

In making a two-stage reduction, allowance should be made by increasing the pipe size for expansion of steam on the low pressure side of the valve. This also allows steam flow to be at a more nearly uniform velocity. Separating the valves by a distance up to 20 ft is recommended to reduce excessive hunting action of the first valve.

When the reduced pressure is approximately 15 lb or lower, the weight and lever diaphragm valve gives the best results with minimum maintenance. Above 15 lb, spring loaded diaphragm valves should be used, because of the extra weights required on weight and lever type. Equalizing line connections should be made not too close to the valve, and into the bottom of the reduced pressure steam main, to allow maximum condensation to exist in this equalizing line, or the connection is made into the top of the main and a water accumulator used to reduce the variation of the head of water on the diaphragm.

Care should be exercised in selecting the size of a reducing valve. The safest method is to consult the manufacturer. It is essential that sizes of piping to and from the reducing valve be such that they will pass the desired amount of steam with the maximum velocity desired. A common error is to make the size of the reducing valve the same size as that of the service, or outlet pipe size. Generally, this will make the reducing valve oversized, and bring about wire-drawing of valve and seat, due to small lift of the valve seat.

On installations where the steam requirements are relatively large and variable in mild weather or reduced demand periods, wire-drawing may occur. To overcome this condition, two reducing valves are installed in parallel, with the sizes selected on a 70 and 30 per cent proportion of maximum flow. For example, if 50,000 lb of steam per hour are required, the size of one valve is on the basis of $0.7 \times 50,000$ lb, or 35,000 lb, and the other on the basis of $0.3 \times 50,000$ lb, or 15,000 lb. During the mild or reduced demand periods, steam will flow through the smaller valve only. During the remainder of the season, the larger valve is set to control at whatever low pressure is desired, and the smaller one at a somewhat lower pressure. Thus, when steam flow is not at its maximum, the smaller valve is shut, and automatically opens when the maximum steam demand occurs, since this maximum demand of steam creates a slight pressure drop in the service line.

The installation of reducing valves in pipe lines requires detailed planning. They should be installed to give ease of access for inspection and repair, and wherever possible with diaphragm downward, except in cases of pilot operated valves.

There should be a by-pass around each reducing valve of size equal to one-half the size of reducing valve. The globe valve in by-pass line should be of a better type of construction, and must shut off absolutely tight. A steam pressure gage, graduated up to the initial pressure should be installed on the low pressure side. Safety valves located on the low pressure side should be set 5 lb higher than the final pressure but may be 10 lb higher than the reduced pressure if this reduced pressure is that of the first stage reduction of a double reduction. Strainers are sometimes installed on the inlet to the reducing valve but are not required before a second-stage reduction. If a two-stage reduction is made, it is well to install a pressure gage immediately before the reducing valve of the second-stage reduction also. In sizes 3 in. and above, it is advisable to install a drip trap between the two reducing valves.

BOILER CONNECTIONS

Steam

Cast-iron, sectional heating boilers usually have several outlets in the top. Two or more outlets should be used whenever possible 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 tapplings on both sides, while steel boilers are generally equipped with only one return tapping. Where two tapplings are provided, both should be used to effect proper circulation through the boiler. The return connection should include either a Hartford return connection or a check valve to prevent the accidental loss of boiler water to the returns with consequent danger

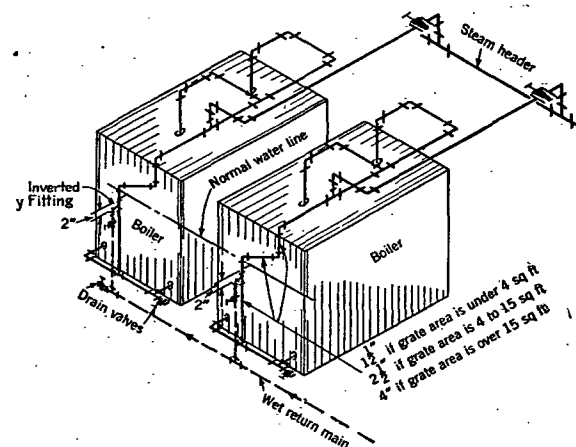


FIG. 16. THE HARTFORD RETURN CONNECTION

of boiler damage. The Hartford return 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.

In order to prevent the boiler from losing its water under any circumstances, the use of the Hartford return connection is recommended. This connection for a one- or two-boiler installation is shown in Fig. 16. The essential features of construction of a Hartford return 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, or preferably an inverted Y-fitting 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. 16, based on grate areas, but in no case shall this pipe size be less than the main return piping from the system.

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