

Sectional boilers, may be of the rectangular pattern with vertical sections, or of the round pattern with horizontal sections. They are usually constructed of cast iron; and on account of their sectional construction and the usual practice of being shipped knocked down and assembled on the job, they are easily handled through small openings at any stage of construction. Their design also facilitates the removal and replacing of damaged parts as well as an increase or decrease in capacity by the addition or removal of sections.

Cast-iron boilers are limited to operating pressures of 15 lb. steam or 30 lb. water, excepting when used for hot-water supply, in which case the boilers are built for operation at city pressure and are tested at pressures two and one-half times the operating pressure.

The fire-tube boiler, which may be of the horizontal tubular brick set pattern, the horizontal tubular firebox pattern (with or without supplementary brick setting), the vertical tubular brick set pattern or the vertical tubular firebox pattern.

Fire-tube steel boilers may be built for high or low pressure, but when used for heating with consequent usual low pressure operation, they are generally built according to the *A. S. M. E.* Steel Plate heating boiler code which limits working pressure to 15 lb. per sq. in. for steam boilers or 250 deg. Fahr. or 160 lb. per sq. in. for water boilers. In construction they may be riveted or welded. Where higher operating pressures (e.g. up to 100 lb. per sq. in.) are required, boilers of the same dimensions as low pressure boilers can be obtained at a comparatively small increase in cost.

Low pressure operation is favored because of greater possible operating economy due to lower temperature of the water in the boiler. The large water content provide for heat storage capacity and minimized water line fluctuation under sudden variations in load. Chimney heights for the larger sizes of fire-tube boilers as specified by the manufacturer are generally lower than for corresponding sizes of cast-iron boilers.

The water-tube boiler, which may be of the horizontal brick set pattern with either horizontal or cross drums, the vertical brick set pattern, the bent or inclined tube brick set pattern, or the self-contained firebox pattern with any one of the above arrangements of tubes.

Water-tube boilers are usually constructed with steel or iron tubes, steel drums and either steel, cast steel or cast-iron headers. They heat up and steam rapidly and also lose their heat and steam pressure quickly. The water and steam spaces are moderate and their performance on rapid and wide variations of load is accordingly responsive.

The principal heating surface consisting of tubes with the water inside and the heated gases outside, is easy to clean from the inside with hydraulic or pneumatic tube cleaners and from the outside with steam or air jet soot blowers, although with highly scaling waters are to be avoided since the scale formation on the inside of the small tube may be comparatively rapid.

The water line is generally high and considerable head room is required. On account of being constructed with drums and banks of tubes they

may be shipped knocked down and assembled on the job, thus passing through small openings at any stage of the construction.

INSTALLING AND PREPARING BOILER FOR SERVICE

Manufacturers directions should always be read before assembly or installation of any boiler is begun even if the contractor is familiar with the boiler. All joints requiring boiler putty or cement which cannot be reached after assembly is complete must be carefully finished as assembly progresses as even small openings permitting short circuiting of gases hardly ever fill up during operation.

Nuts or tie rods of sectional cast-iron boilers must always be loosened about one thread to allow for expansion of 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 manufacturers outlet and should preferably be vertical from outlets to a height of 2 or 3 ft. above boiler wherever possible. Vertical piping and low outlet velocity are of great value in keeping the steam dry especially if the boiler accumulates grease and oil from the system. Steam velocities of 20 to 25 ft. per second are recommended for the maximum continuous boiler output. Where optional outlets are provided, those on steam boilers should be in the least active parts, whereas, those on water boilers should be on the most active parts.

If lack of head room necessitates a low vertical connection from boiler to steam main, it is advisable to make a drip connection to the return at first change of direction of the main.

Recommended methods of connecting piping to steam boilers are shown in Chapter III, Steam Heating Systems and Piping.

CLEANING BOILERS

Grease serves as a carrier for sand and dirt in the system with the result that a scum of fine particles and grease accumulates on the surface of the water in the boiler while heavier particles settle to the bottom of the boiler or remain in suspension. The scum is best removed through an outlet at the surface of the water. The method given below has been used successfully.

Connect a pipe (full size of opening at boiler) from the surface blow-off tapping or opening nearest surface to a convenient drain. Raise water level in boiler to bottom of blow-off. Build a brisk fire in the boiler and raise pressure between 5 and 10 lb. Open valve and keep it open as long as pressure remains. Close valve when necessary to enable boiler to build up pressure, then open and proceed as before. Keep water level at the bottom of the blow-off by feeding fresh water. Continue blowing until water in blow-off is clean. The fire should then be removed and the water drained preferably under steam pressure from the bottom of boiler to remove heavy particles and material in suspension.

Where appreciable dirt and grease are present it is advisable to add soda ash to the water in the boiler before boiling out.

Refill boiler with water to proper level before starting fire.