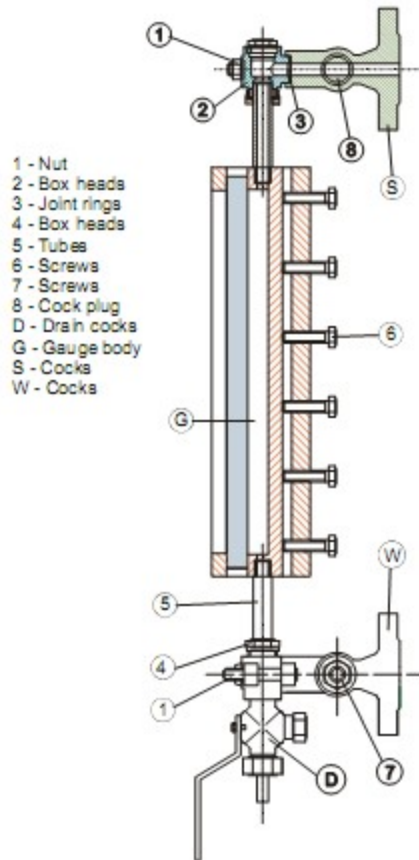


### Working of Boiler Gauge Glass

A gauge glass has two different compartments – top side and bottom side, connected to two different sections of a boiler. The top side of the gauge glass is connected to the steam side of the boiler and the bottom side is connected to the water side of the boiler. The pressure on both sides will equalize and the level of water can be seen in the gauge glass.

### Maintenance During service check up.



Refer the diagram for better understanding of boiler gauge glass.

- Check the nut (1) and tighten if necessary.
- Bolts on the boiler flanges are to be checked, if loose tighten them.
- Check if union nuts are loose.
- Bolt from screw 7 with cocks in open position.
- If the leak can not be stopped from water side on the gauge glass by tightening the screw 7 then the sealing surface of the cock plug 8 may be damaged or corroded.

### Gauge glass blow down procedure

Gauge glass should be blown before lighting up of boiler, after stopping the boiler and regularly if the level in gauge glass is suspected to be wrong.

### Cleaning the water side of gauge glass

- Close the valve S and W as shown in the figure.

- Now open the cock W and see if the water is coming out of the drain valve D indicating the drain line is clear.
- Now close the drain valve D and keep the cock W open and see if the water level rises in the gauge glass; this indicates the line to gauge glass is also clear.
- Repeat the steps two to three times to remove nuds and deposits inside.

#### **Cleaning the steam side of gauge glass**

- Close both the cocks S and W.
- Now open the cock S and open the drain valve D and see the steam is coming out. The drain is opened only for 1-2 seconds only as steam may damage the sealing and service life decreases.

#### **Putting the gauge glass in normal operating position**

- Close all the valves S, W and the drain valve D.
- Now open the cock W and let the water fill inside the gauge glass.
- Now open the cock S and then the level can be seen as the pressure equalizes.

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## **Blow-Down Procedure for Marine Boilers**

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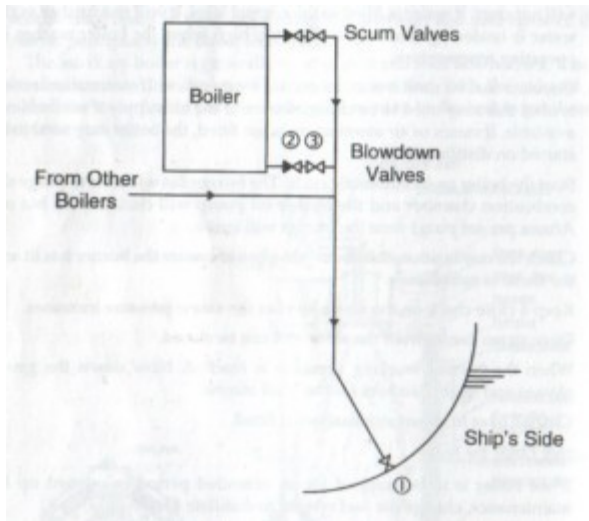
### **Boiler blow down**

Boiler blow down is done to remove carbon deposits and other impurities from the boiler. Blow down of the boiler is done to remove two types of impurities – scum and bottom deposits. This means that blow down is done either for [scum or for bottom blow down](#). Moreover, the reasons for boiler blow down are:

1. To remove the precipitates formed as a result of chemical addition to the boiler water.
2. To remove solid particles, dirt, foam or oil molecules from the boiler water. This is mainly done by scum valve and the procedure is known as “scumming.”
3. To reduce the density of water by reducing the water level.
4. To remove excess water in case of emergency.

