MSC Guidelines for Vital System Automation

Procedure Number: E2-01 Revision Date: 11/10/2011

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Purpose:

To provide guidance for plans submitted to the vital system automation installation aboard self-propelled vessels of 500 gross tons and over that are certificated under subchapters D, I, and U, and to self-propelled vessels of 100 gross tons and over that are certificated under subchapter H.

References:

a. Title 46 CFR Subchapter F Parts 58, 61 and 62,

b. Title 46 CFR Parts Subchapter J, Electrical Engineering

c. Navigation and Inspection Circular (NVIC) 2-89, "Guide for Electrical Installations on Merchant Vessels and Mobile Offshore Drilling Units," can be found at: http://www.uscg.mil/hq/cg5/nvic/pdf/1989/n2-89.pdf

d. Navigation and Inspection Circular (NVIC) 8-84, "Recommendations for the Submittal of Merchant Marine Plans and Specifications," can be found at http://www.uscg.mil/hq/cg5/nvic/pdf/1984/n8-84.pdf

e. Safety Of Life at Sea (SOLAS), Consolidated Editions, 1997, Chapter II-1, Part D

f. COMDTINST M16000.8, USCG Marine Safety Manual Volume III, "Marine Industry Personnel," can be found at: http://cgweb.comdt.uscg.mil/CGDirectives/CIM/CIM_16000_8B.pdf

g. MSC Plan Review Guideline, E2-5, Design Verification Test Procedures

h. MSC Plan Review Guidelines, E2-7, Electrical One-Line Diagram

i. MSC Plan Review Guidelines, E2-17, Periodic Safety Test Procedures

j. MSC Plan Review Guidelines, E2-18, Qualitative Failure Analysis

Contact Information:

If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by email or phone. Please refer to the Procedure Number E2-01

Email: MSC@uscg.mil
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Responsibilities:

Using applicable portions of references (a) through (j), the submitter shall provide sufficient documentation and plans to indicate compliance with the applicable requirements. To facilitate plan review and project management, all plans and

Responsibilities (continued):

information specified in these guidelines should be submitted as one complete package through a single point of contact for the project. The submission shall be made in triplicate if a stamped copy is desired.

General Guidance:

- The following information should provided with vital automation system submittals:

a) Manning level of the engineering department, i.e., fully-manned, minimally attended (MAMS), periodically unattended (PUMS) machinery spaces.

b) Scope of the vital system automation submittal as noted in reference (d). Equipment or systems that are automated or remotely controlled should be identified in the submittal.

c) The configuration of the machinery plant, i.e., location of propulsion engines, ship's service generators, steam plant, main switchboard, engineering control center, fire control station (if required); number of propulsion units; auxiliary machineries, type of propulsion control system (i.e., controllable pitch propeller, azimuthal control system, slow-speed reversible engine, fixed propellers, waterjet, electric drive, Z-Drive; cycloidal propeller); and hull configuration.

Required Plan Submittals:

- The following plans, analysis, and procedures should be submitted for all vital automated systems.

a) A qualitative failure analysis (QFA) for the following (Please see reference (j)):

1. Propulsion controls.

2. Safety controls.

3. Automatic power management, if installed.

4. Monitoring and alarm, and main boiler control systems, if microprocessor-based.

5. Integrated automated systems, required to be independent from each other.

6. Other automated systems that can potentially constitute a safety hazard to the vessel or personnel in case of failure.

b) Design verification test procedures (DVTP) for each of the failures considered in the QFA. (Please see MSC Plan Review Guideline E2-05)

General Guidance (continued):

c) Periodic Safety Test Procedures (PSTP). (Please see MSC Plan Review Guidelines E2-17)

d) Console drawings and internal component layouts of each remote control or automatically controlled system.

e) Manufacturer or designer's certification of the automated system.

f) Sources of power for each automated system.

Propulsion Controls (Speed and Direction of Thrust):

- Propulsion Control Sensors. Plans submitted should demonstrate there is a sensor of feedback device for primary speed, pitch, or direction of rotation control in closed loop propulsion control systems is independent of other systems, i.e., alarm and monitoring and safety control (46 CFR 62.30-5(b)(2)).

