Accident 1: Navigating in stormy weather

Accident 2: Activation of over-speed protection device for diesel generator

Accident 3: Loss of control power source DC24V

Accident 4: Cooling fan control circuit failure

Accident 5: During port entry standby, crewmembers set the start switch for standby diesel generators from "automatic" to "manual" to clean the lubricating oil strainers of the diesel generators. After a while, one of two diesel generators in operation stopped suddenly due to an oil leakage from its load management governor. As a result, the automatic power backup sequence could not be engaged.

Accident 6: Activation of ACB safety protection devices of the diesel generator during operation

Accident 7: Activation of safety protection device for the boiler and stopping the main engine suddenly due to sensor failure

Accident 8: After switching the valve to the middle position to receive marine diesel oil and heavy fuel oil, this caused heavy fuel oil of higher hydraulic head pressure to flow into the marine diesel oil tank. As a result, this caused the diesel generators (supplied by the marine diesel oil tank) to stop.

For more details, please refer to "Reference Material 05: Details of The investigation reports of the Japan Transport Safety Board; cases of loss of power" (Page 119).

3-3 Response to be taken by a ship in the event of an emergency

3-3-1 Diesel Engine Plant System

Before going on to talk about how a ship should respond in the case of an emergency, we will first look at the layout of the engine room's machinery and how each piece of equipment is related. The purpose of each piece of machinery in the engine room is as follows. Below is a Diesel Engine Plant System. Please see Figure 3-7.

(1) Main engine & shaft system: Generating propulsion
(2) Generator: Generating electric power
(3) Boiler: Generating the heating source mainly for fuel oil or cargo
(4) Emergency generator: Generating emergency electric power supply to the minimum critically important backup machinery when the generators cannot supply electric power.
(5) Emergency battery: Supplying power to the control system and some lighting when power cannot be supplied from an emergency generator.

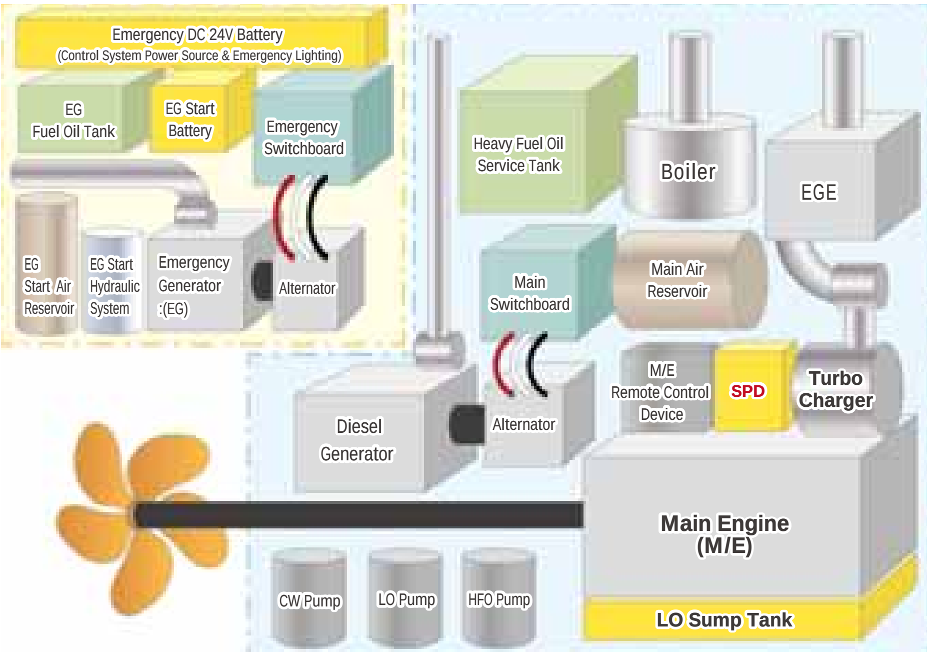


Figure 3-7 Machinery layout in engine room (Diesel engine plant system)

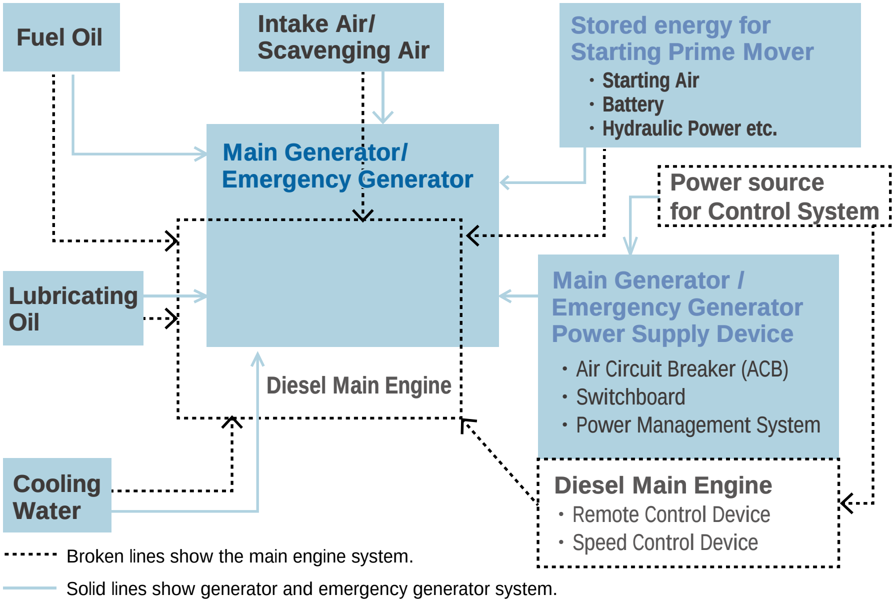


Figure 3-8　Basic configuration diagram of diesel engine system

Assuming that fuel oil supplies, lubricating oil, cooling water, intake air/scavenging air, a control device, a power supply device, or a power source for a control system is disrupted, in such a case, a diesel engine such as the main engine, diesel generators, and an emergency generator cannot operate in good order as designed. As a result, loss of propulsion or loss of power will take place. Figure 3-8 shows a basic configuration diagram of a diesel engine system.

