

On new jobs it is advisable wherever possible to drain condensation directly to sewer during first week of operation, thereby preventing passage of grease and dirt to the boiler from the system. The length of time fresh water should be fed to the boiler will depend somewhat on the amount of scale forming material in the water, as it would be objectionable to accumulate scale on the heating surfaces.

PROTECTION OF BOILERS

The following precautions should be taken in all installations to prevent damage to the boiler:

1. Proper and convenient drainage connections for use if boiler is not in operation during freezing weather should be provided.
2. Strains on boiler due to movement of piping during expansion should be prevented by suitable anchoring of piping and proper provision for pipe expansion.
3. Direct impingement of intense local heat upon any part of surface should be avoided by protecting surface with fire brick or other insulating material.
4. Condensation must flow back to boiler as rapidly and uniformly as possible. Return connections should prevent water from backing out of boiler.
5. Low water cut-off devices which shut off the source of heat if the water in boiler falls below a safe level are recommended for boilers fired with oil or gas.
6. In single boiler installations the steam and return main should be free of valves.

SMOKE BREECHING AND CHIMNEY CONNECTIONS

Connections from boiler outlet to chimney should be air-tight and as short and direct as possible, preference being given to long radius and 45 deg. instead of 90 deg. bends. The bend at entrance to chimney should not project beyond inside of chimney. Where a battery of boilers are connected into a breeching each boiler should be provided with a tight damper. Good connections made to a good chimney will usually result in a rapid response by boiler to demands for heat.

COMPLETING INSTALLATION

In addition to the usual examination to insure that all work is done in a workmanlike manner and that the system is free of leaks, a check should be made on the following:

1. Whether boiler has sufficient draft to burn the amount of fuel which would be required during pick-up period in cold weather.
2. That boiler operates with a steady water line and condensation returns rapidly to boiler.
3. That rods and levers of pressure or temperature control apparatus are adjusted to proper length.
4. That any safety equipment used works properly.

BOILER TROUBLES

A complaint regarding boiler operation will generally be found to be one of the following:

1. *The boiler fails to deliver enough heat.* The cause of this condition may be: (a) poor draft, (b) poor fuel, (c) inferior attention or firing, (d) boiler too small, (e) improper

piping, (f) improper arrangement of sections, (g) heating surfaces may be covered with soot and (h) insufficient radiation installed.

2. *The water line is unsteady.* The cause of this condition may be: (a) grease and dirt in boiler, (b) water column connected to a very active section and therefore may not be showing actual water level in boiler, (c) boiler operating at excessive output.

3. *Water disappears from gage glass.* This may be caused by: (a) priming due to grease and dirt in boiler, (b) too great pressure difference between supply and return piping causing water to back into return, (c) valve closed in return line, (d) connection of bottom of water column into a very active section or thin waterway, (e) improper connections between boilers in battery permitting boiler with excess pressure to push water into boiler with lower pressure.

4. *Boiler causes water to be carried into steam main.* This may be caused by: (a) grease and dirt in boiler, (b) insufficient steam dome or too small steam liberating area, (c) outlet connections of too small area, (d) excessive rate of output, (e) water level carried higher than specified.

5. *Boiler is slow in response to operation of dampers.* This may be due to: (a) poor draft due to air leaks into chimney or breeching, (b) inferior fuel, (c) inferior attention, (d) accumulation of clinker on grate, (e) boiler too small for the load.

6. *Boiler requires too frequent cleaning of flues.* This may be due to: (a) poor draft, (b) smoky combustion, (c) too low a rate of combustion, (d) too much excess air in firebox causing chilling of gases.

7. *Boiler smokes through fire door.* This may be due to: (a) defective draft in chimney or incorrect setting of dampers, (b) air leaks into boiler or breeching, (c) gas outlet from firebox plugged with fuel, (d) dirty or clogged flues.

If boiler trouble is attributed to oil and dirt in boiler one of the following tests will determine whether cleaning of boiler is necessary:

1. Draw off a small quantity of water from the try-cock near the water line. Boil this water in a pan and at the same time boil an equal quantity of water such as fed to boiler in another pan (of same size if available.) A marked difference in liberation of steam from the surface will indicate that the boiler should be cleaned.

2. After building a pressure in the boiler of 2 to 5 lb. open safety valve by means of a wire attached to lifting lever. Keep valve open for one minute. If water is discharged with the steam after the first rush of steam and water, it can safely be assumed that the boiler should be cleaned.

OPERATING BOILERS WITH VARIOUS FUELS

To keep the fuel bed in proper condition, the following general rules should be observed:

1. Remove ash from fuel bed by shaking the grates whenever fresh fuel is fired. This removes ash from the fire; enables the air to reach the fuel and does away with the formation of clinker (which is melted ash).
2. Supply the boiler with a deep bed of fuel. Nothing is gained by attempting to fire a small amount of fuel. A deep bed of fuel secures the most economical results.
3. Remove ash from ashpit at least once daily. Never allow ash to accumulate up to the grates. If the ash prevents the air from passing through, the grate bars will burn out and much clinker trouble will be experienced.

USE OF SECONDARY AIR

Secondary or auxiliary air (air supplied over the fuel bed), should be provided whenever it increases the temperature in the firebox. After firing considerable combustible gas rises from any fuel and enough air for its combustion cannot be supplied through the fuel bed, but must be provided by other means, usually through a slide damper in the fire door.