- Prior to submitting plans, check for control system failsafe design measures:

  a) For a vessel with one propulsion engine (single propeller), a failure of the remote propulsion control system should maintain the preset speed and direction of thrust until local manual or alternate manual control is in operation. For verification, the propulsion control system's QFA should be used for this purpose. (46 CFR 62.35-5(e)(3)). This does not preclude vessels with multiple propulsion engines (multiple propellers) to design the entire propulsion plant so that the preset speed and direction of thrust are maintained in the event of a failure of any part of the propulsion control system, i.e. the propulsion systems behave as if there is only one propulsion engine.

  b) For vessels with "independent duplicate" propulsion systems, or multiple engine propulsion plant, partial reduction of normal propulsion capability as a result of single non-concurrent failures of the control system is acceptable (in lieu of maintaining the preset speed and direction of thrust). However, the reduced propulsion capability shall not be below that necessary for the vessel to run ahead at 7 knots or half speed, whichever is less, and is adequate to maintain control of the ship. Please note 46 CFR 58.01-35 is the basis for acceptance of the reduced propulsion capability.

- Propulsion Auxiliaries:

  a) For a vessel with one propulsion engine (single propeller), verify that the auxiliary machinery vital to the main propulsion system is provided in duplicate.

General Guidance (continued):

b) For vessels with propulsion plant arranged in "independent duplicate" or more, the required auxiliaries for each propulsion engine need not be provided in duplicate. However, the conditions defined in 46 CFR 58.01-35 shall be met.

c) Auxiliary machineries may be engine-driven (attached) or electrically-driven, or both. Also, please see CFR 111.10-7 regarding the requirements for "dead-ship" start.

d) One or more starting air compressors, capable of charging the air receivers to the required capacity within one hour, should be clearly noted on submitted plans. The total air capacity required for reversible main engines shall be sufficient for at least twelve 12 consecutive starts, for nonreversible main engines sufficient for six (6) consecutive starts, without recharging the air receivers. Special consideration is given for multiple engine installations (46 CFR 62.35-35).

e) One emergency air compressor with a driving unit not requiring air for starting shall be provided for initially charging the starting air receivers (46 CFR 62.35-35).

f) Main engines arranged for air starting shall have at least two starting air receivers. (46 CFR 62.35-35)

g) Storage batteries for starting the main engines shall have sufficient capacity without recharging for the same number consecutive starts for reversible and nonreversible main engines (46 CFR 62.35-35).

- Alternate Controls:

a) Plans should indicate the availability of manual alternate control, located at the equipment, that is operable in an emergency or after a remote or automatic primary control system failure (46 CFR 62.25-10(a)(1) and 62.35-5(a)).

b) Compliance with the required manual alternate control shall be verified in the "Alternatives Available to the Crew" section of the propulsion control system's QFA (46 CFR 62.25-1(a)(2), 62.25-10(a) and 62.35-5(a)).

- For electric propulsion (SCR, variable frequency, etc.) drives. Plans should demonstrate compliance with the requirements in 46 CFR 111.33 and 35.

- Interlocks:

General Guidance (continued):

a) When propulsion machinery is equipped with jacking or turning gear, there should be a remote starting control system interlock. Remote starting shall be inhibited when jacking or turning gear is engaged (46 CFR 62.25-5(a)).

b) If the primary remote control system provides automatic starting, the number of automatic consecutive attempts that fail to produce a start must be limited to less than 50% of the required starting capability (46 CFR 62.35-5(c)(3)).

- Plans should indicate communications equipment will pass propulsion orders (engine order telegraph systems) (46 CFR 113.30-5 and 113.35-3, and 62.35-5(b)(4)).

- Plans should indicate a permanent means of communications between the primary remote control location and the manual alternate control location (if operator attendance is necessary) to maintain safe alternate control (46 CFR 62.25-10(b)).

