

prevent possible damage to their mechanisms by water as may occur if the valves are installed directly above the drips. The air valves may be manual or automatic, with or without a check. Air-vent valves with checks prevent the ready re-entrance of expelled air.

The radiator valves may be the angle-globe, corner pattern or gate type. Straight-globe type should not be used since the damming effect of the raised valve seat would interfere with the flow of condensation through the valve. Graduated valves cannot be used since the steam valves on this system must be fully open or fully closed to prevent the radiators filling with water and creating a dangerous water line condition. An objection to the one-pipe steam system is that the heat cannot be regulated at the radiator. Regulating at the radiator is possible only by having the heat *all on* or *all off*, or by setting the valve in an intermediate position. Improved systems and devices are now available which make it possible to obtain a modulating effect from one-pipe heating systems. This is accomplished by the use of special *one-pipe regulating plates* and automatic control of the rate of steam supply which permits varying rates of steam supply and gives fair control during average and severe winter weather.

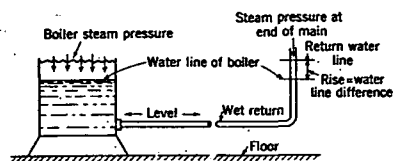


FIG. 4. DIFFERENCE IN STEAM PRESSURE ON WATER IN BOILER AND AT END OF STEAM MAIN

It is important to keep the lowest points of the steam mains and heating units sufficiently above the water line of the boiler to prevent flooding. Usually a distance of 18 in. is sufficient but construction limitations frequently make shorter distances necessary. The minimum distance which may be used can be checked in the following manner:

Referring to Fig. 4 it will be seen that the water in the wet return is really in an inverted siphon, or 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 of the 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 enough farther to produce a flow through the return into the boiler (usually about 3 in. unless the pipes are small or full of sediment), and it will rise still farther if a check valve is installed in the return so as to obtain sufficient head to lift the tongue of the check (usually 4 in. will be necessary).

If a one-pipe steam system is designed, for example, for a total pressure drop of $\frac{1}{2}$ lb, and utilizes an Underwriters' Loop 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 pressure would be $\frac{1}{8}$ of 28 in., or $3\frac{1}{2}$ in. Adding 3 in. to this for the flow through the return main and 6 in. as a factor of safety gives 12 $\frac{1}{2}$ in. as the distance the bottom of the lowest part of the steam main and all heating units must be above the boiler water line. The same system, however, installed and sized for a total pressure drop of $\frac{1}{2}$ lb, and with a check in the

return, would require $\frac{1}{2}$ of 28 in., or 14 in., for the difference in steam pressure, 3 in. for the flow through the return, 4 in. to operate the check, and 6 in. for a factor of safety, making a total of 27 in. as the required distance. Higher pressure drops would increase the distance accordingly.

DOWN-FEED GRAVITY ONE-PIPE AIR-VENT SYSTEM

The overhead down-feed system varies basically only from the up-feed systems in the location of the steam main. The steam supply is taken from the boiler and carried to the top of the building, as near the boiler as possible as shown in Fig. 5. If the run to the main riser is long, or the

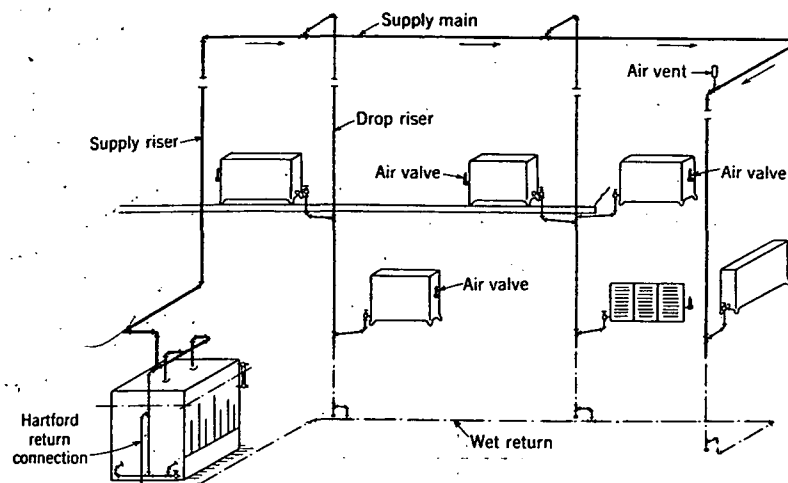


FIG. 5. TYPICAL DOWN-FEED GRAVITY ONE-PIPE AIR-VENT SYSTEM

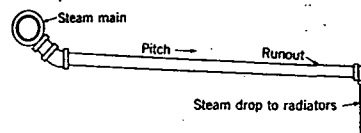


FIG. 6. STEAM RUNOUTS DRIPPING MAIN

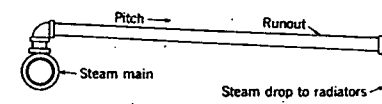


FIG. 7. STEAM RUNOUTS WITH MAIN DRIPPED AT END ONLY

riser extends several stories, the bottom of the riser should be dripped into the wet return. The horizontal main extends from the top of the riser and grades down from it toward all the drops or down-feed risers. The connections to the risers are taken from the bottom of the main, and each drop carries its share of the main's condensation (Fig. 6). All of the drops, except the last, may be taken from the top of the main (Fig. 7), the last drop being from the bottom and serving to drain the entire main. The overhead main does not carry condensation from the radiators. The air vent may be located on the main before the last drop (Fig. 5) but the preferable location is at the bottom of the drop below the last radiator