### **Procedure for Scumming and Bottom Blow Down**

Below is the procedure for boiler blow down using the blow down valve located at the bottom of the boiler. In order to do scumming, instead of bottom blow down, the scum valve is to be opened.



Steps for blow down procedure are as follows:

Kindly refer the diagram to understand the blow down procedure properly.

1. Open the overboard or ship side valve(1) first.
2. Open the blow down valve (2), this valve is a non-return valve.
3. The blow down valve adjacent to the boiler (2) should be opened fully so as to prevent cutting of the valve seat.
4. The rate of blow down is controlled by the valve (3).
5. After blow down close the valve in reverse order.
6. A hot drain pipe even when all valves are closed indicates a leaking blow down valve.

## **STARTING AND STOPPING BOILER**

In this article we have brought to you a step-by-step procedure for starting and stopping a boiler on a ship. With this procedure you can never go wrong, as far as boilers are concerned. Starting and stopping a boiler was never so easy.



### **Starting a Boiler**

It is to note that the following steps may not apply to all types of boilers and each boiler requires some additional steps to be followed as per its system design. However, the basic steps remain the same:

1. ✓ Ensure that the vent valve on the boiler is open and check there is no pressure in the boiler.
2. ✓ Check that the steam stop valve is closed.
3. ✓ Check that all the valves for fuel are open, and let the fuel circulate through the system until it comes to the temperature required by the manufacturer recommendation.
4. ✓ Check and open the feed water valves to the boiler and fill the water inside the boiler drum to just above the low water level. This is done because it is not possible to start the boiler below the low water level due to safety feature which prevent boiler from starting. Also, the level is not filled much because if filled too much, the water inside the boiler might expand and over pressurize the boiler.
5. ✓ Start the boiler in automatic mode. The burner fan will start the purging cycle which will remove any gases present in the furnace by forcing it out through the funnel.
6. ✓ After the pre-set purge time the pilot burner will ignite. The pilot burner consists of two electrodes, through which a large current is passed, via the transformer, producing the spark between the electrodes. The pilot burner is supplied with diesel oil and when the oil passes over, the former ignites.
7. ✓ The main burner which is supplied by heavy oil catches fire with the help of pilot burner.
8. ✓ Check the combustion chamber from the sight glass to ensure the burner has lit and the flame is satisfactory.
9. ✓ Keep a close eye on the water level as the pressure increases and open the feed water when the level of water inside the gauge glass is stable.
10. ✓ Close the vent valve after the steam starts coming outside.
11. ✓ Open the steam stop valve.

12. ✎ Once the working steam pressure is reached, blow down the gauge glass and float chambers to check for the alarms.

#### **Stopping a boiler**

1. ✎ If the boiler is needed to be stopped for longer duration for maintenance or opened up for survey, change the fuel to distillate fuel.
2. ✎ If separate heating arrangement for heavy oil is present then there's is no need to change over to distillate fuel and the oil is kept on circulation mode.
3. ✎ Stop the boiler automatic cycle.
4. ✎ Close the steam stop valves.
5. ✎ Close the boiler feed water valves.
6. ✎ When the boiler pressure is just reduced to over atmospheric pressure the vent valve is kept open to prevent vacuum formation inside the boiler.