- <u>Propulsion control location transfer and independence, and required overrides:</u>

a) The main control station is the remote control station in the engineroom. The secondary stations are the navigating bridge, bridge wings and aft stations, if provided. The main control station shall have the capability to take control from any secondary station at all times and blocking any unauthorized control from any secondary station. Cable ships, survey ships, and dredges may provide the secondary station to have command over control transfers between control stations. Alternative arrangements may be considered on a case by case basis. 46 CFR 62.35-5(d).

b) Transfer of control from one station to another shall be possible only with acknowledgment from the receiving station (46 CFR 62.35-5(d)).

c) Propelling thrust shall not alter significantly when transferring from one location to another (46 CFR 62.35-5(d)).

d) Plans should note the manual alternate control system's capability to override automatic controls and interlocks ((46 CFR 62.25-10(a)(4) and 62.35-5(d)).

- <u>Propulsion control device :</u>

a) The navigating remote propulsion control is to be provided by a single control device for each independent propeller and shall include automatic performance of all associated services (46 CFR 62.35-5(c)(1)).

General Guidance (continued):

b) Plans should show the rate of movement of the propulsion control device will not cause overload of the propulsion machinery or a "dead-ship" condition (46 CFR 62.35-5(c)(1)).

c) Each operator control device must have detent at the zero thrust position (46 CFR 62.35-5(e)(1)).

d) Navigating bridge, ECC, maneuvering platform, and manual alternate propulsion control located at the equipment, shall control the speed and direction of thrust for each independent propeller controlled (46 CFR 62.35-5(b)(1)).

- Primary or automatic control system:

a) Automatic propulsion systems, and all subsystems and equipment must be capable of meeting load demand from standby to full system rated load, under steady state and maneuvering conditions, without the need for manual adjustment or manipulation (46 CFR 62.35-1(b)).

b) Plans must show the primary automatic control system is stable over the entire range of normal operation (46 CFR 62.25-1 and –5(b)).

- Manual alternate control systems:

a) Plans must demonstrate manual alternate control systems are suitable for prolonged periods of operation (46 CFR 62.25-10(a)(2)).

b) Such systems must be readily accessible and operable (46 CFR 62.25-10(a)(3)).

Safety Controls (manual, automatic, trip and limit):

- Vital systems that are automatically or remotely controlled shall be provided with a safety control system. The minimum safety trip controls for specific types of automated vital systems are listed in 46 CFR Table 62.35-50 (46 CFR 62.25-1(a)(3) and 62.25-15(a)).

- Safety trip controls must not operate as a result of a failure of the normal electrical power source, unless it is the failsafe state. This should be verified in the QFA of the system's normal power supply (46 CFR 62.25-15(b)).

- For the navigating bridge propulsion primary remote control system that provides automatic starting, the number of consecutive attempts that fail to produce a start should be limited to no less than 50 percent of the required starting capability in 46 CFR 62.35-35 (46 CFR 62.35-5(c)(3)).

General Guidance (continued):

- Local manual safety trip controls are required for all main boilers, turbines and internal combustion engines (46 CFR 62.25-15(d)).

- Automatic safety trip shall:

  a) Be provided where there is immediate danger that a failure will result in serious damage, complete breakdown, fire, or explosion (46 CFR 62.35-5(e)(1)).

  b) Require manual reset prior to renewed operation of the equipment (46 CFR 62.35-5(e)(2)).
  c) Not be provided if safety limit controls provide a safe alternative and trip would result in loss of propulsion (46 CFR 62.25-15(e)(3)).

- On vessels propelled by steam turbines, the navigating bridge control must include safety limits controls for high and low boiler water levels and low steam pressure (46 CFR 62.35-5(c)(2)).

- Plans should clearly indicate the safety trips provided for gas turbine installations (46 CFR 58.10-15(f)).

- The manually actuated safety trip control (emergency shutdown, which stops the propelling machinery) for each independent propeller controlled in the navigating bridge, ECC, maneuvering platform, and manual alternate control locations, must be independent and physically separate from all other systems (46 CFR 62.35-5(b)(3)).

- Please note overrides are prohibited (46 CFR 62.35-5(e)(2)).

