

boilers. Good connections made to a good chimney will usually result in a rapid response by the boilers to demands for heat.

PREPARING BOILERS FOR SERVICE

The directions of the boiler manufacturer always should be read before the assembly or installation of any boiler is started, even though the contractor may be familiar with the boiler. All joints requiring boiler putty or cement, which cannot be reached after assembly is complete, must be finished as the assembly progresses.

Nuts or tie rods of sectional cast-iron boilers always must be drawn up and then loosened about one thread to allow for expansion of the boiler when hot. The nuts should be just a little more than hand-tight when the boiler is at its operating temperature.

Flow piping connections should be full size of the manufacturers outlet and preferably should be vertical from the outlets to the maximum height available above the boiler. A large tall outlet pipe and a low outlet velocity are of great value in separating the steam from the water; especially if the boiler has accumulated grease and other foreign matter.

Maximum steam velocities of from 20 to 25 ft per second at the boiler outlet are recommended.

The outlets from steam boilers should be placed as remotely as possible from the areas of the water surface at which steam separation is most violent.

There is usually some advantage to be obtained with low-pressure steam boilers by installing a large drip connection back to the boiler below the water line, from a point as near as practicable to the steam outlet.

WATER LINE IN STEAM BOILERS

Enough water only should be added to heating boilers to keep the water line at the height established by the manufacturer. Raising the water to a higher level may result in carrying over of water with the steam. Water from small steam heating systems should not be lost by leakage or withdrawn to serve as hot water supply as the fresh water required to make up the loss may introduce scale-forming or corrosive matter. On the other hand the occasional addition of new scale-forming water under some conditions may prevent excessive corrosion or pitting of the boiler interior.

WATER GAGE GLASS FITTINGS AND COCKS

Each boiler should have at least one water gage glass and two or more gage cocks located within the range of the visible length of the glass. The water glass fittings or gage cocks may be connected direct to the boiler but it is preferable to mount them on a water column. No connections, except for combustion regulator, drains or steam gages, should be placed on the pipes connecting the water column and the boiler. The steam pipe should drain toward the water column; the water pipe should drain toward the boiler. If the water column is fitted with a low water alarm, the alarm should operate before the level reaches a line not less

than two inches above the lowest permissible water level, usually at the center of the lower gage cock.

CORRECTING UNSATISFACTORY OPERATION

A complaint regarding boiler operation generally will be found to be due to 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. *Water is carried over 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; (e) improper reduction in breeching size.

For further information on this subject, refer to the subject of Trouble Shooting treated in Chapter 40.

PROTECTION OF BOILERS

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

1. There should be provided proper and convenient drainage connections for use if the boiler is not in operation during freezing weather.
2. Strains on the boiler due to movement of piping during expansion should be prevented by suitable anchoring of piping and by proper provision for pipe expansion and contraction.
3. Direct impingement of too intense local heat upon any part of the boiler surface, as with oil burners, should be avoided by protecting the surface with firebrick or other insulating material.
4. Condensation must flow back to the boiler as rapidly and uniformly as possible. Return connections should prevent the water from backing out of the boiler.
5. Automatic boiler feeders and low water cut-off devices which shut off the source of heat if the water in the boiler falls below a safe level are both recommended for boilers fired with oil or gas. In apartment or commercial buildings where the boiler attendant is frequently absent from the boiler room an electric signal should be attached to the