3-3-2 Analysis of loss of propulsion

It is necessary to analyze and understand the causes behind a loss of propulsion in order to consider an appropriate response. Figure 3-9 is a diagram that breaks down the problems into elements and shows us a causal relationship among the main causes, their factors, and their elements in a step by step format. This style of visual representation is known as the Fishbone analysis.

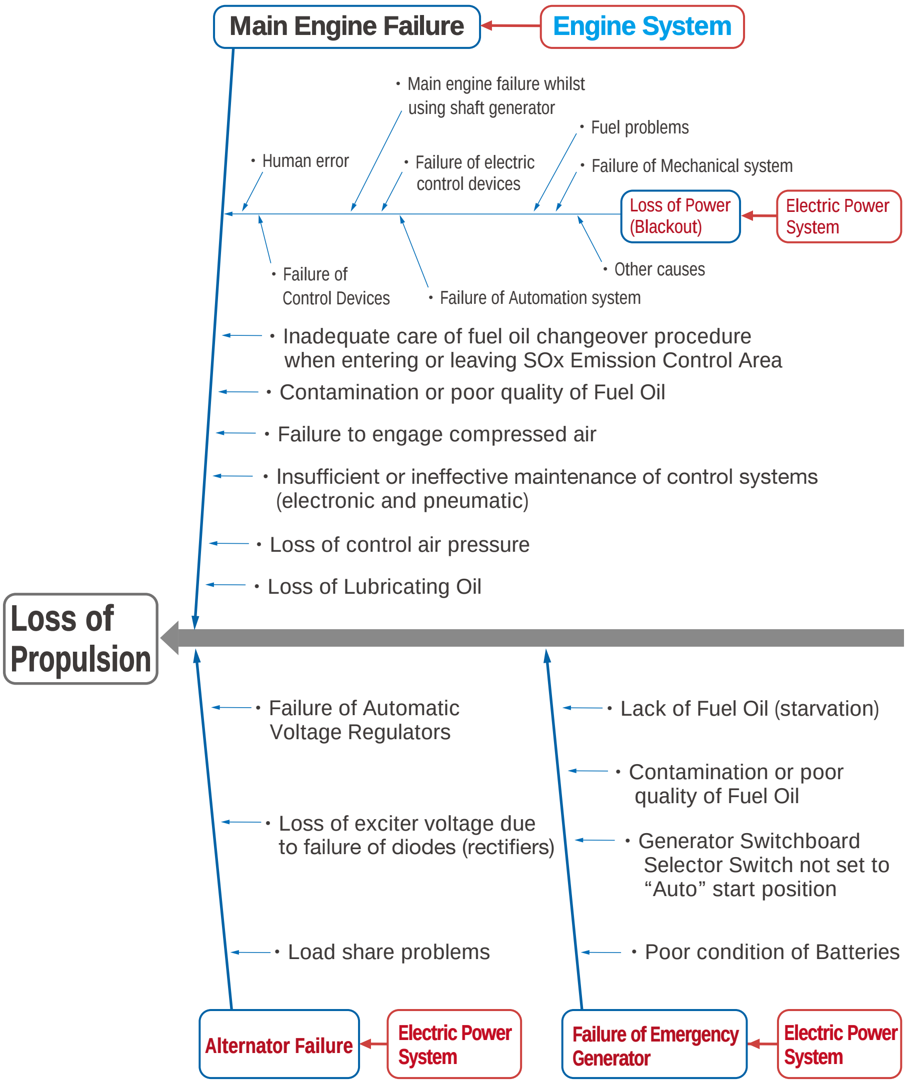


Figure 3-9 Overview of loss of propulsion and power: Fishbone analysis

As can be seen above, engine crewmembers need to manage the fuel oil, lubricating oil, cooling water, intake air/scavenging air, control devices, power supply devices, power sources, and so on, in order to maintain main engine propulsion. Furthermore, as described in the Japan Transport Safety Board's investigation reports, we must take extreme care and understand that the failure of the electric power system deeply affects the maintenance of propulsion. Therefore, it is recommended that the company and the ship review power supply system maintenance planning and an emergency response procedure to maintain the reliable operation of the main engine.

