**SHIP HANDLING AND MANEUVERING**

**IN CASE OF LOSS ENGINE**

## **Controlling the speed and direction of the ship**

### **Use of the engines**

In order not to jeopardise the safety of the ship, the OOW should not hesitate to use the engines to change speed on passage if the situation so requires.

Whenever possible, timely notice of intended changes to engine speed should be given to the engine room. If the ship is fitted with UMS engine controls, direct control of the engines will be possible from the bridge.

**Safe speed**

In compliance with the COLREGS, ships should at all times proceed at a safe speed. In restricted visibility safe speed may require a reduction in service speed to reduce the stopping distance of the ship. Near ice, ships are specifically required to proceed at moderate speeds. Speed changes may be required to avoid a collision in circumstances where the ship is unable to alter course.

**Control, and different engine types**

To control the main engines effectively, the OOW should be familiar with their operation from the bridge, as well as the operation of the propeller mechanism. The OOW should also be aware of any limitations the system may have, and appreciate that the type and configuration of the ship's engines could have implications when changing speed. Direct-drive diesel, diesel through gearbox/clutch, turbo-electric and gas turbine engines all have relatively quick responses to change, provided the engines are on stand-by. Geared turbines are less responsive.

**Standard Engine Orders**

Any engine order given should be repeated by the person operating the bridge telegraph(s) and the officer of the watch should ensure the order is carried out correctly and immediately.

***Order***

1. (Port/starboard engines) Full ahead / astern
2. (Port/starboard engines) Half ahead / astern
3. (Port/starboard engines) Slow ahead / astern
4. (Port/starboard engines) Dead slow ahead / astern
5. Stop (port / starboard) engines
6. Emergency full ahead / astern
7. Stand by engine

(engine room personnel fully ready to maneuver the bridge manned to relay engine orders.)

1. Finished with engines – no more maneuvering.

(operation of engines no longer required)

In vessels fitted with twin propellers, the word “both” should be added to all orders affecting both shafts, e.g. “Full ahead both”, and “Slow astern both”, except that the words “Stop all engines” should be used, when appropriate. When required to maneuver twin propellers independently this should be indicated, i.e. “Full ahead starboard”, “Half astern port”, etc.

Where bow thrusters are used, the following orders are used:

1. Bow thruster full / half to port / starboard
2. Stern thruster full / half to port / starboard
3. Bow / stern thruster stop.

**Engine room**

The ship’s engine room is the home to a variety of machinery and systems, which work together to move the ship from one port to another. Engine room professionals have to continuously work amidst such high temperature and pressure systems, which make an extremely hostile working environment.

In spite of taking all the precautions and safety measures while handling engine room machinery systems, accidents are bound of take place in the ship’s engine room. Many of these accidents are extremely dangerous not only to the ship’s properly but also the lives of seafarers. Mentioned below are ten such types of extremely dangerous engine room accidents that occur in ship’s engine room.

***1. Crankcase Explosion of Ship’s Engine***

Explosion of ship’s crankcase is one of the most dangerous accidents in the ship’s engine room which has led to devastating consequences, including loss of lives in the past.

In the engine crankcase, oil particles are churned into smaller particles of up to 200 micro meters in diameter. These small particles cannot ignite readily even with some naked flame. However, if a hot spot comes in contact with these small particles, it reduces the size of the particles, resulting in the formation of mist, which can be readily ignited with a hot spot.

In the crankcase, all the three elements required for fire are available – lubricating oil (fuel source), air, and heat from a hot spot. Coming together of all these three elements can lead to a major explosion that will not only damage the engine but also take lives of crew members.

***2. Over-Speeding of Generators***

This kind of accidents though rare have occurred in the past, causing heavy damage and loss of lives. When the ship’s generator starts, there are high changes of it to over-speed. If this occurs and the over-speed trip fails to work properly, the high RPM of the generator leads to failure of internal parts. When such situation go out of control, the internal parts such as crank shaft, connecting rod, nut-bolts etc. become loose, get detached, and are thrown away because of the high speed. If crew members do not evacuate the surrounding place in time, the loosen parts can severely harm the crew members.

