2. All machined surfaces should be coated with oil or grease.

3. Connections to the chimney should be cleaned and in case of small boilers the pipe should be placed in a dry place after cleaning.

4. If there is much moisture in the boiler room, it is desirable to drain the boiler to prevent atmospheric condensation on the heating surfaces of the boiler when they are below the dew-point temperature. Due to the hazard of some one inadvertently building a fire in a dry boiler, however, it is safer to keep the boiler filled with water. A hot water system usually is left filled to the expansion tank.

5. The grates and ashpit should be cleaned.

6. Clean and repack the gage glass if necessary.

7. Remove any rust or other deposit from exposed surfaces by scraping with a wire brush or sandpaper. After boiler is thoroughly cleaned, apply a coat of preservative paint where required to external parts normally painted.

8. Inspect all accessories of the boiler carefully to see that they are in good working order. In this connection, oil all door hinges, damper bearings and regulator parts.

BOILER INSULATION

Insulation for cast-iron boilers is of two general types: (1) plastic material or blocks wired on, cemented and covered with canvas or duck; and (2) blocks, sheets or plastic material covered with a metal jacket furnished by the boiler manufacturer. Self-contained steel firebox boilers usually are insulated with blocks, cement and canvas, or rock wool blankets; HRT boilers are brick set and do not require insulation beyond that provided in the setting. It is essential that the insulation on a boiler and adjacent piping be of non-combustible material as even slow-burning insulation constitutes a dangerous fire hazard in case of low water in the boiler.

REFERENCES

A.S.H.V.E. Code of Minimum Requirements for the Heating and Ventilation of Buildings.

A.S.H.V.E. Standard and Short Form Heat Balance Codes for Testing Low-Pressure Steam Heating Solid Fuel Boilers (Codes 1 and 2).

A.S.H.V.E. Performance Test Code for Steam Heating Solid Fuel Boilers (Code No. 3).

A.S.H.V.E. Standard Code for Rating Steam Heating Solid Fuel Hand-Fired Boilers.

Heating, Ventilating and Air Conditioning, by Harding and Willard, Revised Edition, 1932.

A.S.M.E. Boiler Construction Code for Low Pressure Heating Boilers.

Heating, Piping and Air Conditioning Contractors National Association Standards (boiler selection tables).

House-Heating, published by *American Gas Association.*

Handbook of Oil Burning, published by *American Oil Burner Association.*

Heating and Air Conditioning, by Allen and Walker (fourth edition).

Selecting the Right Size Boiler, by Sabin Crocker (*Heating, Piping and Air Conditioning*, February, March, April, 1932).

PROBLEMS IN PRACTICE

1 ● What basic requirements of boiler design are to be accomplished with a combination boiler and oil burner unit?

Combination units vary widely but in general, the basic requirements of design depends upon a combustion chamber of proper design and arranged for the flame shape with adequate heating surface for the complete combustion of the fuel.

2 ● Name the construction materials that distinguish two types of low pressure heating boilers.

a. Cast-iron.

b. Steel.

3 ● What is the normal rating range of each type of boiler?

a. Cast-iron boilers are rated at from 200 to 18,000 sq ft EDR.

b. Steel boilers are rated at from 300 to 50,000 sq ft EDR.

4 ● a. What is meant by direct boiler heating surface?
b. What is meant by indirect boiler heating surface?

a. Direct boiler heating surface is that boiler surface upon which the fire shines, namely, the walls of the firebox and the crown sheet.

b. Indirect boiler heating surface is that boiler surface not exposed to the direct rays of the fire and over which heated gases pass after they have been in contact with the direct surface. Indirect surface is generally known as convective surface.

5 ● What is the average heat transmission rate in heating boilers in Btu per sq ft of heating surface per hour?

3500 for coal burning boilers; 4200 for oil burning boilers.

6 ● What factors contribute to economical fuel operation in low pressure boilers burning coal or oil?

a. Proper furnace volume for complete combustion.

b. Arrangement of heating surfaces in series to create a turbulent and scrubbing contact of gases against the convective surfaces.

c. Rapid internal water circulation which will remove steam bubbles from the water side of heating surfaces and allow other steam bubbles to be formed. Rapid disengagement of steam bubbles increases the steam generating efficiency of each unit area of heating surface, and thereby lowers flue gas temperatures.

7 ● What equipment is usually directly attached to a low pressure heating boiler?

For coal burning steam boilers: water column, water gage, tri-cocks, steam gage, lever pop safety valve, boiler damper regulator.

For coal burning hot water boilers: damper regulator, altitude gage, thermometer, relief valve.

For oil burning boilers, the damper regulators are omitted and the following additional equipment is usually attached: automatic water feeder, low water cutout, a pressure control, and a water temperature control. These are generally furnished by the oil burner manufacturer and do not come with the boiler.

8 ● What general precautions regarding the boiler should be taken to make sure a proposed heating installation will work properly?

a. Select the right size and type of boiler.

b. Be sure the combustion space is proper for the type of fuel burned.

c. Allow sufficient space around the boiler for cleaning.

d. Secure proper height and area of chimney and connecting breeching.

e. Clean the boiler thoroughly and provide surface blowoff connections and bottom blowoff connections for periodic cleaning after operation is begun.

f. See that the boiler heating surface is cleaned at regular periods.

g. Check flue gas temperatures and make a flue gas analysis at least once a month.

h. Secure information and advice from boiler manufacturer.

9 ● Below what temperature should the water in direct water heaters be maintained to reduce scale formation and corrosion?

140 F.