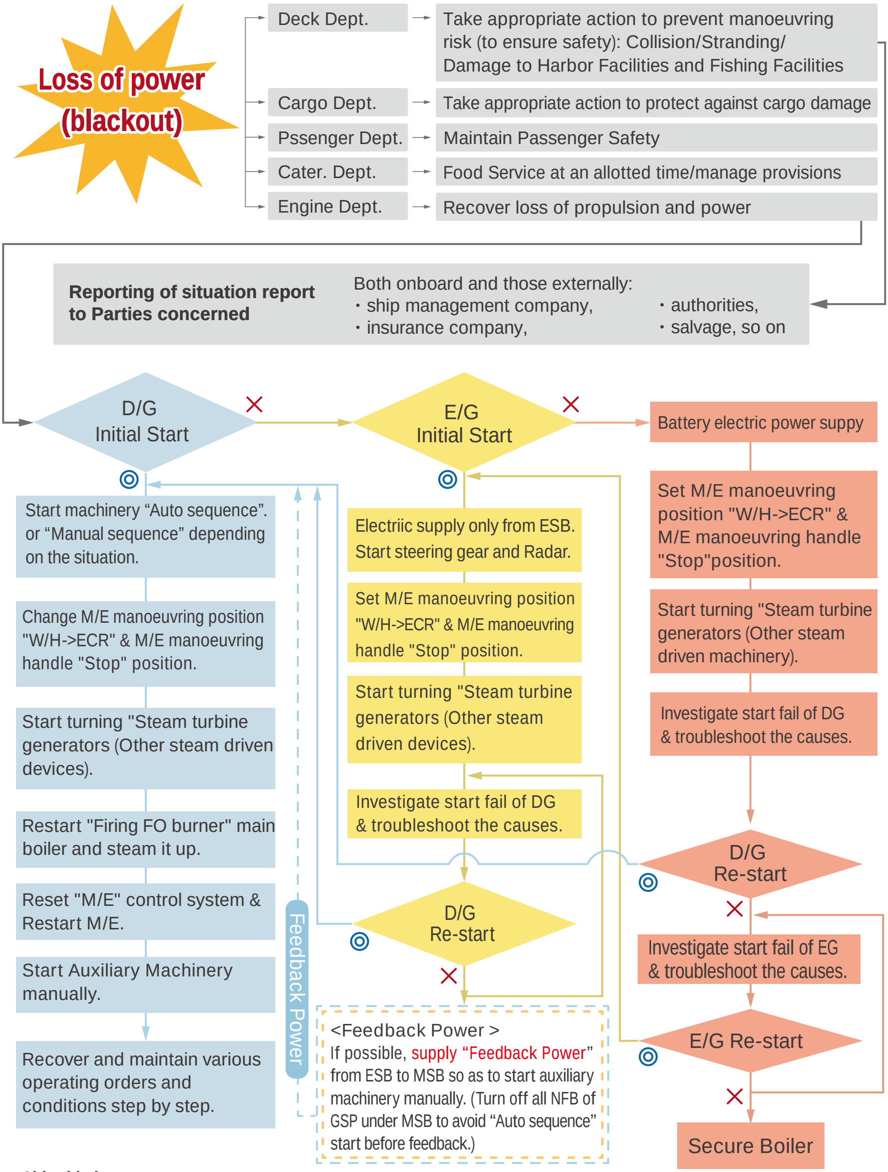
3-3-3 Emergency response when loss of power occurs (blackout)

Loss of power affects the various operations in the engine room and the entire ship. So, engine crewmembers need to take this into account and understand & respond with a recovery procedure.

It is necessary to work on an emergency response and recovery operation together with the cooperation of the entire team on board: not only the engine department alone but also the deck department, the cargo department, the passenger department, the catering department, and so on. See Figure 3-10 " Recovery flowchart for loss of power (Blackout) (Diesel Engine Plant System)".

In particular, close information sharing is required between the deck department and the engine department that is directly involved in the ship manoeuvring operation. The crewmembers need to understand that the procedure will differ depending on each power supply pattern, such as (a) successful start of diesel generator, (b) successful start of emergency generator only, and (c) only battery.

Furthermore, it is necessary to take action appropriately in accordance with the procedures specified in the SMS (Safety Management System).



Abbrebiations

M/E: Main Engine D/G: Deisel Generator E/G: Emergency Generator MSB: Main Switch Board
ESB: Emergency Switch Board W/H: Wheel House ECR: Engine Control Room FO: Fuel Oil Dept.: Department
NFB: No Fuse Breaker ◎: Yes ×: No

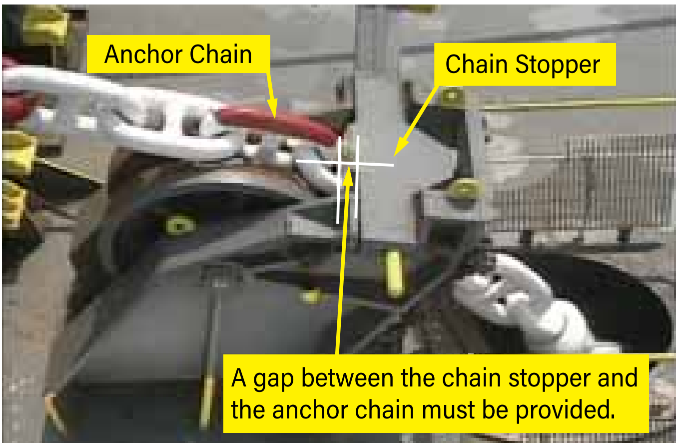
Figure 3-10 Recovery flowchart for loss of power (Blackout) (Diesel Engine Plant System)

Furthermore, it is also important that the crewmembers properly utilize the checklist, and confirm everything on it using the pointing and calling method to prevent the overlooking of a work procedure. Please refer to "Reference Material 06: Emergency response checklist immediately after loss of propulsion and loss of power" (Page 125).

Please confirm your department's appropriate response.

1 Recovery work in the Deck department = Control action for voyage risk (collision, stranding, etc.)

The first action of manoeuvring in the wheelhouse is to grasp the circumstances surrounding the ship and to appropriately take collision avoidance actions. The next thing the officer on watch needs to do is to issue safety notifications to surrounding areas by VHF and report the situation to the Maritime Safety Authority and the company. Furthermore, in the case of loss of propulsion and loss of power in coastal waters, it is necessary to consider dropping an emergency anchor as appropriate.