***3. Boiler explosion***

Everyone working on ships has heard about boiler explosion as one of the most deadly accidents in the ship’s engine room. A highly pressurized equipment on board ships, boiler has been attached to different kind of accidents as a result of mistakes while operating them. Boiler explosion is one such dangerous accident which is caused because of the following reasons:

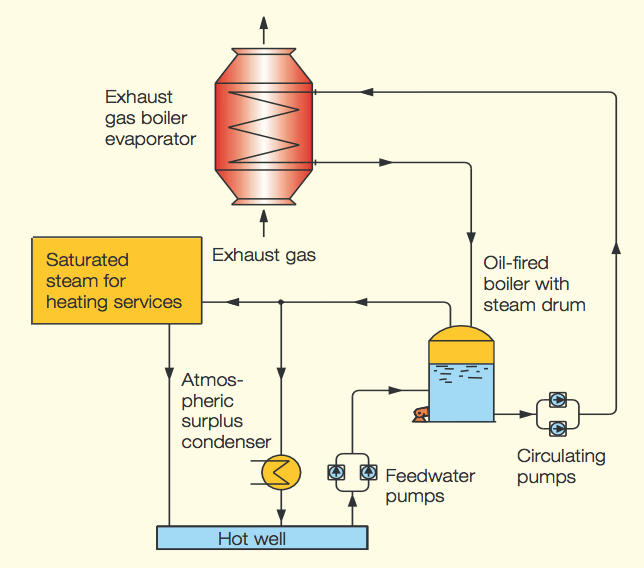
– Fuel dripping inside the furnace of the boiler. If the dripping is more and the boiler is fired after an interval, it can lead to blowback and even explosion.

– Misfiring

– Overheating of boiler due to loss of water circulation

– No pre and post purging

– Exhaust gas boiler fire



***4. Compressor Airline Explosion***

Air compressor on ships is also a highly pressurized equipment that can cause deadly accidents. Compressor’s airline explosion is one accident everyone is afraid of. Such explosions usually occurs when during maintenance, the discharge air valve in the line is closed. There is also a common practice among seafarers to shut the discharge valve of the air compressor to minimize air leakage. But when this discharge valve is not opened again while starting the compressor and if the relief valves fail to operate, the airline gets over-pressurized and explodes.

***5. High Pressure Fuel Line Bursting***

All high pressurized lines and equipment on board ships are accident prone. The high temperature and pressure fuel line which supplies fuel to the combustion chamber of marine engines can explode if proper maintenance is not carried out. Also, if the lines are not adequately secured, they can burst due to continuous vibrations and friction. Fuel line bursting leads to severe burns, injury and even death of seafarers.

As per regulations, all high pressurized pipes must be jacketed type to avoid chances of fuel leakages and sprays from the pipe joints.

***6. High Pressure Steam Leakages***

High pressurized steam lines are present in several parts of the ship’s engine room. These high temperature steam lines when burst or crack, lead to leakage of steam at extremely high pressure. Steam burns are extremely dangerous and can even cause instant death. Accidents due to steam leakages can occur because of the following reasons:

* Failure of steam joints
* Steam burns or scalding from opening of boiler mounting valves if not properly isolated or de-pressurized
* Steam line bursting due to failure of material or crack from vibration or if not properly secured

***7. Hydraulic High Pressure Components Bursting***

* Hydraulic high pressure equipment tools are used during overhauling of ship’s machinery and other important systems. If these high pressure systems are not properly tested before use, it can lead to bursting of their high pressurized parts and causing serious injury to the ship’s crew operating them. Some of the major types of hydraulic high pressure accidents are:
* Hydraulic jack oil seal leakage
* Hydraulic jack oil pipe fracture resulting in high pressure jet of oil
* Loose or worn-out connection between jack and pipe causing snapping of pipe which can harm the user

***8. Turbo Charger Explosion***

Turbo charger explosion on ships is caused when turbochargers are not cleaned for a long time. When the parts of turbo charger are not cleaned properly, the carbon deposits do not allow the parts to cool down properly. As a result, when the oil gets into the exhaust side of the turbo charger through the cracks, the heated parts and fuel source form the perfect combination of an explosion.

***9. Electrical Shocks***

Equipment and cables carrying high electrical power are extremely dangerous for people working on ships. If any kind of maintenance is carried out on such systems without isolating them properly, then there are high chances of getting electrical shocks. Moreover, accidental starting of electrical equipment during maintenance has also been a serious cause of seafarers deaths in the past. Electrical shocks frequently occur on board ships and therefore adequate precautions must be taken to prevent them.

***10. Accidental CO2 Release***

CO2 system is used to release CO2 in the ship’s engine room during fire emergencies only after all the crew has left the engine room. But accidental release of CO2, when the crew members are still present in the engine room, would lead to instant and tragic death of all. Cases of accidental CO2 release in the ship’s engine room has caused several deaths in the past.

