

Special self-inspection guide to prevent electromechanical failures on ships

Ships should conduct self-inspections on the ship's safety technical status and electromechanical equipment in accordance with international conventions, domestic laws and regulations, and other relevant regulations, and conscientiously implement the main responsibility for safety production.

1. Is the main propulsion device (prime mover) normal?

Preventing main propulsion unit failure requires self-examination from the aspects of oil, gas, water, and electricity. It should focus on the fuel system, lubricating oil system, air system, cooling water system, and main engine control system.

- 1) Whether the fuel system of the main propulsion unit is normal (fuel supply unit, high-pressure oil pump, oil pipe, oil leakage monitoring, fuel heating, automatic fuel pump switching (if any), etc.).
- 2) Whether the communication facilities such as the console and driving platform clock are normal, and whether the nearby instruments such as the tachometer are normal.
- 3) Is the starting air system of the main propulsion device normal (main starting air bottle pressure, main air compressor, main starting valve, cylinder starting valve, air distributor, etc.)?
- 4) Whether the main engine's lubricating oil system is normal (whether there are traces of leakage in the pipelines and filter joints, whether the pressure gauge display is normal, whether the sensor joints are firm, whether the lubricating oil pump automatically switches (if any), etc.).
- 5) Whether the cooling water system of the main engine is normal (whether there are traces of leakage in the pipelines and coolers, whether the pressure gauge display is normal, whether the sensor joint is firm, whether the cooling water pump switches automatically (if any), etc.).
- 6) Check whether the host control air system is normal (control air pressure, control whether there is water in the air, etc.).
- 7) Main engine retreat measures (adjustable propeller blade pitch control system, clutch).

2. Whether the main propulsion device security, monitoring remote control, and other ancillary equipment are normal.

To prevent the failure of the security system of the main propulsion unit, it is necessary to conduct self-examination from the aspects of oil mist concentration detector, oil pressure loss protection, and overspeed protection function reliability.

- 1) Whether the main diesel engine overspeed alarm and emergency stopping device are normal.
- 2) Whether the main diesel engine lubricating oil low pressure, cylinder jacket water high-temperature alarm, and automatic shutdown protection devices are normal.
- 3) Are the main diesel engine oil mist concentration detector and main bearing temperature detector normal?

(Only applicable to sea-going ships and unattended engine rooms with diesel engine power greater than 2250KW or cylinder inner diameter greater than 300mm)
- 4) Check whether there are alarm records related to the main propulsion system security and automatic parking devices in the centralized monitoring system. (Only applicable to sea-going ships).
- 5) Whether the low-pressure oil pressure alarm device of the gear transmission device is normal. For gear transmission devices with an input power greater than 1470kW, whether the high-lubrication oil high-temperature alarm device is normal. (Applicable to sea-going ships).
- 6) For gear transmissions with input power greater than 370KW, whether the low-pressure oil alarm device is normal; for gear transmissions with input power greater than 1470kW, whether the high-temperature oil alarm device is normal. (Applicable to inland waterway vessels only).

3. Is the ship's steam boiler normal?

The boiler can adjust the oil and water temperature through steam heating to ensure that the diesel engine operates within normal operating conditions. To prevent boiler failure, it is recommended to conduct a self-examination of the water supply system, combustion system, safety protection, etc.

- 1) Whether the water supply system is normal (number of water supply pumps, water supply quality, water level indicating device, etc.).
- 2) Whether the combustion system is normal (ignition, fuel supply, air supply, etc.).
- 3) Whether the security system is normal (safety valve, air supply, flame extinguishing, low water level alarm, etc.).

4. Is the main power supply of the ship normal?

Preventing main power failure requires preventive self-examination from three aspects: prime mover, generator, and main switchboard.

- 1) Whether the main power supply capacity is sufficient (focus on the failure of single or multiple sets of generators and ships equipped with side thrusters, desulfurization towers, ballast water treatment devices, etc.).
- 2) Check whether the prime mover starts and operates normally (fuel, lubricating oil, cooling water, etc.).
- 3) Whether the prime mover security system functions normally (overspeed protection, low oil pressure, high cooling water temperature, etc.).
- 4) Whether the main switchboard and generator unit control panel are normal (automatic start, stop, parallel, de-paralleling, load distribution, graded unloading control of the generator unit, etc.).
- 5) Check whether the insulation monitoring function of the main distribution board is normal.

5. Is the emergency power supply normal?

The ship's emergency power supply (mainly the emergency generator) can be used as an independent energy source to provide power for important equipment such as steering gears when the ship's main power supply fails. The inspection of the ship's emergency power supply can be carried out from the aspects of emergency generators, emergency switchboards, emergency battery banks, etc.

- 1) Check whether the emergency generator starts and operates normally (fuel, oil, cooling water, etc.).
- 2) Whether the emergency generator starting device meets the requirements. (Only applicable to sea-going ships).
- 3) Whether the emergency generator has sufficient fuel reserve.
- 4) Whether the emergency generator mode switch for automatic starting is placed in the automatic position.
- 5) When the main power is lost, according to regulations, can power be supplied to emergency equipment within 45 seconds (inland river ships are required to within 30 seconds).
- 6) Whether the insulation monitoring function of the emergency switchboard is normal.

