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CHAPTER 20

STEAM HEATING SYSTEMS

Classification of Steam Heating Systems by Types; One-pipe; Two-pipe, Sub-atmospheric and Orifice Systems; Sizing Piping for Steam Heating Systems; Pressure Reducing Valves; Boiler Connections; Condensate Return Pumps; Vacuum Heating Pumps; Traps; Drips; Connections to Heating Units; Control Valves

STEAM heating systems may be classified according to any one of, or combination of, the following features: (1) piping arrangement, (2) pressure or vacuum conditions obtained in operation, (3) method of returning condensate to the boiler.

1. *By Piping Arrangement*. A steam heating system is known as a *one-pipe system* when a single main serves the dual purpose of supplying steam to the heating unit and conveying condensate from it. Ordinarily, to each heating unit there is but one connection which must serve as both the supply and the return, although separate supply and return connections may be used.

A steam heating system is known as a *two-pipe system* when each heating unit is provided with two piping connections, and when steam and condensate flow in separate mains and branches.

Heating systems may also be described as *up-flow* or *down-flow*, depending on the direction of steam flow in the risers; and as a *dry-return* or a *wet-return*, depending on whether the condensate mains are above or below the water line of the boiler or condensate receiver.

2. *By Pressure or Vacuum Conditions*. Steam heating systems may also be classified as *high pressure*, *low pressure*, *vapor*, and *vacuum* systems, depending on the pressure conditions under which the system is designed to operate.

A system is known as a *high pressure system* when the operating pressures employed are above 15 psig; as a *low pressure system* when pressures vary from 0 to 15 psig; as a *vapor system* when the system operates under both vacuum and low pressure conditions without the use of a vacuum pump; and as a *vacuum system* when the system operates under vacuum and low pressure conditions with the use of vacuum pump.

When automatic controls are employed to vary the pressure conditions in the system in accordance with outside weather conditions, the system may be known as a *sub-atmospheric, differential*, or *synchronized* system. These latter classifications are proprietary designations.

When orifices are employed on the inlets to the heating units the system may be known as an *orifice system*.

3. *By Method of Returning Condensate*. When condensate is returned to the boiler by gravity, the system is known as a *gravity return system*. In this system all heating units must be elevated sufficiently above the water line of the boiler, so that the condensate can flow freely to the boiler. Elevation of the heating units above the water line must therefore be sufficient to overcome pressure drops due to flow, as well as pressure differences due to operation.

Referring to Fig. 1 it will be noted that the boiler and wet-return form a U-shaped container, with the boiler steam pressure on the top of the water at one end, and the steam main pressure on the top of the water at the other end. The difference between these two pressures is the *pressure drop* in the system, *i.e.*, the friction and resistance to the flow of steam in passing from the boiler to the far end of the main, and the pressure reduction in consequence of the condensation occurring in the system. The water in the far end will rise sufficiently to overcome this difference in order to balance the pressures, and it will rise far enough to produce a flow through the return pipe and overcome the resistance of check valves, if installed.

If a one-pipe steam system is designed, for example, for a total pressure drop of ⅛ psi, and utilizes a Hartford return connection instead of a check valve on the return, the rise in the water level at the far end of the return, due to the difference in steam