**Note**: While testing engine room CO2 alarm, the CO2 pilot bottles should be properly isolated.

**POSSIBLE CAUSES OF MAIN ENGINE FAILURE**

***Blackout***

* Fuel oil poor quality or contamination (e.g. fines, water or bacteria inside the tank)
* Insufficient attention to proper fuel changeover procedure when entering or exiting SECA
* Failure of starting air (insufficient pressure in the bottle).

High or excessive numbers of engine starts and stops while manoeuvring will deplete pressure in the main engine start bottles. This may lead to the engine failing to start with a consequent loss of navigational control at critical times, such as when docking. It is important that the start air pressure is monitored while the ship is being manoeuvred and also vital that the pilot and bridge team are made aware of the maximum number of consecutive engine starts they can demand.

* Insufficient or ineffective maintenance of electronic and pneumatic control systems (for example, filters in pneumatic control systems are often neglected)
* Loss of control air pressure Loss of lubrication

Engine automated shut down or even slow down at a critical time

Shaft intermediate bearing failure

Stern tube bearing failure

**POSSIBLE CAUSES OF ALTERNATOR FAILURE**

* Load share issues
* Loss of exciter voltage due to failure of diodes
* Failure of AVR

**POSSIBLE CAUSES OF EMERGENCY GENERATOR FAILURE**

* Batteries in poor condition
* Failure of starting system S
* witchboard selector switch not in “auto” start position
* Fuel oil poor quality or contamination
* Fuel oil starvation

**POSSIBLE CAUSES OF BLACKOUTS**

* Human error
* Control equipment failures (e.g. governor failures, defective trips for high temperature cooling or low lube oil pressures)
* Main engine failure whilst using shaft generator (e.g. shaft generator tripping whilst auto start and load share of auxiliary generators inoperative)
* Automation failure (e.g. AVR defect or auxiliary load control / sharing failures)
* Electrical failure (e.g. overload, reverse power trip or preferential trip device failure)
* Fuel issue, e.g.: - blocked filters - poor changeover procedures - failure to bleed the stand by filter before putting it back in use
* Poor quality (for instance, water in fuel) - fuel supply piping and pump failures (fuel starvation) - loss of air control supply to fuel tank valves
* Mechanical failure, e.g.: - lack of compression - engine seizure - loss of lubrication - overheating - scavenge fires
* Other causes (e.g. fire in electrical panel / main

**PREVENTIVE (considered to be good practice)**

* Ensure correct maintenance of all equipment: engines (including their control and automation systems), purifiers, filters, fuel systems and sealing arrangements.
* Ensure that no maintenance is carried out on filters and fuel systems when on standby or approaching restricted navigational areas.
* Ensure fuel oil viscosity and temperature control equipment is accurate and fully operational.
* Ensure that all engineers are aware of how to isolate one cylinder on the main engine in the event of failure, so that this does not have to be stopped until convenient.
* Wait for the results of tests on newly supplied fuel oil to ensure that the fuel is ‘on spec’ before changing-over to the new one. It is recommended not to mix bunkers from two different suppliers in the same tanks.
* Ensure water is regularly drained from fuel oil tanks, in order to prevent water build up and carryover in the fuel and to lessen the risk of bacterial contamination / microbial infestation.
* Removal of water or reducing its presence to a minimum is the best method to prevent microbial infestation.
* Ensure that system temperature and pressure alarms, fuel filter differential pressure transmitters, etc. are accurate, tested and operational.
* Ensure that engineers are fully familiar with all engine room systems and their pipelines, including the changeover procedures from heavy fuel oil to MGO / LSMGO / ULSMGO and vice versa.
* Engineers should also be familiar with the method of changing from remote control to local control of valves and equipment.
* Establish ‘failure to start’ / blackout procedures / checklist as well as emergency response manual / procedures / checklist / instructions. These should include familiarisation with operation locally and from the engine control room, as well as information to ensure control of the vessel’s propulsion when operating on emergency power.

# Blackout Situation on a Ship: What are the First Steps that Should be Taken?

Blackout is one condition each and every mariner is familiar with and also afraid of. It is one situation everyone on the ship is terrified of because it brings the whole ship to a standstill. From the bridge to the engine room, from dining crew members to the sleeping ones, everyone is affected by a blackout.

## **Understanding Blackout Condition**

Blackout condition is a scenario on a ship, wherein the main propulsion plant and associate machineries such as boiler, purifier and other auxiliaries stop operating due to failure of power generation system of the ship – Generator and alternator.

