- b. Auxiliary machinery vital to the main propulsion system must be provided in duplicate unless the system served is itself independent and duplicate, or otherwise provides continued or restored propulsion capability in the event of a failure or malfunction of any single auxiliary component. Partial reduction of normal propulsion capability as a result of malfunction or failure is acceptable if the reduced capability is not below that necessary for the vessel to run ahead at 7 kts or half speed, whichever is less, and is adequate to maintain control of the ship as per 46 CFR 58.01-35.

## Remote Propulsion-Control Systems 46 CFR 62.35-5(d) and ABS SVR

- a. Remote control of the propulsion machinery shall be possible from only one location at a time. At each location there is to be an indicator showing which location is in control of the propulsion machinery. The following protocol is to be observed for transfer of control between stations:
  - (1) The transfer of propulsion control between stations is to take effect only with acknowledgment by the receiving station. This does not apply to transfer of control between the centralized control station and the local manual control.
  - (2) The transfer of propulsion control between the navigation bridge and the propulsion machinery space shall be possible only in the propulsion machinery space, i.e. at either the centralized control station or the local manual control position.
  - (3) The centralized control station shall be capable of assuming propulsion control at any time or blocking orders from other remote control stations via an emergency override. Where special operating requirements of the vessel prevail, override control over the centralized control station will be considered. The engine room control station is normally designated as the centralized control station.
  - (4) Propeller speed and direction of thrust shall not be altered significantly when propulsion-control is transferred from one control station to another.
- b. Proper operation must be demonstrated from the pilothouse and engineering control center (ECC) or maneuvering platform for the remote propulsion-control system per 46 CFR 62.35-5.
- c. Remote propulsion control must be performed by a single control device for each independent propeller. Control must include automatic performance of all associated services, and must not permit rate of movement of the control device to overload the propulsion machinery as noted in 46 CFR 62.35-5(c)(1).
- d. Centralized propulsion control equipment must include:
  - (1) Provisions for the control of speed and direction of propulsion thrust for each independent propeller controlled, per 46 CFR 62.35-5(b)(1).
  - (2) A guarded manually actuated safety trip (emergency shutdown) control for each independent propeller controlled, per 46 CFR 62.35-5(b)(2).
- e. Manual alternate propulsion-control locations must be capable of overriding and assuming operation independent of all remote and automatic propulsion-control locations, per 46 CFR 62.35-5(d).



- f. Propulsion machinery automatic safety trip control operation must only occur when continued operation could result in serious damage, complete breakdown, or explosion of the equipment. Overriding safety trip controls is to be alarmed and guarded against inadvertent operation, per 46 CFR 62.35-5(e)(2).

## Power Generation and Distribution

- a. Generator prime movers must:
  - (1) Meet the design standards noted in 46 CFR 111.12-1.
  - (2) Have an over-speed device that is independent of the normal operating governor as per 46 CFR 111.12-1(b).
  - (3) Shut down automatically upon loss of lubricating pressure (for direct drive) or declutch (for PTO) per 46 CFR 111.12-1(c).
- b. The emergency generator must shut down automatically upon loss of lubricating oil pressure, over-speed, or operation of fixed fire extinguishing system, per 46 CFR 112.50-1(g).
- c. If prime mover is a diesel engine, there must be an audible alarm that sounds on low oil pressure and high cooling water temperature, per 46 CFR 112.50-1(h).
- d. For each generator that is controlled by a voltage regulator, the main switchboard must have a voltage regulator functional cut-out switch and manual voltage control (generator field rheostat) as required by 46 CFR 111.30-25. For the emergency generator that is controlled by a voltage regulator, the emergency switchboard must have a voltage regulator functional cut-out switch and manual voltage control (generator field rheostat) as required by 46 CFR 111.30-29. This is demonstrated by disengaging the automatic function of the regulator and manual control of the speed of the prime mover.
- e. For vessels with Low Voltage Release (LVR) provided for motors which are not explicitly required to have automatic restart, compliance with the generator capacity requirement of 46 CFR 111.70-3(b) must be verified by restarting one of the generators after a shutdown test. The test procedure should be such that before the shutdown, all LVR pumps are running, but are lost during the shutdown. Then, after restarting, all should come back on line.