Photograph 3-11 Chain stopper

In particular, there are set precautions that need to be taken regarding emergency anchoring. Normally, the anchor chain is stopped using the windlass brake. The anchor must always be securely held by the force of the brake, and a gap between the chain stopper and the anchor chain must be provided, so that the chain stopper and the anchor chain do not come into contact, as shown in Photograph 3-11. If the anchor chain slips and comes into contact with the stopper, the stopper cannot be removed. In case of loss of power, the ship will not be able to operate the windlass and hence be unable to drop an emergency anchor.

Therefore, the chief officer and technical superintendent must observe and inspect the gap as mentioned above as an important item to be confirmed for Chief Officer's on-deck rounds and the Superintendent's ship visit.

2 | Recovery work in the Engine department

1) Report to the Master

The Chief Engineer should precisely identify the power supply source at that time from and distribution destination as shown in Table 3-12 "Recovery procedures for engine department (Diesel engine plant system)", and report this so that the Master can get a complete picture of the current situation, when first reporting the loss of power to the ship and the company.

Furthermore, it is easy to clarify and understand the relationship between the power supply source and the power supply destination using the "Schematic diagram of the power supply system," as shown in Figure 3-13 as a supportive aid.

Recovery procedures for the engine department

(1) Report power supply source and its destination

① Diesel generator:
Nautical instruments, communication equipment, lighting, Main engine (high power device), auxiliary machinery (boiler), fire pump, etc.

② Emergency generator:
Nautical instruments, lighting, emergency fire pumps, etc.

③ Battery only:
DC 24V control system power source, radio communication devices, etc.

(2) Recovery work

① Initial response:
Keep calm, check the current situation, share information with Wheel House.

② Second:
Pay attention to heated steam drain returning to the drain tank.

③ Sequentially:
Work on fixing the causes and restart the engine plant system simultaneously.

1) Change the manoeuvring position "W/H->ECR" of the main engine's remote control system, and set the maneuvering handle to the "Stop" position.
2) Start turning steam turbine driven machinery such as steam turbine generators if necessary.
3) Confirm that the emergency generator started and that ACB closed automatically.
4) Confirm the direct cause.
Check whether each ACB can close in order to restart the generators.
5) Automatically or manually start the standby generator and close its ACB. Alternatively, restart the generator that was running and re-close ACB.
6) Pay attention to the electric load. Start important auxiliary machinery with "Auto sequence," or "Manual sequence "depending on the situation.
7) Start up other auxiliary machinery.
8) Restart the main engine and check that each operation is fully functional step by step.
9) Investigate the root cause and establish preventive countermeasures.

Table 3-12 Recovery procedures for engine department (Diesel engine plant system)

〈 Schematic diagram of power supply system 〉

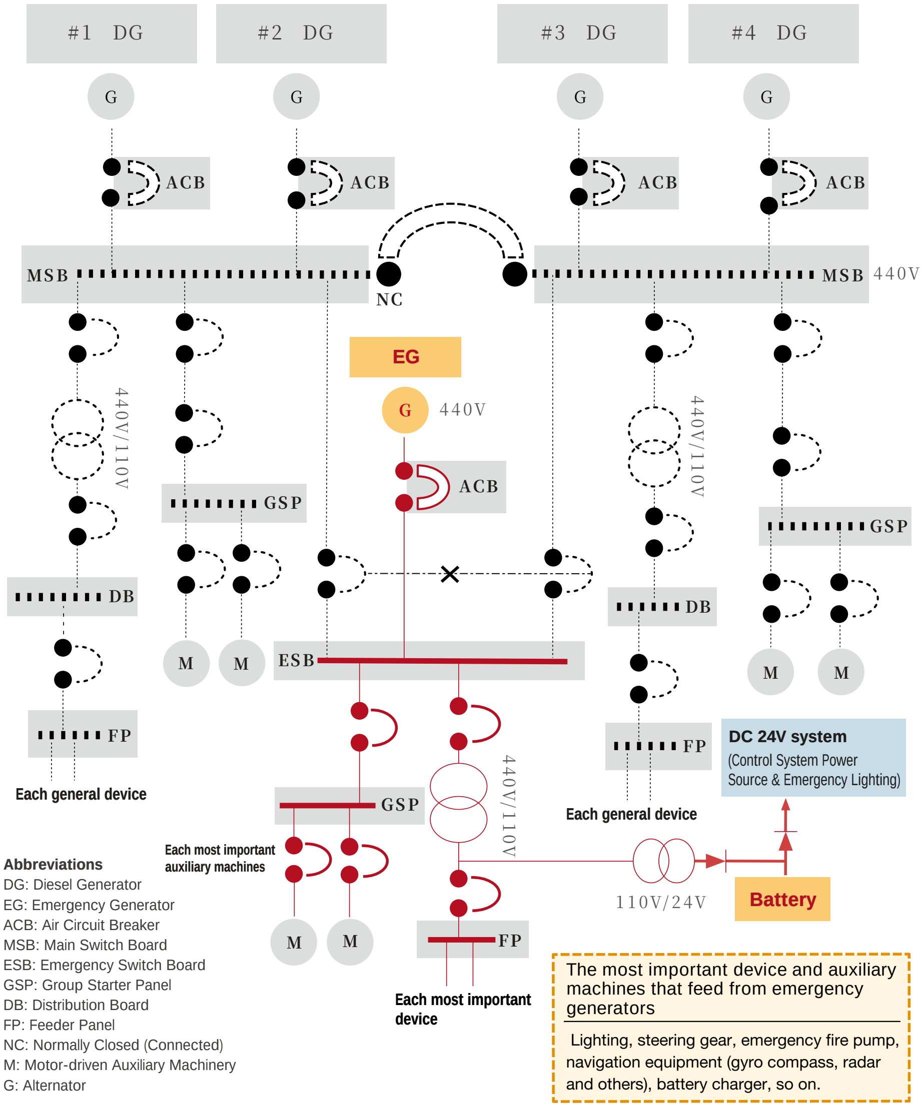


Figure 3-13 Schematic diagram of power supply system

Figure 3-14 shows the recovery work cycle. Recovery work in the engine department consists of repeating the following: “investigating causes in the engine room”, “establishing common understanding and recognition of the situation”, “repairing damage”, “trialing a test run for restart”, “understanding the stoppage/failure”, and “investigating causes”. If the recovery work is deemed to take a long time, from the perspective of fatigue, the Chief Engineer may need to consider shifting from an all-out staffing arrangement to the mobilization of a split work rotation with a second shift or a third shift and arrange for shore support if necessary.

