

Two satisfactory methods of making runouts for one-pipe systems for either the up-feed or the down-feed type are shown in Fig. 44. Where the vertical distance is limited and the runouts must run above the floor, the radiator may be set on pedestals or raised by means of high legs. A method of connecting a unit heater to a one-pipe steam heating system is illustrated in Fig. 2.

Typical two-pipe radiator connections are shown in Figs. 45 and 46. While these show top inlet supply connections which are preferred, it is also possible to connect the supply to the bottom of the radiator. Short radiators may be connected with top supply and bottom return on the same end.

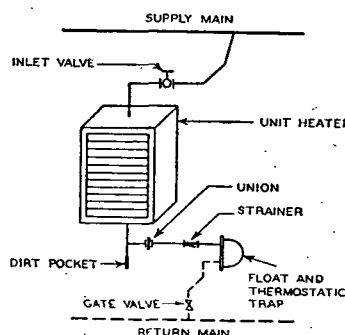


FIG. 53. TYPICAL UNIT HEATER CONNECTIONS FOR TWO-PIPE SYSTEM

A typical method of connecting convectors is shown in Fig. 47. Sometimes the supply valve is omitted on convector connections, and a damper is supplied in the outlet grille for heat control.

A typical connection for finned pipe convectors is shown in Fig. 48.

Typical connections to blast heaters are shown in Figs. 49, 50, and 51. Fig. 52 shows a typical return and connection for blast heaters connected to high pressure systems.

A typical two-pipe connection to a unit heater is indicated in Fig. 53.

### CONTROL VALVES

Gate valves are recommended in all cases where service demands that the valve be either entirely open or entirely closed, but they should never be used for throttling. Angle globe valves and straight globe valves should be used for throttling in such cases as by-passes around pressure reducing valves or on by-passes around traps.

### REFERENCES

<sup>1</sup> A.S.H.V.E. RESEARCH REPORT No. 954—Condensate and Air Return in Steam Heating Systems, by F. C. Houghten and J. L. Blackshaw (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 199).

<sup>2</sup> Pipe size tables in this chapter have been compiled in simplified and condensed form for the convenience of the user; at the same time all of the information contained in previous editions of THE GUIDE has been retained.

<sup>3</sup> A.S.H.V.E. Standard Code for Testing and Rating Return-Line Low Vacuum Heating Pumps (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 33).

## CHAPTER 21

### HOT WATER HEATING SYSTEMS

Features of Low Temperature Systems: Design of Two-Pipe, One-Pipe, and Series-Loop Systems; Adjustment; Air Elimination; Piping Principles; Circulating Pumps; Expansion Tanks and Pressure Control; Temperature Control; Care and Maintenance; High Temperature Systems; Principles, Design, Pumps, Fittings and Insulation; Control of Hot Water Generators; Heat Storage and Distribution

A HOT WATER heating system is one in which water is used to convey heat by flowing through pipes connecting a boiler or water heater with radiators, convectors, or other suitable heat distributing means. Classified according to the means of generating flow, hot water heating systems are of two types: the *Gravity System* in which circulation of the water is due to the difference in weight between the supply and return water columns of any circuit or system, and the *Forced System* in which a pump, usually driven by an electric motor, maintains the necessary flow.

Since the available head or force producing circulation in a gravity system is limited, the piping must be of such size that the friction loss at the desired flow is not in excess of the available head.

Gravity circulation heads which can be obtained with various supply and return temperatures are shown in Fig. 1. The basic principles which determine design in gravity and forced systems are the same but since the former has less total head available to produce flow, greater precautions are necessary in design to secure even distribution of heat with gravity systems. Gravity systems are no longer of commercial importance. Complete details on the design of gravity type systems are contained in editions of THE GUIDE issued before 1957. Fig. 1 is also useful in determining effects due to temperature difference in forced systems when large elevation or temperature differentials occur.

This chapter is devoted to the design of forced hot water systems. System characteristics and design are discussed under two main headings: *Low Temperature* and *High Temperature* Systems. Those having maximum operating temperatures less than 250 F are considered *Low Temperature Systems*, while those having operating temperatures greater than 250 F are considered *High Temperature Systems*. Generally, the section on *High Temperature Systems* will indicate where the principles of design used with *Low Temperature Systems* must be modified in order to apply to high temperature systems, or where they do not apply.

The selection of a type of distribution system for the heating of a particular building should be based upon an objective analysis of the characteristics of the building, the comfort and temperature conditions required, the system operating and maintenance characteristics, the space available for piping and equipment, and the economics involved.