- Automatically or remotely filled fuel oil day tanks, settlers and similar fuel oil service tanks must be provided with an automatic safety shut-off or an overflow arrangement (46 CFR 62.35-40(d)).

- As per 46 CFR 62.25-5(b), inadvertent grounding of an electrical or electronic safety control system must not cause safety control operation or safety control bypassing. This problem is often seen on hard-wired relay-logic control systems or the hard-wired portion (output or input side) of a microprocessor-based system. Schematic diagrams should be provided.

- System's on-line built-in test equipment must not lock-out or override safety trip control systems (46 CFR 62.30-10(b)).

General Guidance (continued):

Automatic Power Management System (PMS):

- The APM system is a control system where ship's service generators are automatically placed in service and removed out of service, as dictated by the ship's service and propulsion load demand.
- This system should not include control of the emergency generator.
- The QFA of the automatic PMS must insure failures are alarmed in appropriate locations (depending on the manning level of the machinery plant), no complete loss of the electrical plant results, and switchboard alternate manual controls and instrumentation remain operational, or are independent of the automatic power management controls.

Monitoring and Alarm System:

- Manual control locations (remote manual and manual alternate control locations) must be provided with instrumentation necessary for safe operation from that location. Instrumentation typically includes means to monitor the output of the monitored system.
- Remote instrumentation must have provisions for the installation of instrumentation at the monitored system equipment.
- Visual status indicators of automatically or remotely controlled vital auxiliaries, power sources, switches, and valves must be provided in the machinery spaces or the cognizant remote control location. Control system sequential interlocks to show if interlocks are satisfied must have summary indicators in the machinery spaces and at the cognizant control location.
- Demand instrumentation displays must be clearly readable and immediately available to the operator.
- Required alarms in high ambient noise areas must be supplemented with rotating beacons or other visual means. Red beacons must be used for general or fire alarm purposes only.
- Automatic transfer to required backup or redundant systems or power sources must be alarmed in the machinery spaces.

For vital systems that are automatically or remotely controlled, the following are required:

- A QFA and DVTP are required for microprocessor-based or computer-based systems. These are not required for hard-wired systems.

General Guidance (continued):

- Instrumentation, 46 CFR 62.25-20(b) and (c). Plans must show the instrumentation to monitor system parameters necessary for safe and effective operation of the system (46 CFR 62.25-1(a)(4)).

- Shaft speed and thrust direction indicators must be shown for each independent propeller controlled (46 CFR 62.35-5(b)(3)).

- As per 46 CFR 113.40-10(a), for azimuthal control system (integrated propulsion/steering, e.g., Z-Drive, cycloidal propellers, Z-Pods), azimuth indicators should be independent of the azimuth control system. Also, for equivalency to the requirements in 46 CFR Subpart 113.43, the system must detect an azimuthal failure. Compliance should be demonstrated in the QFA and DVTP.

- The minimum instrumentation and alarms required for specific types of automatic vital systems are listed in 46 CFR Table 62.35-50. Display may be continuous or demand display type. Displays must be in the ECC or in the machinery spaces (if an ECC is not provided) (46 CFR 62.35-1(a)).

- **Alarms, 46 CFR 62.25-20(d).** An alarm system is required if instrumentation is not continuously monitored or is inappropriate for detection of a failure or unsafe condition. 46 CFR 62.25-1(a)(5).

- All alarms must be continuously powered.

- Alarms must clearly distinguish among the fire, general alarm, CO2/halon, vital machinery, flooding, engineers' assistance-needed, and non-vital alarms.

- Automation alarms must be separate and independent of the fire detection and alarm systems, the general alarm, and CO2/halon release alarms.
- Immediate alarm must provided in the machinery spaces and at the ECC (if provided) on failure of an automatic control, remote control, or alarm system (46 CFR 62.25-20(d)(6) and 62.35-5(e)(3)).

- Propulsion override alarms must be noted on plans (46 CFR 62.35-5(e)(2)).

- As per 46 CFR 62.25-15(c), automatic safety trip operation must be alarmed in the machinery spaces and the cognizant remote control locations.