〈 **Recovery work cycle** 〉

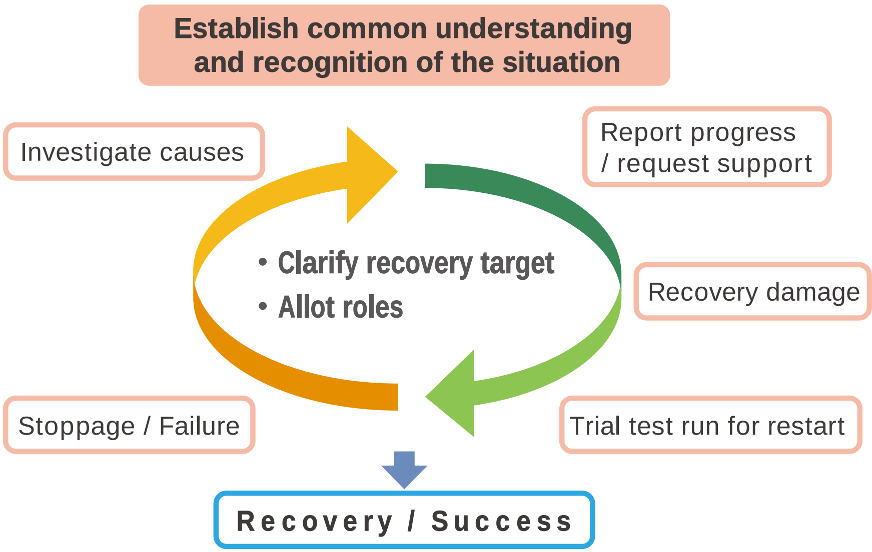


Figure 3-14 Recovery work cycle

2) Precautions for recovery work

Regarding “②Second” in “(2) Recovery work” shown in Table 3-12, even if the boiler or pump is stopped due to loss of power, the liquid (steam) may flow downstream (low pressure) due to its physical properties. Therefore please pay close attention to the water level and temperature in the atmospheric drain tank.

Regarding the recovery response pattern, in Figure "3-10 Recovery flowchart for loss of power (Blackout) (Diesel Engine Plant System)", "**blue**" represents the successful start of the diesel generator, "yellow" is the successful start of the emergency generator only, and "**red**" is battery only. The recovery procedure differs depending on the circumstances of each power supply source.

Especially when it takes a considerable amount of time to restart the diesel generator, if the ship is equipped with a switching system that allows feedback power supply from the emergency generator to the main switchboard, the ship may take advantage of it.
However, caution must be exercised when using the feedback power supply, if engine crewmembers do not have such dry docking experience, they will be unfamiliar with the operation of switching from the emergency switchboard to the main switchboard using the feedback power supply, which may lead to an insufficient emergency response. Therefore, it is recommended that the engine department carry out onboard training of the feedback power supply system when time permits, along with opportunities such as any drills necessary for an emergency response and start-up test/load test run of the emergency generator.

3) Elimination of causes

Table 3-15 shows the typical causes behind the failure of an engine system and electrical power system. Past cases from the current ship and from other similar ships will be indispensable in investigating any future cause and help build countermeasures. Engine department crewmembers must utilize such information to promptly establish the abnormality and eliminate causes during the recovery process.

Engine System

(1) Engine failure

① Diesel Generator

(a) Fuel issue

・Blocked strainer

・Blocked fuel oil supply system because of Vapor Lock

(b) Overspeed trip

・Malfunction of speed sensor

(c) Trip due to Loss of Lubricating Oil Pressure

・Blocked strainer

・Malfunction of a Pressure switch

(d) Trip due to Overtemperature of Cooling fresh water

・Malfunction of a Temperature control valve or a thermocouple sensor

② Steam turbine generator

(a) Excessive shaft vibration, movement of shaft position, High exhaust pressure, Overspeed, Loss of Lubricating Oil Pressure, etc.

Electric Power System

(2) Electrical failure

① Air Circuit Breaker (ACB: Circuit breaker between generator and bus)

・Over current

・Under voltage

・Reverse power trip

・Mechanical defect

② Switchboard bus

・Voltage: Over or under

・Frequency: Over or under

③ Control power supply

・Voltage drop

・Fuse blown, etc.

Past Cases

(3) Check and study "Analysis and Lessons learned" of past accident cases encountered.

Table 3-15 Possible loss of power causes

4) Daily operation management as preventive measures

The Chief Engineer needs to encourage crewmembers in the engine department to carry out the management of preventive measures on a daily basis, as shown in Table 3-16, in order to ensure safe and secure operation management.

In particular, it is recommended that crewmembers satisfy the following minimum requirements.

① With reference to the countermeasures of cleaning a strainer in Accident 5 shown in Table: Reference 11 “Reference Material 05: The investigation reports of the Japan Transport Safety Board; cases of loss of power”, crewmembers must never carry out maintenance of equipment on a fuel oil supply pipeline during manoeuvring standby station.

② Engine crewmembers must secure adequate electrical capacity available before starting large electric motors such as bow thrusters.