## Communications

- a. Sound powered phones are required for communication between pilothouse and steering gear compartment by 46 CFR 58.25-15, unless an alternative is approved by the MSC.
- b. 46 CFR 113.30-3(b) and 46 CFR 113.30-5 require emergency internal communications that are reliable and independent of the vessel's electrical system. This is typically designed in conjunction with the sound powered phone requirement. The following spaces must be served by this system:
  - (1) Navigation bridge.
  - (2) Steering gear room, if outside engine room.
  - (3) Alternative steering station if outside steering gear room.



- (4) Engine control room/maneuvering platform.
- (5) Emergency lockers.
- c. If the fire or smoke detecting system control unit is not in the navigation bridge, a means of communication must be provided between the bridge and stations where control units are located per 46 CFR 113.30-5(f).
- d. An engineers' assistance alarm designed in accordance with 46 CFR 113.27-1 must be:
  - (1) Manually-operated from engine control room/maneuvering platform.
  - (2) Audible in the engineers' accommodation spaces.
- e. Personnel in the engine control room must be capable of selectively calling any engineering department personnel from the engineering accommodation spaces, per 46 CFR 62.50-20(f).

Miscellaneous Systems

- a. Low level alarms listed in ABS SVR table 8 are required for diesel engines, as incorporated in 46 CFR 62.50-30(c). Fuel oil day tanks, settlers, and similar fuel oil service tanks that are filled automatically or by remote control must be provided with a high level alarm that annunciates in the machinery spaces and either an automatic safety trip control or an overflow arrangement.
- b. Automatic auxiliary boilers must be tested to the requirements of 46 CFR 61.35-3.

Additional Requirements for Vessels with Central Control Rooms 46 CFR 62.01-5(d)

Vessels normally designed with automation to replace personnel, to reduce overall specific personnel, or to reduce overall crew requirements must meet the entire requirements of 46 CFR 62.50 along with ships where the main propulsion or ship service electrical generating plants are automatically or remotely controlled from a control room. All vessels with centralized control rooms must meet these requirements **regardless of the level of manning**:

- a. The ECC must include control and monitoring of all vital engineering systems as required by 46 CFR 62.50-20(a)(3) except for the provisions of 62.50-20(a)(3)(ii):
  - (1) The propulsion plant and its auxiliary equipment.
  - (2) Machinery space fire detection alarm, and extinguishing systems.
  - (3) Machinery space flooding safety system, except the valves described in 46 CFR 62.50-20(e)(4).
- b. All required audible alarms must annunciate at the ECC and throughout the machinery spaces, as required by 46 CFR 62.50-20(b)(3).
- c. An approved automatic fire detection and alarm system must be provided to monitor all machinery spaces. The system must activate all alarms at the ECC, the navigating bridge, and throughout the machinery spaces and engineers' accommodations. The ECC and bridge alarms must visually indicate which machinery spaces are on fire, as applicable by 46 CFR 62.50-20(c).



- d. Machinery space bilges, bilge wells, shaft alley bilges, and other minimally attended locations where liquids might accumulate must be monitored from the ECC to detect flooding at angles from vertical up to 15 degrees heel and 5 degree trim as required by 46 CFR 62.50-20(e)(1).
- e. The ECC must include the controls necessary to bring at least one independent bilge pump and independent bilge suction required by 46 CFR 56.50-50(e) into operation to counter flooding as required by 46 CFR 62.50-20(e)(2).
- f. Controls must be provided to operate the emergency bilge suction required by 46 CFR 56.50-50(f) and 46 CFR 62.50-20(e)(4). **Note:** Vessels under 180ft need not have emergency bilge suction except passenger vessels per 46 CFR 56.50-50(f)(4). When conducting the emergency bilge suction test, the PSTP only has to demonstrate operation of the valve, to prevent accidental discharge overboard.
- g. The voice communications system required by 46 CFR 113.30-5(a) of this chapter must also include the engineering officers' accommodations, per 46 CFR 62.50-20(f)(2).

