Notes on Vacuum Systems

1. It is not generally considered good practice to exceed ⅛-lb drop per 100 ft of equivalent run nor to exceed 1 lb total pressure drop in any system.
2. Pitch of mains should not be less than ¼ in. in 10 ft.
3. Pitch of horizontal runouts to risers and radiators should not be less than ½ 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 branch 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 Chapter 13.
7. No lifts can be used in orifice and atmospheric systems. In sub-atmospheric systems the lift must be at the vacuum pump.

BOILER CONNECTIONS

Steam

Cast-iron, sectional heating boilers usually have several outlets in the top. Two or more outlets are sometimes used to reduce the velocity of the steam in the vertical uptakes from the boiler and thus to prevent water being carried over into the steam main.

Return

Cast-iron boilers are generally provided with return tappings on both sides, while steel boilers are generally equipped with only one return tapping. Where two tappings are provided, both should be used to effect proper circulation through the boiler. The return connection should include either a Hartford loop or a check valve to prevent the accidental loss of boiler water to the returns with consequent danger of boiler damage. The Hartford loop connection is to be preferred over the check valve because the latter is apt to stick or not close tightly and, furthermore, because the check valve offers additional resistance to the condensate coming back to the boiler, which in gravity systems would raise the water line in the far end of the wet return several inches[4].

Hartford Return Connection

In order to prevent the boiler from losing its water under any circumstances, the use of the Hartford connection, or the Underwriters Loop, is recommended. This connection for a one- or two-boiler installation is shown in Fig. 3. The essential features of construction of a Hartford Loop connection are: (1) a direct connection (made without valves) between the steam side of the boiler and the return side of the boiler, and (2) a close nipple connection about 2 in. below the normal boiler water line from the return main to the boiler steam and return pressure balance connection. Equalizing pipe connections between the steam and return are given in Fig. 3, based on grate areas, but in no case shall this pipe size be less than the main return piping from the system.

[4]See method of calculating height above water line for gravity one-pipe systems in Chapter 13.

Sizing Boiler Connections

Little information is available on the sizing of boiler runouts and steam headers. Although some engineers prefer an enlarged steam header to serve as additional steam storage space, there ordinarily is no sudden demand for steam in a steam heating system except during the heating-up period, at which time a large steam header is a disadvantage rather than an advantage. The boiler header may be sized by first computing the maximum load that must be carried by any portion of the header under any conceivable method of operation, and then applying the same schedule of pipe sizing to the header as is used on the steam mains for the building. The horizontal runouts from the boiler, or boilers, may be sized by calculating the heaviest load that will be placed on the boiler at any

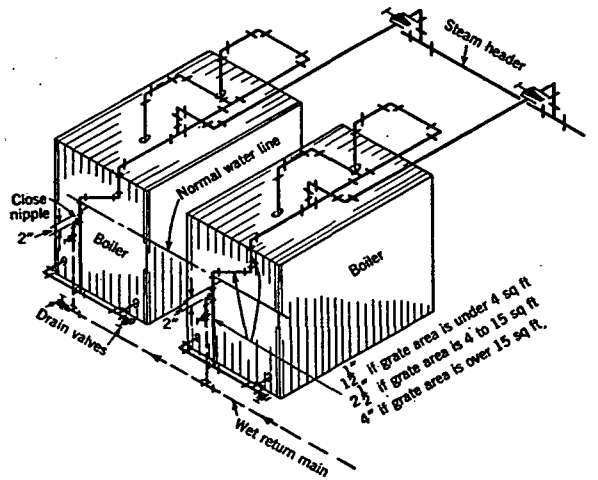


FIG. 3. THE HARTFORD RETURN CONNECTION

time, and sizing the runout on the same basis as the building mains. The difference in size between the vertical uptakes from the boiler and the horizontal main or runout is compensated for by the use of reducing ells.

Return connections to boilers in gravity systems are made the same size as the return main itself. Where the return is split and connected to two tappings on the same boiler, both connections are made the full size of the return line. Where two or more boilers are in use, the return to each may be sized to carry the full amount of return for the maximum load which that boiler will be required to carry. Where two boilers are used, one of them being a spare, the full size of the return main would be carried to each boiler, but if three boilers are installed, with one spare, the return line to each boiler would require only half of the capacity of the entire system, or, if the boiler capacity were more than one-half the entire system load, the return would be sized on the basis of the maximum boiler capacity. As the return piping around the boiler is usually small and short, it should not be sized to the minimum.