This is because the starting current of electric motors may be several times the full amount of an "on load" current.

Furthermore, regarding engine operation management and emergency generator management, assuming that the standby generating machinery cannot be started, the engine department must regularly carry out a start-up test/load test run of the standby diesel generators and emergency generator.

Daily operation management for preventive measures

(1) During manoeuvring operation on standby

① Engine crewmembers must not carry out cleaning and maintenance of strainers or fuel supply systems.

② The watchkeeping engineers must monitor the starting air pressure. The deck department's bridge team must know the limitations of starting air availability and operate the main engine appropriately. (12 times for Single screw ships: Class Rule).

③ Engine crewmembers must switch power supply from shaft generators to Diesel generators well before entering restricted waters and well before initiating a critical manoeuvring operation. They must follow the manufacturer's guidelines.

④ The ship must test the astern operation of the main engine prior to boarding of pilot and before approaching berth.

⑤ Engine crewmembers must establish that there is sufficient electrical capacity available before starting up the lateral thrusters, mooring machinery, or other heavy load equipment. They must pay special attention to the simultaneous starting of large electric motors that will lead to a large power surge and risk of overload.

⑥ The ship must test the lateral thrusters and mooring machinery well in advance of entering restricted waters and starting critical manoeuvring operations.

⑦ The ship runs two (or more) generators in parallel because Engine crewmembers must ensure sufficient power availability even if one of them stops or trips.

(2) Sharing of power load and related training

All watchkeeping engineers must have training in manually operating load share, putting generators on board, and taking generators off board.

(3) Engine operation management

① All engineers must be fully familiar with all engine room systems and their pipelines.

- They must know how to isolate one cylinder of the main engine when it fails so that the main engine can at least continue running until repair has been completed.
- They must know all operation methods of the Main engine plant system.

② Engine crewmembers must know the cause of power loss and take preventive measures.

- Fuel pressure control valve condition, a clogging strainer, damage to fuel supply piping, a lack of cooling water supply, etc.

③ Engine department must regularly carry out a start-up test/load test run of the standby diesel generators under the following conditions.

- Weekly start-up test runs: prior to port arrival and narrow channel entry.
- Load test: supply heavy fuel oil, and regular loads, for 30 minutes.

(4) Planned Maintenance System (PMS)

① The ship carries out repair/inspection/maintenance regularly.

(5) Fuel oil management

① Engine crewmembers must strictly ensure that the fuel oil viscosity and temperature control devices work accurately.

② They must drain water regularly from fuel oil tanks because they must prevent water build-up and carryover in the fuel and lower the risk of bacterial contamination/microbial infestation.

(6) Emergency response

① Engine Department must make manuals/procedures/checklists/work instructions for emergency responses such as "standby machinery failing to start".

- Engine Department must regularly conduct "Loss of Propulsion" and "Loss of Power" drills by carrying out simulations of the situations on board.

・Additionally, they need to study and include them in the procedure for supplying power via the feedback method from the emergency switchboard to the main switchboard.

(7) Emergency generator management

① Engine Crewmembers must disconnect the battery charger from the mains when carrying out weekly tests for emergency generator with a battery charger.

② Engine department must also regularly carry out start-up tests/load test runs on the emergency generator under the following conditions.

・Start-up test run: weekly.

・Load test: supplying on load as close to the maximum capacity as possible, for 30 minutes.

・The Marine Safety Agency of the UK recommends weekly tests in the Marine Guidance Note (MGN) 52, 1998.

(8) Others and incident investigations

① Properly trained personnel must investigate any loss of propulsion or loss of power and determine the root cause.

② After analysing the incident and specifying the countermeasures, the ship must work on them effectively by comprehensively evaluating and prioritizing depending on their level of importance.

Table 3-16 Daily operation management for preventive measures

3-4 Summary

According to the accident investigation report of the Maritime Safety Authorities, the following points of caution are often introduced because accidents, such as loss of propulsion and loss of power, have occurred in the world.

(1) What daily operation management of preventive measures are required onboard?

(2) How effective is the sharing of information and collaboration among related parties when a recovery operation is to be carried out together as one team on board, following the occurrence of an accident?

(3) How should the engine department establish causes, eliminate them, and work on recovery procedures, taking into account other departments' work?

While these may be understood in theory, in practice it is difficult for many to take immediate action appropriately right after a marine casualty has occurred.

Therefore, parties concerned need to prepare measures on a regular basis that deal with both the soft aspects and hard aspects of engine room management in preparation for an actual situation. It is recommended that crewmembers properly prepare and repeat practical training onboard. Please refer to “Reference Material 07: How to prevent panic” (Page 127).

Chapter 4 Prepare for Bunker Trouble (Engine accident due to poor fuel oil quality)

When engine troubles occur due to the properties of fuel oil, the causal relationship between the cause and the result becomes a moot point when it comes to claims. The ship summarizes the facts recognized as phenomena related to troubles in chronological order and prepares a statement of facts. Its purpose is to explain the situation surrounding the trouble and where the problems lie to relevant parties such as charterers. Furthermore, the ship also needs to thoroughly collect supporting documentation simultaneously.

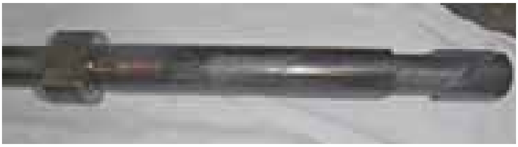
For continued safe operation, it is essential to secure fuel oil of stable quality. However, the ship sometimes faces bunker trouble (engine accidents caused by bunkering fuel oil). Therefore, in order to take precautions against bunker trouble, it is also necessary to reconfirm the preventive measures that engine crew members must adhere to daily and be well versed in methods for preserving evidence, a must when it comes to bunker trouble.