- Summarized and group alarms must be sufficiently specific to allow any necessary action to be taken, and have a display at the equipment or an appropriate control location to identify the specific alarm condition or location (46 CFR 62.25-20(f)).

- Engineer's assistance-needed alarm, operated from the control room (if there is a control room) or in the maneuvering platform in the machinery space, must be

General Guidance (continued):

shown as audible in the engineers' accommodation spaces, and powered from the general alarm power source (46 CFR 113.27).

- For integrated propulsion/steering systems, e.g., Z-drives, Z-Pods, or cycloidal propellers, an equivalent steering system alarm as required by 46 CFR 58.25-25 must be provided as part of the machinery automation plans.

- On vessels propelled by steam turbines, the navigating bridge control must include safety limit controls for high and low boiler water level and low steam pressure, and when actuated, include alarms on the navigating bridge, maneuvering platform or the engineering control center (ECC) (46 CFR 62.35-5(c)(2)).

- For internal combustion propulsion engines, the starting air alarm should annunciate in the navigating bridge, maneuvering platform or ECC to indicate starting capability of less than 50 percent of required capacity (46 CFR 62.35-5(c)(3)).

- Alarm on normal power supply failure of vital control systems. 46 CFR 62.30-5(c).

- Automatic operation of a safety control is alarmed in the machinery spaces and at the cognizant remote control location (46 CFR 62.25-15(b), and (c)).

- <u>Automatic bilge pumps (46 CFR 62.35-10):</u>

  a) Plans must show bilge high level alarms that annunciate in the machinery spaces and at a manned control location and are independent of the pump controls. Level sensors must be located to detect flooding at an early stage and to provide redundant coverage.
  b) Automatic bilge pumps must be monitored to detect excessive operation in a specified time period.

  c) Automatic bilge pump arrangements including all piping must meet all applicable pollution control requirements.

- <u>Fuel systems (46 CFR 62.35-40(c)):</u>

  a) Automatic fuel oil heating must have a high temperature alarm or a low flow alarm, in addition to the temperature control, unless the flash point of the fuel cannot be reached.

  b) Automatically or remotely filled fuel oil day tanks, settlers and similar fuel oil service tanks must be provided with a high level alarm that annunciates in the machinery spaces.

General Guidance (continued):

- Fire pump remote control locations noted on plans must include a firemain pressure indicator or a firemain low pressure alarm (46 CFR 62.35-15).

- Alarm details (46 CFR 62.25-20(e)):

  a) Plans should indicate a means to test audible and visual alarm annunciators.

  b) Nuisance alarms must be prevented by providing appropriate delay to allow for normal equipment starting and operating transients, and vessel motions.

  c) Alarms must clearly distinguish among normal, alarm, and acknowledged conditions.

  d) Plans must clearly show the system is able to simultaneously indicate more than one alarm condition.

  e) Plans should state that alarms must be visually and audibly annunciated until manually acknowledged and the alarm condition is cleared.

  f) The plans should demonstrate that the alarm system will not prevent the annunciation of subsequent alarms because of previous alarm acknowledgment.

  g) Alarms must automatically reset to the normal operating condition only after the alarm has been manually acknowledged and the alarm is cleared.

- Central control locations, 46 CFR 62.25-20(g):

  a) Control and monitoring consoles must be designed to ergonomic principles to provide the operator minimum confusion and distraction.
  b) Navigating bridge visual alarms and instruments must not interfere with the crew's vision at night. Dimmers must not be capable of totally dimming visual indicators.

  c) Navigating bridge alarms and instrumentation must be limited to those that require the attention or action of the navigating watch bridge officer on watch.

  d) Vital control and alarm system consoles, control cabinet and similar enclosures that rely upon forced cooling for proper system operation must have high cooling temperature alarm or alarm on failure of the cooling system (46 CFR 62.25-1(c)).

General Guidance (continued):

Other Equipment and Systems:

- Two independent sources of power are required for all primary control, safety control, and instrumentation and alarm systems (46 CFR 62.30-5(c)).

- For programmable systems, non-volatile memory storage devices are required (46 CFR 62.25-25(b)).