Additional Requirements for Minimally Unattended Machinery Spaces 46 CFR 62.50-20

- a. Navigating bridge propulsion control must be provided per 46 CFR 62.50-20(a)(1).
- b. An ECC must be provided and it must meet 46 CFR 62.01-5(d) in addition to the requirements of this section, see 46 CFR 62.50-20(a)(2).
- c. The ECC must be provided and must include control and monitoring of electrical power generation and distribution per 46 CFR 62.50-20(a)(3)(ii).
- d. Alarms and Instrumentation:
  - (1) A personnel alarm ("Deadman's alarm) is required by 46 CFR 62.50-20(b)(1) and must annunciate on the bridge if not routinely acknowledge at the Engineer Control Center (ECC) or in the machinery spaces.
- e. Fire Pumps:
  - (1) .
  - (2) The ECC must include control of the main machinery space fire pumps, per 46 CFR 62.50-20(d)(1).
  - (3) Remote control of a required fire pump must be provided from the navigating bridge, per 46 CFR 62.50-20(d)(2).
- f. Flooding Safety:
  - (1)
  - (2) Where class 3 watertight doors in subdivision bulkheads are required in the machinery spaces, the doors must be controllable from the ECC and the navigating bridge, per 46 CFR 62.50-20(e)(3).
- g. Communications:
  - (1) Personnel in the ECC must be capable of selectively calling any engineering department personnel from engineering accommodations, per 46 CFR 62.50-20(f).





- h. Electrical Systems: The Engineer Control Center (ECC) must include the controls and instrumentation necessary to place the ship service and propulsion generators in service within 30 seconds, per 46 CFR 62.50-20(g).

## Additional Requirements for Periodically Unattended Machinery Spaces 46 CFR 62.50-30

- a. For periodically unattended machinery spaces, the requirements of 46 CFR 62.50-20 must also be met, as required by 46 CFR 62.50-30(a).
- b. Each fuel system for the service or treatment of fuel must meet section 4-6-4/13.5 of ABS Rules for Building and Classing Steel Vessels, in accordance with 46 CFR 62.50-30(b).
- c. The assistance-needed alarm noted in 62.50-30(e) must annunciate if:
  - (1) An alarm at the ECC is not acknowledged in a period of time necessary for the engineer to respond at the ECC from the machinery space or engineers' accommodations
  - (2) An ECC alarm system's normal power supply fails.
- d. All ECC alarms required by 46 CFR 62 must be extended to the engineers' accommodations. Other than fire or flooding alarms, this may be accomplished by summarized visual alarm displays per 46 CFR 62.50-30(f).
- e. All requirements of 46 CFR 62 for system or equipment monitoring must be met by providing both displays and alarms at the ECC as described in 46 CFR 62.50-30(g).
- f. A control station for fire protection of machinery spaces must be provided outside of the machinery spaces per 46 CFR 62.50-30(h), and must include controls of the following:
  - (1) Annunciation of which machinery space is on fire.
  - (2) Control of a fire pump, independent of the main machinery spaces
  - (3) Controls for machinery space fixed gas fire extinguishing systems.
  - (4) Control of oil piping positive shutoff valves for the machinery spaces.
  - (5) Control for machinery space fire door holding and release system.
  - (6) Remote stopping of machinery listed in 46 CFR 111.103.
  - (7) Voice communications with the bridge that meets 46 CFR 113.30 (sound powered telephones or phones with independent UPS).
- g. Leakages from high pressure fuel oil pipes must be collected and high levels must be alarmed at the ECC per 46 CFR 62.50-30(i).
- h. The electrical plant must meet sections 4-8-2/3.11 and 4.8.2/9.9 of (2003) ABS Rules for Building and Classing Steel Vessels, for the continuity of electrical power in accordance with 46 CFR 62.50-30(k), and must:
  - (1) Not use the emergency generator for this purpose.
  - (2) Restores power in not more than 30 seconds.
  - (3) Account for the loading specified in 46 CFR 111.70-3(b).