4-1 Importance of preserving evidence in time of bunker trouble

In 2018, hundreds of accidents related to severe technical problems and mechanical damage on ships due to contaminated fuel oils delivered in the Houston (USA) area and Caribbean ports such as Panama occurred.

HFO separator after one hour of operation
: blocked by heavy, hard sludge

HFO separator damaged gear due to overload caused by heavy sludge



Fuel injection pump :
the plunger was found completely seized in the barrel

Fuel booster plunger stuck in the barrel

Photograph 4-1 (a) An INTERTANKO Critical Review（An INTERTANKO Critical Review）

Sludge particles

HFO separator :
completely blocked by heavy, hard sludge

Fuel filter: visible heavy sludge,
which blocked the filter completely

Photograph 4-1 (b) An INTERTANKO Critical Review（An INTERTANKO Critical Review）

The statement that the international association of independent tanker owners (INTERTANKO) issued concerning issues that the industry needs to be aware of includes Photographs 4-1 (a) and (b).
Typical situations related to engine accidents are as follows.

> **① The fuel injection pump's plunger was seized due to chemical contaminants, which made the main engine and generator inoperable.**
>
> **② The oil purifier became blocked due to the accumulation of a large amount of sludge, thus becoming inoperable.**

When an engine accident occurs on board, engine crewmembers rush to respond to the recovery on site. So evidence of bunker trouble is prone to being misplaced or even lost. However, it is difficult to establish a causal relationship if there is insufficient evidence in the subsequent stakeholder dispute. Focusing on the seriousness of the accident, Law Offices of Toda & Co. (experts in various shipping cases) proposed the following issues and countermeasures to legally resolve an engine accident caused by bunkering fuel oil.

1.Issues:

① When the ship (shipowner) disputes the claim caused by poor quality bunkering fuel oil, the background of repair/inspection/maintenance, machinery operation, defective design, and so on is also an issue to be disputed. Since it is difficult to establish a causal relationship, the timing of fuel oil switching, the history of abnormal occurrence, and the preservation of evidence are extremely important.

② On the other hand, unfortunately, in quite a few cases, engine crewmembers always give the highest priority to inspection/repair/maintenance work on board, so they are prone to overlook the following:

a) The poor handling of damaged parts and extracted fuel oil/sludge etc.

b) The disposal of a piece of important evidence in error.

c) To put off reporting on the facts surrounding bunker trouble until later.

As a result, this only increases the risk of evidence getting misplaced or lost.

③ There have been many cases whereby evidence on board has been misplaced or lost. (Engine crewmembers are likely to discard sludge and replaced parts during onboard work.)

Point **When engine crewmembers concentrate on their daily onboard work, they are prone to forget many record-keeping tasks. As a countermeasure, if they become accustomed to recording, including date and time, work details, confirmation, and repair/inspection/maintenance, they can safeguard themselves.**

2.Countermeasures:

① To be able to take appropriate measures (following "3.Guidelines for the preservation of evidence:") in the event of an accident, the ship management company must provide regular guidance to engine crewmembers based on the importance of preserving evidence.

Point **Repeated "training".**

② When there is a problem reported from a ship, the ship management company must promptly contact the charterer to cooperate with protesting against the fuel oil supplier.

Point **Based on the designated response flow, parties perform "Report, Inform, and Consult".**

Photograph 4-2(a) Bunkering work: Sounding tank level

Photograph 4-2(b) Bunkering work: Calculating tank volume

3.Guidelines for the preservation of evidence:

Table 4-3 shows the steps for countermeasures in order to preserve evidence.

Procedure for preservation of evidence

(1) Preservation of evidence to be carried out by ship/ship management company (owner)

① Engine crewmembers must precisely record and retain Tank Sounding Records, the Oil Record Book, and the Engine Log Book in case the ship needs to ascertain if/when it started using suspect bunker oil.

② Engine crewmembers must take photographs of unusual sludge with Date/Time taken, and securely retain them.

③ Engine crewmembers must take photographs of damaged parts with Date/Time taken, and securely retain them.

④ Engine crewmembers must report in detail on Engine trouble and the sequence of events that led to it.
They must also report any trouble and how it was handled to the ship management company.
This goes especially for HFO.

⑤ The owner/ship management company must prepare the Crewmembers ' Statement
(This must include succinct details about the process leading up to the use of suspect bunker oil, damage status, and how to respond to trouble.)

⑥ Engine crewmembers and ship management company must check the accuracy of the records of the Bunker Delivery Note (BDN) every time
(to especially, check the serial number of sample bottles and the remarks.
Some supply barges try to avoid taking a bunker sample at the vessel's manifold.)
・Remarks must include the following

information:

・Where to take samples: from manifold?
・How to take samples: by way of continuous drips?
・How to witness sampling: attend bunker delivery?

※ 1 If there are inaccuracies or a lack of information in the BDN, correct it and record the remarks into the BDN.
In case the crewmembers fail to correct the records in the BDN, please immediately prepare the crewmembers 'statement for future reference.

※ 2 In case of inconsistency between the serial number of the sample bottle and the record in the BDN, the sample's testing result may not be trusted or ruled out due to it not being representative. In such a case, collect/keep the materials to prove that it is representative, such as Landing Pass, Fuel Information Sheet of the bottle, Fuel analysis report, etc.

⑦ Engine crewmembers are to safely retain the sample bottle after having taken a sample of bunker.
They must also take/safely retain a sample bottle of suspect bunker oil in the fuel tank before de-bunkering operation.
(Please pay attention not to take a biased sample when taking the sample.)