With technologies and automation, measures are provided to avoid such blackout situations by means of autoloading sharing system and auto standby system in which the generator set that is running in parallel or standby comes on load automatically if the running diesel generator fails.

## **What to Do in Case of a Blackout?**

In case of Blackout following precautions and actions should be taken:

* Never panic in such a situation, be calm and composed. An emergency generator will restore the power in no time.
* Inform Officer on bridge briefly about the condition.
* Call for manpower and inform the chief engineer.
* If the main propulsion plant is running, bring the fuel lever to zero position.
* Close the feed of the running purifier to avoid overflow and wastage of fuel.
* If the auxiliary boiler was running, shut the main steam stop valve to maintain the steam pressure.
* Find out the problem and reason for blackout and rectify the same.
* Before starting the generator set, start the pre- lubrication priming pump if the supply for the same is given from the emergency generator; if not, then use a manual priming handle (provided in some generators).
* Start the generator and take it on load. Then immediately start the main engine lube oil pump and main engine jacket water pump.
* Reset breakers and start all the other required machinery and system. Reset breakers that are included in preferential tripping sequence. (Non-essential machinery).
* It requires both skill and patience to tackle a situation like a blackout especially when the vessel is sailing or manoeuvring. However, the best way to tackle such situations is to be calm and composed; and to know your engine room and machinery very well in advance.

The main causes of propulsion loss by the London P&I club members’ ships and for which P&I investigation was required during the last five full P&I years are as follows:

Main engine failures and blackouts which result in large claims tend to occur when a ship is at its most vulnerable. The stable electrical consumption which is a characteristic of a ship during deep sea passage is replaced by more volatile or variable consumption requirements due to additional load placed on the electrical generation equipment when the ship begins manoeuvring in more confined waters (e.g. by starting supplementary machinery such as additional steering motors, starting and stopping bow thrusters, starting general service pumps, powering up hydraulic equipment and running deck machinery). Compliance with the low sulphur fuel regulations and changes from one grade of fuel to another has added to incidents of propulsion failures and power interruptions

**THE CHECKLIST MAIN ENGINE FAILURE**

|  |  |  |
| --- | --- | --- |
| Action to be carried out: | | |
|  |  |  |
|  |  | Inform master |
|  |  |  |
|  |  | Prepare for anchoring if in shallow water |
|  |  |  |
|  |  | Exhibit ‘not under command’ shapes/lights |
|  |  |  |
|  |  | Commence sound signalling |
|  |  |  |
|  |  | Broadcast URGENCY message to ships in the vicinity if appropriate |
|  |  |  |
|  | | |
|  | | |
| Other actions | | |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**URGENCY MESSAGES**

An urgency message is one containing urgent information relating to a ship, aircraft or person. For example:

* man overboard;
* lost propeller;
* permanent loss of power;
* announcing and identifying medical transports; .
* communications concerning medical advice.

The urgency signal should only be sent on the authority of the master.

If using terrestrial communications, the urgency announcement should be made on one or more of the DS.C distress frequencies contained in annex A6. The actual urgency message which follows should be sent on one or more of the radio telephony/telex frequencies for follow-up distress traffic.

If using satellite communications, it should be noted that ship earth stations only have 'distress' and 'routine' priority levels. Inmarsat has therefore devised a system of two-digit codes for urgency and safety communications. Not all coast earth stations accept all the codes.

**Standard Urgency Message**

**Structure**

After the transmission of a DSC Urgency Call switch the transmitter to VHF Channel 16 or frequency 2182 kHz (if not automatically controlled) and commence the urgency traffic as follows:

PAN-PAN (repeated three times)

ALL STATIONS (repeated three times)

THIS IS

* The 9 digit Maritime Mobile Service Identity code (MMSI) plus name / call sign

or other identification of the vessel calling

* The position of the vessel
* The text of the urgency message

**Example**

* PAN-PAN PAN-PAN PAN-PAN
* ALL STATIONS ALL STATIONS ALL STATIONS
* THIS IS TWO-ONE-ONE-TWO-THREE-NINE-SIX-EIGHT-ZERO

MOTOR VESSEL “BIRTE” CALL SIGN DELTA ALPHA MIKE KILO

* POSITION SIX TWO DEGREES ONE ONE DECIMAL EIGHT MINUTES NORTH
* ZERO ZERO SEVEN DEGREES FOUR FOUR MINUTES EAST
* I HAVE PROBLEMS WITH ENGINES
* I REQUIRE TUG ASSISTANCE