*Note: This test will typically be combined with test "e" described in the Power Generation and Distribution portion of this section.*





## **Section 4. SOLAS**

This section is to assist in the review of any vessel meeting SOLAS requirements. In most cases, vessels with PSTPs will be reviewed to section 4 and another section. An example of a vessel only reviewed to this section is OSV <100 GT. This section will be applicable to vessels under the Maritime Security Program (MSP) and Alternate Compliance Program (ACP), see NVIC 1-13, CH-1 and NVIC 2-95, CH-3 respectively for details.

NOTE: The requirements of SOLAS are not equivalent to the requirements of 46 CFR 62. Requirements denoted with \* are for periodically unattended machinery spaces.

- a. \* II-1/46.3 requires that every ship be provided with documentary evidence of its fitness to operate with periodically unattended machinery spaces (PSTP).
  
- b. Alarm Systems:
  - (1) The engineers' alarm shall be operated from the engine control room and be clearly audible in the engineers' accommodation, per II-1/38.
  - (2) \* II-1/51.1.2 states the alarm system must sound in the engineers' public spaces as well as each engineers' cabins through a selector switch.
  - (3) \* The alarm system shall activate the engineers' alarm if an alarm has not received attention locally with a limited time, per II-1/51.1.5.
  - (4) \* The alarm system shall indicate any fault requiring attention with an audible alarm and indicate visually each separate alarm function, per III/51.1.1.
  - (5) \* An alarm system shall be continuously powered and automatically change over to stand-by power in case of loss of normal power supply, per II-1/51.2.1.
  - (6) \* Failure of normal power of the alarm system shall generate an alarm in accordance with II-1/51.2.2.
  - (7) \* The alarm system shall be able to indicate at the same time more than one fault, and acceptance of any alarm shall not inhibit another alarm, per II-1/51.3.1.
  - (8) \* An alarm system shall be provided for all important pressures, temperature, and fluid levels and other essential parameters, per II-1/reg 53.4.3.
  - (9) \* A centralized control position shall be provided with the necessary alarm panels and instrumentation indicating any alarm, per II-1/reg 53.4.4.
  
- c. Steering Alarms:
  - (1) Power failure of any one of the steering gear power units and control system shall activate an audible and visual alarm on the navigation bridge, per II-1/29.5.2 and 8.4.
  - (2) A low-level alarm shall be provided for each hydraulic fluid reservoir. Audible and visual alarms shall activate on the navigation bridge and machinery space where they can be readily observed per II-1/29.12.2.
  
- d. Fire Detection and Suppression:
  - (1) The function of fixed fire detection and fire alarm systems shall be periodically tested by means of hot air, smoke, or aerosol particle to which the detector is designed to respond, per II-2/7.3.2.
  - (2) Where other pumps such as general service, bilge and ballast are fitted in a machinery space, II-2/10.2.2.3.3 states that they shall be capable of providing water to the fire main.



- (3) \* Refer to II-2/5.2.3.1 (fire control station) for special consideration on maintaining fire integrity of the machinery spaces, location and centralization of fire-extinguishing system controls, and required shutdowns (e.g. ventilation, fuel pumps, etc).
- (4) \* One of the main fire pumps must be capable of remote starting from the navigation bridge and fire control station per II-2/10.2.1.2.2.2. Ships under 1,600 ITC may be exempt if the fire pump starting arrangement in the machinery space is in an easily accessible position.
- (5) \* A fixed local application fire-extinguishing systems on cargo ships 2,000 ITC and over is required by II-2/10.5.6.2 for machinery spaces of category A above 500 m<sup>3</sup>, to be additionally protected by an approved fixed water-based or equivalent local application system. For periodically unattended machinery spaces, this system shall have both automatic and manual release capabilities and should be tested to verify operation.

e. Machinery and Propulsion Systems:

- (1) Where risk from over-speeding of machinery exists, means shall be provided per II-1/27.1 to ensure that the safe speed is not exceeded.
- (2) Main turbine propulsion, main internal combustion machinery, and auxiliaries shall be provided with automatic shutoff arrangement per III/27.5 in the case of failures, such as lubricating oil supply failure which could lead rapidly to complete breakdown, serious damage or explosion. Manual override may be permitted.
- (3) Local propulsion control must be tested, per II-1/31.2.6.
- (4) There must be a threshold warning of impending or imminent slowdown/shutdown of the propulsion system, per II-1/31.2.10. A separate alarm that notifies the operator that they are about to lose an engine must be provided. The operator can decide to allow shutdown or possible override if installed.
- (5) Electric propulsion systems installed after 1998 must be capable of restoring propulsion from dead ship condition within 30 min after blackout, per II-1/43.3.4.
- (6) \* As a fire precaution, there must be a means to detect and give alarms for boiler air supply casings and exhausts (uptakes) and scavenging air belts of propulsion machinery if installed, per II-1/47.1.
- (7) \* Internal combustion engines of 2,250 kW+ or having cylinders of more than 300 mm bore shall be provided with crankcase oil mist detector or engine bearing temperature monitors or equivalent devices, per II-1/47.2.
- (8) \* The main propulsion machinery must have an emergency stop on the navigation bridge per II-1/49.1.2, independent of control system.
- (9) \* Remote control of propulsion shall be possible only from one location at a time and each location shall have an indicator showing which location is in control, per II-1/49.3. Transfer of control between Navigation Bridge and machinery spaces shall be possible only in machinery space/control room. Also, the system shall have a means to prevent thrust from altering significantly when transferring control from one location to another.
- (10) \* Local manual control shall be available for all machinery essential for safe operation of the ship, per II-1/49.4.
- (11) \* Failure of the remote automatic control system shall be provided with an alarm, per II-1/49.5.



- (12) \* The number of consecutive automatic attempts which fails to start machinery shall be limited to safeguard sufficient starting air pressure. An alarm for low starting air set at a level which still permits starting operations of the propulsion machinery must meet II-1/49.7.
- (13) \* A safety system shall be provided to ensure that a serious malfunction in machinery or boiler operations, which presents an immediate danger shall initiate the automatic shutdown and alarm. Shutdown of the propulsion system shall not be automatically activated except in cases which could lead to serious damage, complete breakdown, or explosion. Where arrangements for overriding the shutdown are fitted, it shall be designed to preclude inadvertent operation, per II-1/52. Visual means shall be provided to indicate when the override has been activated.
- (14) \* Where stand-by machines are required for other auxiliary machinery essential to propulsion, automatic change-over devices shall be provided, per II-1/53.3.
- (15) \* The control system for operation of the main propulsion machinery and auxiliaries must be ensured through the necessary automatic arrangements described in II-1/53.4.1.
- (16) \* Automatic change over for propulsion control and auxiliaries shall alarm per II-1/53.4.2.

f. Power Generation Systems:

- (1) The emergency generator must automatically start upon failure of the main source of power as quickly as is safe and practicable, but within 45 seconds, per II-1/43.3.1.3.
- (2) Testing of the complete emergency system, including automatic starting arrangements must be provided in accordance with II-1/43.7.
- (3) \* When power is normally supplied by one generator, load shedding shall be provided in accordance with II-1/53.2.1 to ensure integrity of supplies for propulsion and steering, as well as safety of the ship. In case of the loss of the generator in operation, the stand-by generator must start automatically. The Administration may dispense with this requirement for a ship <1,600 ITC, if it is to be considered impracticable.
- (4) \* If power is normally supplied by more than one generator in parallel, provision shall be made to ensure in case of loss of one of these generating sets, the remaining ones can be kept in operation without overload, to permit propulsion, steering and safety of the ship per II-1/53.2.2.

g. Communications:

- (1) A means of communication between Navigation Bridge and steering gear compartment must be provided, per II-1/29.10.
- (2) Two independent means of communicating orders from the navigation bridge to the machinery space/control room from which speed/direction/thrust of the propellers are normally controlled must be provided, per II-1/37.2. One of these shall be an EOT with visual indication of orders.
- (3) \* There must be a reliable means of communication between main machinery control room/control position, Navigation Bridge, and engineer officers' accommodation, per II-1/50. Portable radios such as VHF are not considered to be a reliable means of communication.