(2) Preservation of evidence to be carried out by the owner (ship management company) and charterer

⑤ The owner/ship management company must prepare the Crewmembers 'Statement as an official document. (same as above (1) ⑤)
(This must include succinct details about the process leading up to the use of suspect bunker oil, damage status, and how to respond to trouble.)

⑧ The owner (ship management company) and charterer must consider carrying out detailed testing such as GC-MS analysis as soon as possible. (CG-MS: Gas Chromatography-Mass Spectrometry)
(If necessary, they may consider a metallurgical analysis, too.)

(a) The detailed testing shall be carried out jointly by an independent and neutral laboratory with the attendance of surveyors appointed by multiple parties.

(b) Please arrange a joint survey for the testing.

(c) Before testing, please inform the parties, including Suppliers of the detailed information.

(Regarding the collection of the damaged parts, sludge, and the de-bunkered oil, it is desirable to appoint each party's surveyor to attend.)

(3) Preservation of evidence to be carried out by the charterer

⑨ The owner (ship management company) needs the Charterer's full cooperation and support to immediately collect information relating to the Supply chain (Who is the seller of the physical supplier? Who is the refinery?, etc.) of suspect bunker oil.

*3 Since it is difficult for the ship management company (owner) to pursue the supply chain where the real fuel supplier procured the fuel oil from, we recommend the ship management company (owner) ask of the Charterer's investigative cooperation to enable early settlement.

Table 4-3 Procedure for preservation of evidence

4-2 Summary

Fuel oil is supplied from the charterer to the owner (the ship) under the charter party. Safe navigation will always be guided by mutual trust which must be kept under the promise of "Quality of Fuel Oil: the fuel oil shall not include that which jeopardizes the safety of the ship or that which adversely affects the performance of the machinery", Regulation 18 of Annex VI of "The International Convention for the Prevention of Pollution from Ships (IMO MARPOL)".

Example of records related to safety management and repair/inspection/maintenance

(1) Entries in Engine Log Book, and record books, etc.

(2) Maintenance of documents and files in accordance with the SMS manual

(3) Storage of replaced damaged parts as evidence

(4) Monitoring records of machinery status related to running hours

(5) Records of damaged machinery, operating and running history, lubricant management history, planned maintenance system (PMS) documents, and inspection/repair/maintenance records

(6) Ship-shore communication records (FAX, e-mail, etc.) about onboard work management concerns

(7) Memorandums of onboard discussions between the ship (Master & Chief Engineer) and the shoreside (person in charge at the company)

Table 4-4

On the other hand, it is difficult for insurance companies to confirm the accident's history and details even if insurance companies try to handle the claim unless records such as the repair/inspection/maintenance shown in Table 4-4 are retained on the ship. Please understand that the daily onboard work records are always important pieces of evidence or records.

Chapter 5 2020 IMO compliant fuel oil

In order to prevent any adverse effects on human health and air pollution caused by ship exhaust gas, worldwide controls were put in place to reduce the emission of Sulphur Oxides (SOx) and Particulate Matter (PM) from ships in accordance with Regulation14, Annex VI of the "International Convention for the Prevention of Pollution from Ships (IMO MARPOL)".

Since January 1st, 2020, sulphur concentrations of any fuel oil used onboard have been curtailed from 3.50% m/m to the current requirement of 0.50% m/m in open sea areas outside Emission Control Areas (ECAs).

This chapter explains the precautions that crew members need to be aware of when handling low sulphur compliant fuel oil with a 0.5% m/m sulphur limit.

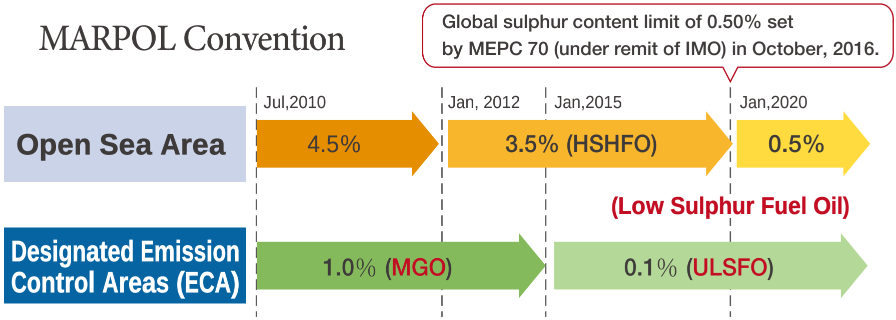
Marine sulphur Emission Control Areas

International Marine Organization Emission Control Areas

European Union Sulfur Directive

Chinese Emission Control Areas

Figure 5-1 Marine sulphur Emission Control Areas



Abbreviations HSHFO: High Sulphur Heavy Fuel Oil, MGO: Marine Gas Oil, ULSFO: Ultra-Low Sulphur Fuel Oil

Figure 5-2 Timeline of sulphur emission restrictions, prescribed under Annex VI of the MARPOL Convention (under remit of IMO)

5-1 IMO 2020 compliant fuel oil concerns

Nippon Kaiji Kyokai (ClassNK) summarized the concerns about IMO 2020 compliant fuel oil in its publication the "March 2019, ClassNK Guidance for onboard use of Compliant Fuel Oil with Sox regulation from 2020", at its technical seminar held in June 2019.

This document is an amalgamation of material and guidelines mainly taken from this seminar, and additional reference material taken from a variety of other technical documents from the marine shipping industry.

5-1-1 Production of marine fuel oils

Figure 5-3 shows the manufacturing process at a typical petroleum refinery, and the blending process required to produce marine fuel oils.

Crude oil is heated to 350°C or below and passed through an Atmospheric Distillation