- 7) Whether the emergency battery pack is functioning normally.
- 8) Whether the quick-closing valve of the emergency generator fuel tank is working properly.
- 9) Whether the switches of various load units on the emergency generator distribution board are in the open position.
- 10) Are there check valves in the emergency generator compressed air bottle supply pipeline (in the emergency generator room)?
- 11) Is the fuel leakage alarm of the high-pressure oil pipe of the emergency generator normal?

6. Is the steering gear normal?

To ensure the effective operation of the steering gear and prevent steering gear failures, self-examination can be carried out from the aspects of the steering gear's electrical system, hydraulic system, alarm device, and operation.

- 1) Whether the steering gear can start automatically after power failure. (Only applicable to sea-going ships).
- 2) When the main power is lost, whether the steering gear can receive power within 45 seconds. (Only applicable to sea-going ships, rudder stock diameter exceeds 230mm).
- 3) When a single failure occurs in the electronically controlled steering gear power equipment, it should be able to switch to the backup power equipment within 10 seconds. (Applicable to river boats only).
- 4) Whether the capacity of the steering gear hydraulic oil storage tank is sufficient to refill at least one power actuator system (including the reservoir).
- 5) Whether the low-level audible and visual alarms of the hydraulic oil reservoir of the steering gear (in the cab and machinery space) are normal.
- 6) Whether the audible and visual alarms of the steering gear (short circuit protection, overload alarm, phase failure alarm) are normal (in the main engine space or in the control room and bridge where the main engine is normally controlled). (Only applicable to sea-going ships).
- 7) Is the steering performance test normal?
- 8) Whether the communication facilities between the cab and steering gear room are good.

7. Whether the crew members are competent and familiar with the operation of electromechanical equipment within their duties

To prevent ship electromechanical failures caused by human factors such as improper crew operation, it is recommended to conduct self-examination in terms of crew certificates, ship manning, crew practical operations, and emergency response capabilities.

- 1) Whether the crew holds a valid "Certificate of Competency" and whether the ship meets the minimum safe manning requirements.
- 2) Whether crew members can communicate effectively in language during daily work and emergency situations.
- 3) Are the responsible crew members familiar with the operation, testing, and emergency response procedures of the main propulsion unit (lube oil system, cooling system high-temperature alarm test, overspeed alarm test, fuel casing failure (leakage) alarm test, emergency shutdown, main engine runaway emergency response procedures wait).
- 4) Whether the responsible crew members are familiar with the operation, testing, and emergency response procedures of the ship's boiler (low water level, flame extinguishing, air supply alarm, etc.).
- 5) Whether the responsible crew members are familiar with the operation, testing, and emergency response procedures of the ship's main power supply (fuel leakage alarm test, connection, and disconnection test, insulation test, emergency response procedures for the entire ship's power loss, etc.).
- 6) Whether the responsible crew members are familiar with the operation, testing, and emergency response procedures of emergency generators (emergency generator starting, power connection, disconnection test, etc.).
- 7) Whether the responsible crew members are familiar with the operation, testing, and emergency response procedures of the steering gear (steering gear system conversion, steering gear inspection and testing before sailing, steering gear alarm test, emergency steering drills, etc.).

8. Whether the system documents related to electromechanical equipment are effectively implemented on the ship.

Whether the system documents related to electromechanical equipment are effectively implemented on the ship is an important part of preventing electromechanical failures, mainly from the on-board resources and human resources, the formulation of on-board

operation plans, emergency preparedness, accident and danger reporting and analysis, ship and equipment Conduct self-inspections on maintenance and other aspects.

- 1) Does the company ensure that the captain receives necessary support (ship-to-shore communication records, spare parts application and supply records, system document reports, technical support, etc.)?
- 2) Whether the company has qualified and certified crew members to meet various safe operation requirements on board.
- 3) Does the company ensure that crew members can communicate effectively when performing safety management system responsibilities?
- 4) Whether the company has established procedures, plans, or instructions for the operation of electromechanical equipment.
- 5) Whether the company has classified mechanical and electrical equipment failures as emergencies, marked them, and formulated emergency response procedures (main engine, ship power loss, steering gear emergency operation, and drills, etc.).
- 6) Whether the company formulates a maintenance plan for mechanical and electrical equipment and implements it according to the plan.

9. Other problems that may cause electromechanical failures in ships

In addition to the inspection of the electromechanical equipment itself, attention should also be paid to the possibility that other systems may cause problems with the ship's electromechanical equipment. For example, the malfunction of the fuel quick-closing valve may cause the accidental cutoff of the main/auxiliary engine fuel supply, the lack of mechanical and electrical equipment protection facilities may injure the crew and cause manual emergency stop of the equipment, and the failure of the bilge water system may cause engine room flooding, etc. Additional attention should also be paid to crew fatigue issues on board ships and ships leaving the shipyard after repairs at the shipyard.