**Section 5. Alternative Compliance Program (ACP) and Maritime Security Program (MSP)****Alternative Compliance Program (ACP)**

- a. The classification society is authorized to review PSTPs under the ACP program. This section is to assist in the review of vessels inspected under the Alternate Compliance Program (NVIC 2-95). This alternative standard is intended for a vessel built to classification rules and for which the ACP supplement for that classification society applies. All vessels inspected under the ACP program also meet the requirements of SOLAS; therefore, section 4 should also be used. When conducting oversight review of the PSTP, the applicable class rules and supplement should be used.
- b. The single supplement, and past ACS-specific supplements, can be found [here](#).
- c. When reviewing ACP PSTPs, the vessel's notation provides information as to the design of the vessel. The following are some automation notations from ABS and DNV-GL:
  - (1) American Bureau of Shipping (ABS)
    - i. Automatic Centralized Control (ACC): assigned to a vessel having the means to control and monitor the propulsion-machinery space from a continuously manned centralized control and monitoring station installed within or adjacent to, the propulsion machinery space. (Equivalent to MAMS)
    - ii. Automatic Centralized Control Unmanned (ACCU): assigned to a vessel having the means to control and monitor the propulsion machinery space from the navigation bridge and from a centralized control and monitoring station installed within or adjacent to, the propulsion machinery space. (Equivalent to PUMS)
    - iii. Automatic Bridge Centralized Control Unmanned (ABCU): assigned to a self-propelled vessel which is fitted with the required automation and remote monitoring and control systems to enable the propulsion machinery space to be periodically unattended (similar to an ACCU classed vessel) and the propulsion control to be effected primarily from the navigation bridge. This notation is used on vessels that meet the ACCU due to the design of the system, but physically don't have the space for a centralized control room near the engine room.
  - (2) DNV GL
    - i. ECO: considered to meet the regulations of SOLAS for continuous supervision from a control station is granted when alarms, required for ECO are initiated in an attended centralized control station, and a remote control system for the main propulsion machinery is installed at this station. DNV Rules for Ships Pt. 6 Ch. 2 (Equivalent to MAMS)
    - ii. E0: considered to meet the regulations of SOLAS for unattended machinery spaces and alarms are relayed to the bridge and engineers' accommodation, and a bridge control system for the main propulsion machinery, and a watch responsibility transfer system are fitted DNV Rules for Ships Pt. 6 Ch. 2 Sec 2. (Equivalent to PUMS)
- d. Miscellaneous: The following general topics should be included as required by the class society:
  - (1) Testing of the power management system, including load shedding.



- (2) For vessels with electric propulsion: Testing the operation at power limit, then failure of one generator to demonstrate that the system will not result in blackout due to a single point failure.

## Maritime Security Program (MSP)

Foreign built vessels intending to reflag under the Maritime Security Program, see PRG-25.

## **Section 6. Lithium-Ion Battery Installations**

Vessels with lithium-ion battery installations must conduct periodic safety testing to ensure continued proper functioning of the battery system. A battery system is comprised of one or more cells, modules, or battery packs and a battery management system. See CG-ENG Policy Letter No. 02-19, for detailed PSTP requirements. PSTPs for lithium-ion battery installations should include the following:

- a. Testing of all alarms and safety functions.
- c. Testing of emergency shutdowns.
- d. Testing of fire protection systems.
- e. Testing of fire and gas detection systems.
- e. Testing of battery room ventilation system and interlocks.

## **5. Disclaimer**

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is not intended to nor does it impose legally-binding requirements on any party. It represents the Coast Guard's current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other federal and state regulators, in applying statutory and regulatory requirements. You can use an alternative approach for complying with these requirements if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative, you may contact MSC, the unit responsible for implementing this guidance.