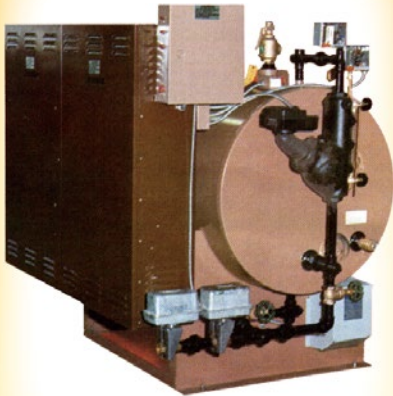


ELECTRICALLY HEATED BOILERS AND THEIR OPERATION



Occupational Safety and Health Branch
Labour Department



ELECTRICALLY HEATED BOILERS AND THEIR OPERATION

Owners of electrically heated boilers must take note of the following before operating and using the boilers:

- The boilers have been registered with the Boilers and Pressure Vessels Division (BPVD) of the Labour Department (LD);
- The boilers have been inspected periodically for safe operation;
- The boilers have been issued with valid “Certificates of Fitness” before use; and
- The operation of the boilers must be under the direct supervision of a competent person.

Registration and Examination

The owner must apply to the BPVD of the LD for registration of the boiler, and to obtain a registration number, at least 30 days before putting the boiler into operation.

Before a boiler can be put into use, the boiler and its accessories must be inspected by an Appointed Examiner, the safety valve must be properly sealed and a “Certificate of Fitness” must be issued.

The boiler and its accessories must be properly maintained and should be inspected by an Appointed Examiner every 14 months and reissued with a “Certificate of Fitness”.

Operating a boiler without a valid “Certificate of Fitness” is an offence and the owner on conviction is liable to a maximum fine of HK\$50,000.

Competent Person

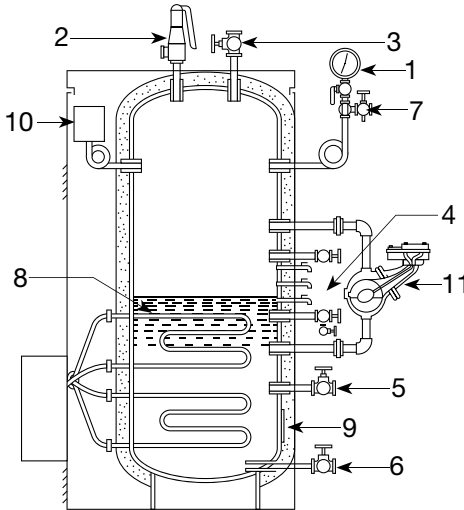
An operating boiler generates high pressure steam. If the operating boiler is not properly managed and maintained, it can lead to serious accidents with loss of lives and property. Section 49(7) of the Boilers and Pressure Vessels Ordinance (BPVO) stipulates that no boiler shall be operated except under the direct supervision of a competent person whose certificate of competency issued by the BPVD of the LD certifies that he is competent to operate the boiler of the class. In the event of a contravention of the aforesaid legislation, the owner of the boiler is liable to be prosecuted subject to a fine up to HK\$30,000.

Electrically Heated Boilers and Their Major Accessories

Electrically heated boilers make use of electric current running through a heating element to create heat, to boil water into high-temperature and high-pressure steam. They can be classified into the automatically controlled and the manually controlled types. The designs of both types are similar with some common accessories, such as the safety valve, pressure gauge, water gauge, valves, pressure switch and low water level alarm.

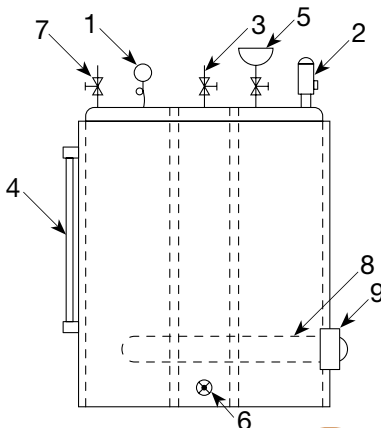
Automatically controlled electrically heated boilers maintained adequate water level and steam pressure in the boiler by the automatic control system; the water level and steam pressure of manually controlled electrically heated boilers are monitored by a competent person.

Automatically Controlled Electric Steam Boiler



1. Steam Pressure Gauge
2. Safety Valve
3. Steam Outlet Stop Valve
4. Water Gauge
5. Feed Water Valve
6. Drain Valve
7. Air Vent Valve
8. Heating Element
9. Inspection Cover/Hole
10. Pressure Control Switch
11. Automatic Water Level Controller

Manually Controlled Electric Steam Boiler



1. Steam Pressure Gauge
2. Safety Valve
3. Steam Outlet Stop Valve
4. Water Gauge
5. Feed Water Valve
6. Drain Valve
7. Air Vent Valve
8. Heating Element
9. Inspection Cover/Hole

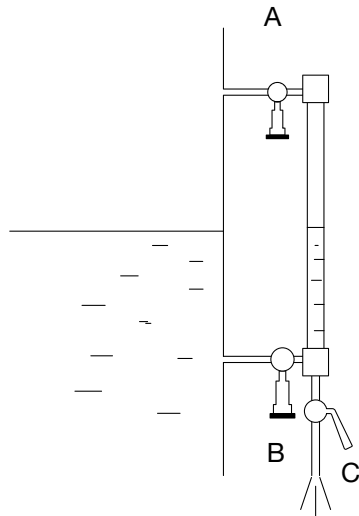
Operation of Electrically Heated Boilers

Starting up procedures

Competent persons should proceed in accordance with the following procedures when starting up electrically heated boilers at room temperature:

1. Familiar with the operation manual of boiler makers and accessories makers;
2. Check the "Certificate of Fitness", confirm that the certificate is valid and the maximum permissible working pressure (MPWP) of the boiler is marked on the pressure gauge with a red line;
3. Close the drain valve;
4. Open the water cock and the steam cock of the water gauge and close the drain cock of the water gauge;
5. Clean and check the filter of the feed water system;
6. Shut the steam outlet stop valve and open the air vent valve;
7. Turn on the power switch, the automatically controlled electrically heated boiler will be filled up with water into the boiler automatically up to the middle of the water gauge, but the water level of the manually controlled electrically heated boiler is controlled by a competent person;
8. Switch on the heater at low heating rate to heat up water inside the boiler and raise steam pressure gradually;
9. Shut the air vent valve when steam comes out of the air vent and switch to high heating rate. The steam pressure will gradually increase to the working pressure;
10. Check the water gauge, the safety valve and each automatic controller to ensure that they are in good working conditions; and
11. Open the steam outlet stop valve slowly to supply steam, and drain any condensate inside the steam pipe to prevent water hammering.

Testing of water gauge



Under normal conditions the steam cock (Cock A) and the water cock (Cock B) should remain open with the drain cock (Cock C) in closed position. The water gauge should be tested according to below procedures:

1. Open Cock C. Cock C is not clogged if steam and water come out from it steadily.
2. Close Cock A and open cocks B and C. Cock B is not clogged if water comes out from Cock C steadily.
3. Close Cock B and open cocks A and C. Cock A is not clogged if steam comes out from Cock C steadily.

If there is no clogging in all the cocks, the water gauge is in normal working condition.

Scale

Untreated water contains different kinds of dissolved salts, some of which form hard scale on the boiler interior surface. Such formation is generally due to the combined effects of heat, pressure and concentration of dissolved salts in boiler water.

Hard scale is a poor conductor of heat. It accumulates on the heating elements, and reduces heat transfer leading to a decrease in boiler efficiency. In severe cases, the heating elements may overheat and burn out.

Scale can also block pipes and cocks of small diameters. For example, blocking the steam cock or water cock of water gauge could cause false water level reading. When the water level cannot be monitored effectively it could be dangerous.

The competent person should shut down the boiler for cleaning and scale removal periodically. The period should be in accordance with the boiler manufacturer's recommendation or after six months' operation.

Scale formation can be minimized by adding chemicals into the feed water to turn the hard scale salts into non-adhering sludge. The sludge is subsequently blown out from the drain valve. The competent person must exercise extreme care when handling chemicals since most of them are either corrosive or toxic. The instructions provided by the chemical manufacturer must be strictly followed and the safety requirements in the Factories and Industrial Undertakings (Dangerous Substances) Regulations in relation to the use and handling of chemicals in industrial undertakings must be complied with. The Competent Person should use appropriate types of chemical in accordance with the boiler manufacturer's instruction.

Methods to minimize or remove scale

Boiler drain valve should be opened daily to discharge the sludge from the bottom of boiler. If possible, drain the boiler water when it has been used for a while and filled it with clean boiler water. Moreover, scale should be removed every half year by an experience person.

Electrical safety when using electrically heated boilers

Incidental contact with a boiler or electrical equipment with electric leakage or short circuit may result in electric shock which can induce serious body injuries and be fatal. The risk of electric shock is particularly high in cases of wet environment or insulation failure. Therefore, the insulation of the electric circuit of the boiler should be kept in good condition. One should pay attention to the extent of abrasive wear, fracture and damage on the insulation. Where necessary, an insulation test should be conducted to ensure that the motor is well insulated. Earth wire of the boiler should be connected properly.

Handling Boiler Fire

When boiler fire starts, handle the fire in three steps:

1. Raise the fire alarm or shout loudly to notify the factory staff of the fire;
2. Turn off the main power switch of the boiler; and
3. Find out the causes of fire. A fire sparked off by electric leakage should be put out by a fire extinguisher suitable for such purpose.

If the fire cannot be extinguished effectively, the Fire Services Department should be called for assistance. Turn off electric power supply for the boiler room, and close windows and doors of the boiler room to reduce air supply that support burning.

Methods of extinguishing fire

In case of electric fire or fire is in the close vicinity of electrical appliances, a fire extinguishing medium which is a non-conductor of electricity should be used, otherwise, the fire fighter may experience electric shock. Carbon dioxide (CO₂) extinguisher or dry powder extinguisher is suitable for combating the electric fire.

Points to Note for Owners and Workers

- ▶ No worker shall be allowed to operate a boiler without a “Certificate of Competency”;
- ▶ A worker holding a “Certificate of Competency” shall only be allowed to operate the types of boiler specified on his “Certificate of Competency”;
- ▶ No worker shall be allowed to remove the lead seal of the safety valve or attempt to adjust the setting of the safety valve to increase the steam pressure. Such dangerous acts can cause over pressure and boiler explosion, resulting in injuries and fatalities; and
- ▶ In case an accident happens to a boiler or its accessories with the risk of loss of life or property, the boiler must be shut down immediately. The owner should report the accident to the Boiler and Pressure Vessels Division within 24 hours, otherwise the owner is liable to prosecution and a maximum fine of HK\$10,000.

Enquiries

If you wish to enquire about the application for “Certificate of Competency”, boiler registration and safe operation of boilers, please contact the Boilers and Pressure Vessels Division of the Labour Department through:

Telephone : 3107 3458

Fax : 2517 6853

E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation is also available on our website at <http://www.labour.gov.hk>.

For details on the services offered by the Occupational Safety and Health Council, please call 2739 9000.

Complaints

If you have any complaints about unsafe workplaces and practices, please call Labour Department's occupational safety and health complaint hotline at 2542 2172. All complaints will be treated in the strictest confidence.