- Designer or manufacturer's certification of all vital automated systems to the environmental design standards in 46 CFR 62.25-30. 46 CFR 62.20-5.

- Plans should show that for flooding safety equipment, remote controls must remain functional under flooding conditions to the extent required for the associated equipment by 46 CFR 56.50-50 and 56.50-95 (46 CFR 62.35-10(b)).

- Fire pump remote control locations must include the controls necessary to charge the firemain (46 CFR 62.35-15).

- Fuel systems (46 CFR 62. 35-40):

  a) Interlocks must be provided to ensure a safe transfer of machinery operation from one fuel to another.

  b) Use of coal fuel. Controls and instrumentation for coal systems require special consideration by the Commandant (CG-521). In the case of coal fuel systems, please contact the MSC to discuss special requirements.

- Starting systems for propulsion and ship's service generator internal combustion engines (46 CFR 62.35-35):

  a) Plans should indicate one or more air compressors, capable of charging the air receivers within one-hour to the required capacities. For reversible main engines, the total air capacity must be sufficient for 12 consecutive starts, and for non-reversible main engines, six consecutive starts, without recharging. Both systems require at least two starting air receivers.

  b) One emergency compressor with a driving unit not requiring air for starting must be provided for initial charging of the air receivers.

  c) Starting batteries for starting reversible main engines, the battery capacity must be sufficient for 12 consecutive starts, and for non-reversible main engines, six consecutive starts, without recharging.

General Guidance (continued):

d) Special consideration may be provided for multiple engine installations. Plans must clearly demonstrate compliance with 46 CFR 62.35-35.

Minimally attended machinery plant operation (46 CFR 62.50-20) (Machinery plant should not be left unattended. Automation emphasis is placed on the centralized remote control and monitoring of the machinery plant and machinery spaces).

- Navigation bridge propulsion controls are required and must be clearly noted on plans (showing stable automatic control system over the entire range of normal operation).

- The engineering control center (ECC) must include the automatic and remote control and monitoring systems of all vital engineering systems necessary to limit the operator's activity to monitoring the plant, initiating programmed control sequences, and taking appropriate actions in an emergency.

- The ECC must include control and monitoring of the following vital engineering systems:

  a) Propulsion plant and its auxiliaries.

  b) Electrical power generation and distribution.

  c) Controls and instrumentation necessary to place the ship's service and propulsion generators in service in 30 seconds.

  d) The main distribution and propulsion switchboards and generator controls must be located at the ECC, if the ECC is within the boundaries of the main machinery space, or the switchboard controls and instrumentation duplicated at the ECC. Controls at the switchboard, if separate from the ECC, must be able to override the controls at the ECC.

  e) Arrangements showing the detection system will activate fire alarms at the ECC, the navigating bridge, and throughout the machinery spaces and engineers' accommodations.

  f) ECC and bridge fire alarms which will visually indicate which machinery space is on fire. Note: An incinerator room, if separate, is considered a machinery space.

  g) Extinguishing systems.

  h) Machinery space flooding control and safety systems which:

General Guidance (continued):

1. Monitor flooding in the machinery space bilges, bilge wells, shaft alley bilges, and other minimally attended spaces where liquids might accumulate.
2. Watertight doors in the machinery space subdivision bulkheads must be Class 3 watertight doors, and controllable from the ECC and the navigating bridge control location.
3. Controls to operate sea inlet and discharge valves must be shown to comply with 46 CFR 56.60-95(d) and the emergency bilge suction requirements are in 46 CFR 56.50-50(f). Controls must be arranged to allow time for operation in the event of flooding with the vessel assumed to be in the fully loaded condition. This may include flooding calculations necessary to demonstrate the ability to close sea inlet and discharge valves from a location above the calculated flooding level. Flooding detection, crew response and time needed to operate the valves must be considered.

- ECC control of vital systems must include the ability to place required standby systems, auxiliaries, and power sources in operation, unless automatic transfer is provided, and to shutdown such equipment when necessary.

