

side of the system is exactly the same as the up-feed system except that the steam riser drips at the bottom are connected into the return line through thermostatic traps. It is preferable to take the runouts for the risers from the bottom or at a 45-deg angle down from the steam main so that they may serve as steam main drips. When this is done it is practical to run the steam main level, if a runout is located at every change in pipe size, or if eccentric fittings are used (Fig. 14). A slight pitch in the steam main, however, should be used when possible. An overhead vacuum down-feed system is shown diagrammatically in Fig. 15.

Vacuum, atmospheric, sub-atmospheric and orifice systems are usually employed in large installations and have total drops varying from $\frac{1}{4}$ to $\frac{1}{2}$ psi. Systems where the maximum equivalent length does not exceed 200 ft preferably employ the smaller pressure drop, while systems over 200 ft equivalent length of run more frequently are designed for the higher drop, owing to the relatively greater saving in pipe sizes. For example, a system with 1200 ft longest equivalent length of run would employ a drop per 100 ft of $\frac{1}{2}$ psi divided by 12, or $\frac{1}{24}$ psi. In this case, the steam main would be sized from Column C, Table 4, and the risers also from Column

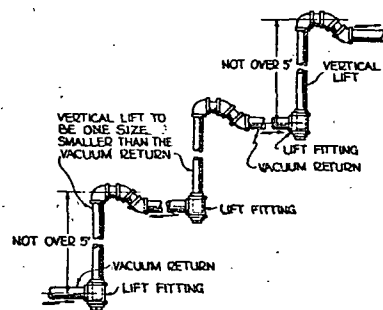


FIG. 12. METHOD OF MAKING LIFTS ON VACUUM SYSTEMS WHEN DISTANCE IS OVER 5 FT

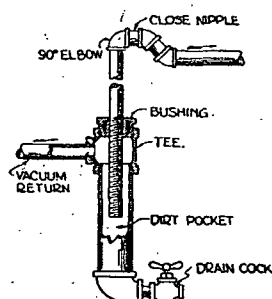


FIG. 13. DETAIL OF MAIN RETURN LIFT AT VACUUM PUMP

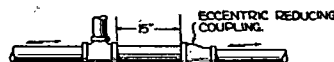


FIG. 14. METHOD OF CHANGING SIZE OF STEAM MAIN WHEN RUNOUTS ARE TAKEN FROM TOP

C (Column H could be used as far as critical velocity is concerned but the drop would exceed the limit of $\frac{1}{24}$ psi). Riser runouts, if dripped, would use Column C but if undripped would use Column I; radiator runouts, Column I; return risers, lower part of Column S, Tables 5 and 6; return runouts to radiators, one pipe size larger than the radiator trap connections.

Notes on Vacuum Systems

1. It is not generally considered good practice to exceed $\frac{1}{8}$ psi drop per 100 ft of equivalent run nor to exceed 1 psi total pressure drop in any system.
2. Pitch of mains should not be less than $\frac{1}{4}$ in. in 10 ft.

3. Pitch of horizontal runouts to risers and radiators should not be less than $\frac{1}{2}$ in. in 10 ft. Where this pitch cannot be obtained runouts over 8 ft in length should be one size larger than called for in the table.

4. In general it is not considered desirable to have a supply main smaller than 2 in.

5. When necessary, the supply main, supply riser, or runout to a supply riser should be dripped separately through a trap into the vacuum return. A connection should not be made between the steam and return sides of a vacuum system without interposing a trap to prevent the steam from entering the return line.

6. Lifts should be avoided if possible, but when they cannot be eliminated they should be made in the manner described in this chapter.

7. No lifts can be used in orifice and atmospheric systems. In sub-atmospheric systems the lift must be at the vacuum pump.

SUB-ATMOSPHERIC SYSTEMS

Sub-atmospheric systems are similar to vacuum systems but, in contrast, provide control of building temperature by variation of the heat

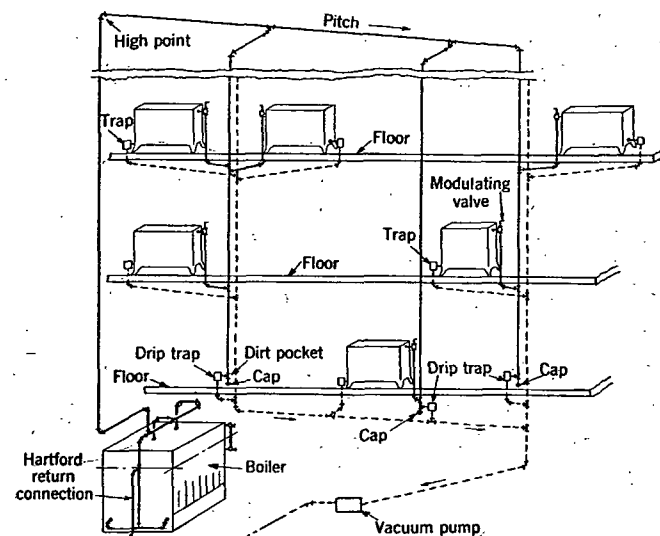


FIG. 15. TYPICAL DOWN-FEED VACUUM SYSTEM

output from the radiators. The radiator heat emission is controlled by varying the pressure, temperature and specific volume of steam in circulation. These systems differ from the ordinary vacuum system in that they maintain a controllable partial vacuum on both the supply and return sides of the system, instead of only on the return side. In the vacuum system, steam pressure above that of the atmosphere exists in the supply mains and radiators practically at all times. In the sub-atmospheric system, atmospheric pressure or higher exists in the steam supply piping and radiators only during severe weather. Under average winter temperature the steam is under partial vacuum which in mild weather may reach as high as 25 in. Hg, after which further reduction in heat output is obtained by restricting the quantity of steam.