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## **Boiler Mountings:**

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- 1) **Main steam Stop Valve:** The steam generated in the boiler is supplied to the main system through this v/v. It is normally non-return type of valve.
- 2) **Auxiliary steam Stop Valve:** If there is separate steam line provided for small auxiliary system, it is supplied through this valve. The valve is smaller in size and usually of a non-return type.
- 3) **Safety valve:** In the event of unsafe excessive pressure inside the boiler, the safety valve comes in action to release the overpressure. The lifting pressure of the valve is set prior to its installation and locked in the presence of a surveyor so that it not changed later on. Safety valves are generally installed in pairs.
- 4) **Water level gauge glass:** Gauge glasses are also fitted in pairs for manually checking the water level inside the boiler drum. It is on the basis of the boiler pressure that the construction of the gauge glass is decided.
- 5) **Air release valve or boiler vent:** This valve is fitted in the headers, boiler drum etc, to avoid imploding of boiler when it is depressurized or when initially raising the steam pressure.
- 6) **Feed check and control v/v:** This valve controls the supply of steam supply as per the demand and is fitted in both main and aux steam line after the stop valve. They are non-return valves with a visible indication of open and close position.
- 7) **Pressure gauge connection:** This pressure gauge can be fitted in super heater, boiler drum and wherever it is necessary to read the pressure reading.
- 8) **Blow down valve:** It is used to empty the boiler completely for maintenance purpose or for water treatment of boiler when the chloride level becomes very high.
- 9) **Scum blow down valve:** It's a shallow dish type arrangement fitted at the normal water level which allows the blow down of floating impurities, oil foaming etc from the water surface.
- 10) **Sampling connection:** Generally, a sampling water cock arrangement is also fitted with cooler in series so that water sample can be collected at any time for feed water analysis.
- 11) **Whistle valve:** If there is a provision for steam whistle in the ship, then steam is supplied directly from the boiler through a small bore type non-return valve known as whistle valve.

- 12) **Low Level alarm:** A device used to initiate audible warning at low water level condition.
- 13) **Soot blowers:** Required to blow the soot and the combustion products from the tube surfaces. It is operated by steam or compressed air.
- 14) **Automatic feed water regulator:** Device which is essential to ensure appropriate water level in all load conditions and is fitted in the feed line. Multiple element feed water control system is used in boilers with high evaporation rate.

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## Boiler Starting Failure - Troubleshooting

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### 1) **Fuel inlet valve to the burner is in close position:**

The fuel line for boiler's burner consists of several valves located at fuel tank, pumps suction, discharge valve, or valve before the boiler burner. Any of these can be in closed position resulting in starvation of fuel.

### 2) **Line filter at the inlet of the fuel line for burner is choked:**

If the system runs in heavy oil then there are chances of filters in the line getting choke. To avoid this, boiler system are normally built for changeover from diesel to heavy oil during starting and heavy to diesel during stopping. This keeps the filter and the fuel line clean.



### 3) **Boiler fuel supply pump is not running:**

There are two main reasons for fuel pump not running. Normally when the pumps are in pairs, the change over auto system is kept in manual position, and if the operating pump trips, the stand by pump will not start automatically. Another reason is tripping of pump due to short circuit in the system etc.

### 4) **Solenoid valve in the fuel supply line is malfunctioning**

Nowadays most of the system adopts advance automation, but there can be a possibility wherein the solenoid in the fuel supply line is malfunctioning and not opening.

**5) Flame eye is malfunctioning:**

A Flame eye is a photocell operated flame sensor fitted directly on the refractory to detect whether the burner is firing or not. If the flame eye unit is malfunctioning, then it will give a trip signal even before the burner starts firing.

**6) Air or Steam ratio setting is not proper**

For proper and efficient combustion, air fuel ratio is very important, if the supply of air is excess then there will be excess of smoke, and if it exceeds more than normal level the combustion will burn off causing flame failure.

**7) Forced draft fan flaps malfunctioning**

For removing excess gases trapped inside the combustion chamber forced draft fan (FDF) are used for pre purging and post purging operation and are connected with a timer to shut the fan flaps. If the flaps are malfunctioning then continuous forced air will go inside the chamber, preventing the burner to produce flame causing flame failure of the boiler.

**8) Any contactor switch inside Control panel is malfunctioning**

Boiler control panel consist of several contactors and PLC cards. Even one contactor malfunctioning may result in trouble for boiler starting.

**9) Trip not reset**

If any previous trips like low water level, flame failure, emergency stop etc. has not been reset then boiler will not start.

**10) Main Burner atomiser is clogged**

Main burners consist of atomizer for efficient burning of fuel. If the atomizer is clogged by sludge and fuel deposits then burner may not produce flame and trip the boiler..

**11) Pilot Burner nozzle is choked :**

A Pilot burner nozzle is very small and can be blocked by carbon deposits and sludge resulting in flame failure. Some pilot burner consists of small filter which can be clogged after continuous operation resulting in flame failure because of carbon accumulation.

**12) Electrodes are not generating spark**

Initial spark for generating a flame is produced by electrode which may be due to carbon deposits on them or fault in the circuit of electrodes etc.