- <u>Instrumentation and Alarms:</u>

  a) Personnel alarm (Dead-man alarm). An alarm must be indicated on plans that annunciates on the bridge if not routinely acknowledged at the ECC or in the machinery spaces.

  b) ECC instrumentation must be shown (continuous or demand displays) to effectively monitor vital systems. Alarms are required if the ECC is not continuously attended, i.e.; watchstander's normal activities include maintenance, a roving watch or similar activities in the machinery spaces.

  c) Plans must show that all required audible alarms will annunciate throughout the ECC and the machinery spaces.

- <u>Fire pumps:</u>

  a) Plans should indicate ECC control of the main machinery space fire pumps.

  b) Plans should also indicate remote control of a required fire pump on the navigating bridge. This must control the fire pump(s) that is required to be independent of the machinery space.

General Guidance (continued):

- Communications:

  a) Plans should show an ECC engineers' call system, which can selectively summon any engineering department member from the engineering accommodations to the ECC.

  b) The plans must show all of required communication means listed in 46 CFR 113.30-5(a)(7).

For periodically unattended machinery plan operation, submitted plans must demonstrate or include the following (46 CFR 62.50-30):

- Automatic transfer of vital auxiliaries and power sources to the back up or redundant units upon failure of operating units.
- Fuel service and treatments systems must have sufficient capacity for 24 hours of operation at normal power. For automatically filled fuel oil tanks, the capacity must at least sufficient for 8 hours of operation. A fuel oil tank low level alarm must be provided.
- Automatic or remote starting systems receivers, accumulators and batteries must be automatically and continuously charged.
- Annunciation of the engineers' assistance-needed alarm. System must be powered from the general emergency alarm system's power source.
- Manual operation of the engineers' assistance-needed alarm in the ECC (46 CFR Subpart 113.27).
- Activation of the assistance-need alarm when the alarm at the ECC is not acknowledged in the period of time necessary for and engineer to respond to the ECC from the machinery spaces or the engineers' accommodations.
- Failure of the normal power supply to the ECC alarm system.
- Extension to the bridge of ECC alarms that require immediate attention of the navigating bridge watch officer for the safe navigation of the vessel.
- All required ECC alarms must be extended to the engineers' accommodations and may be summarized visual alarm displays.
- Fire and flooding alarms must not be presented as summary alarms.
- System or equipment monitoring must be displayed and alarmed in the ECC.

General Guidance (continued):

- A fire control station, for fire protection of the machinery spaces, must be provided outside the machinery spaces, also:

  a) At least one access to the station must be independent of Category A machinery spaces.

  b) Any boundary shared by the station and the machinery spaces must have A-60 fire classification.

  c) Control and monitoring cables and piping for the station must not adjoin or penetrate the boundaries of a Category A machinery space, uptakes, or casings.

- The fire control station must include:

  a) Remote fire alarm panel to annunciate the machinery space that is on fire.

  b) Control of the fire pump that is independent of the main machinery spaces.

  c) Controls for machinery space fixed gas fire extinguishing systems.

  d) Control of oil piping positive shut-off valves located in the machinery spaces, as required by 46 CFR 56.50-60(d).

  e) The ventilation and machinery remote stopping systems required in 46 CFR Subpart 111.103.

  f) Voice communications with the bridge.

- Leakages from high pressure fuel oil pipes will be collected and collection tank high levels alarms must be provided.

- For an electrical plant that is normally supplied by one generator, suitable load-shedding arrangements must be provided to ensure the integrity of the supply to services required for propulsion and steering as well as the safety of the ship.

- In the event of a loss of a generator in operation, a standby generator must automatically start and be connected to the main switchboard in not more than 30 seconds.

- For an electrical plant supplied by more than one generator simultaneously in parallel operation, provision for load shedding to ensure that, in the case of a loss of one of the generators in operation, the remaining generators are kept in operation without overload to permit propulsion and steering, and to ensure the safety of the ship. The emergency generator cannot be used for this purpose.

General Guidance (continued):

- Automatic starting or sequential starting of low voltage release motors or equipment must not cause the standby generator to trip or cause an overload or trip of the remaining generator in operation.

Attachments:

None

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 the Marine Safety Center (MSC), the unit responsible for implementing this guidance.