

Water is boiler's life. The parts which preside over the feed water control are very important. If the boiler is used under the no water condition, the boiler tubes soon deform, and are useless. Then, at this time, we would like to introduce the typical trouble cases concerning the feed water control.

We received the request of boiler maintenance because the feed water control did not work from the ship during voyage, and then we sent our service engineer. When we check the condition before visiting the ships, "The water can be supplied under the manual circuit, but after changing to the auto operation, the water supply does not start although the water level is lower than the position of feed water START in the water gauge glass. Moreover, the condition does not change in spite of electrode cleaning after pulling out. Is the control circuit trouble?"

When the service engineer visited the ships and checked the boiler, there were no any troubles with the control circuit. Next, they carried out the electrode resistance and insulation check, and then we found out that the resistance is normal, but the insulation is low. Then, we replaced the electrode holder with a new one. As the result, the boiler becomes the normal condition.

The cause of this case is low insulation of the electrode holder. The electrode holder and water level detection rod are the important parts for boiler water level control. If the inferior resistance is caused, the water cannot be detected and the feed water pump cannot stop. Moreover, if the inferior insulation is caused, the judgement is always "water is contained", so, water is not supplied, and then it causes the over heat accident and tube deformation.

We would like to explain about electrode holder and water level detection rods.

Four sets (or Five sets) of the water level detection rods are in the water level detention tube as the next Figure 1. They electrically detects the water level, then starts and stops the feed water pump automatically, outputs the alarm at the low water and the signal for the burner auto-stop at the low low water level.

The water level detection rods may get dirty by the condensed boiler water, and it causes the error operation. Therefore, after pulling out the electrode holder, remove the dirt adhered to the teflon part with the cloth and remove the dirt adhered to the metal part with the sand paper once a month. At this time, carry out the resistance and insulation check. Moreover, check that there are no any bends of the water lever detection rods.



Figure 3

The checking procedure is the followings.

- 1. Resistance check with the tester (Resistance check between A and B)
 - *For analog type tester

Check that the resistance is 0Ω with "X1 Ω " range.

*For digital type tester

Check that the measuring value is almost same as the value at the test rod short-circuit.

2. Insulation check with the DC500V megatester.

Measure the insulation resistance speedy after immersing the megatester, below C section in water and then removing, in order to make the condition same as the boiler operation. (as shown in Figure 3) Read the measuring value within 2 to 3 sec. after the measuring starts because the resistance value varies as the time passing. Make sure that the insulation resistance is $0.1 \text{ M}\Omega$ and more.

Except those cases, there are some cases which cause the inferior water supply, such as inferior water level detector and poor feed water pump capacity.

Next, we would like to explain the feed water sequence control.

- 1. In case of float less switch
- 1) Main circuit

The feed water pump switch SW can change the operation. As adding the voltage on the feed water circuit, if the water level is below the position of the feed water pump ON, the float less switch (33W1) starts to run, the voltage is added on the solenoid switch, the feed water pump rotates and water supply starts. Moreover, in the event of overload by the thermal relay, the trop stops the water supply to protect the motor.

2) Control Circuit

We have already explained to detect the water level with the water level detection rod inserted the water level detection tube, moreover see the float less switch operation details in the drawings for relations to the relay. Each of the float less switches (33W1,33W2) has two types of the relay called U1 and U2, U1 and U2 are operated by 24V secondary voltage caused by 100V operation power source. The float less switch and electrode rod are connected to the terminal E10,11,12,13 and E20,21,22,23. As the figure shows, in case of 33W1, U1 starts to run once the voltage starts after current carrying of E13 and D11 through the medium of water, U2 operates after immersing E10 and E13 in water.

3) Operation Explanation

a) In case of no water, U1 does not start to run, then the contact of 33W1,2 is the same as the drawings, the pump rotates after Tc2 and Tb1resistance (0Ω).

b) The pump rotates until U1 starts to run and the contact changes, when the water level reaches A and A', the voltage starts through the medium of water, U1 starts and the pump stops.

c) The pump does not stop until both U1 start to run (that is, until the water level reaches E11 and E21.)

d) When U1 starts to run, and contact point of U1 on 33W1, 33W2 terminal E2 changes.

e) When the feed water pump stops, B contact point of 88W1, 88W2 returns and resistance is 0Ω . Then, U1 resistance becomes 0Ω through E13, E3, U1, U1 contact point E2, 88W1, 88W2, E12(or E22) and maintains the operation.

f) Therefore, U1 keeps the operation through e as contacting E12, E22 even if the water level is low and separates from E11, E21

g) U1 continues the operation until the water level below both E12, E22 because of E12, E22 short-circuit. When the water level is below both E12, E22, U1 stops the operation and the pump starts to rotate.

h) The above mentioned is the normal condition, if the pump does not rotate or water does not go into the boiler for some reason or other, the water level goes down, and then the alarm sounds to warn you when the water level is below the low water level.

2. In case of LM1-200



LM1-200 is the water level detector, the parts from the water level detecting to sequencer output constructed by 2 sets of the former float less switch are unified into one unit without sequencer program modification and connecting change. For feature, 1. Connecting by voltage of both 100V/200V is possible. 2. The relay is not used, output is open collector. 3. IC on the detecting side can be replaced.

< IC Replacement Procedure >

1. Remove LM1-200 from the control box. Remove 5 sets of the screws on the back cover, and then pull out the printed-circuit shown in the diagram.

2. Remove the parts (IC TC4584) shown in the diagram by using the minus driver. (Use the tool for pulling ROM if you have.)

- 3. Adjust IC to fit the socket.
- 4. Adjust the direction of the parts to the mark of the parts, and then install it to the socket.
- 5. Assemble and install it to control BOX.



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