

had some success. Non-ferrous piping may deteriorate rapidly unless selected with due regard to the service conditions to which it will be subjected. The composition and micro-structure are items of special importance. Electrolysis set up by joining copper alloys to iron must be guarded against.

Piping exposed to the elements or buried in the ground is quite successfully protected by coatings of the asphaltic type which are usually applied hot and are often reinforced with fabric wrappings. Galvanizing by the hot-dip process and painting with specially prepared mixtures also afford satisfactory protective safeguards.

The problem of corrosion has been summarized² as follows:

1. Corrosion in steam heating systems is confined mainly to the returns and varies widely in different localities and sometimes in the same locality, due to variations in the water and in operating conditions.
2. There does not seem to be any necessity to use a more costly material for piping than wrought iron or steel, between which long experience indicates no material difference in durability when used for this purpose.
3. The amount of dissolved oxygen and carbon dioxide present determines the extent of corrosion. The carbon dioxide should be low, especially when any considerable amount of oxygen is present.
4. The carbon dioxide in the condensate comes mostly from the dissociation of bicarbonates or carbonates in the boiler. For this reason sodium carbonate should not be used for internal treatment of water in heating boilers.
5. In high pressure plants the water should be pretreated to remove free and half-bound CO_2 and scale-forming matter without leaving more than a slight excess of sodium carbonate. The water should be thoroughly deaerated before entering the boiler.
6. In low pressure steam boilers (less than 5 lb pressure) where corrosion occurs in the returns, an excess of caustic soda with an equal amount of sodium sulphate should be maintained in the boiling water. The hydroxyl alkalinity should be at least twice the carbonate alkalinity. This may be controlled by testing samples of boiler water and the condensate.
7. All returns should be sealed, and every precaution taken to prevent unnecessary leakage of air into the system. Oiling the steam will afford substantial protection to steam piping.

A series of investigations, on the factors influencing corrosion in steam systems, including a study of the raw water, the production, the distribution, and the utilization of steam, demonstrated the extent and constitution of deposits in the heating systems of a large office building and a large hotel in New York City³. These deposits were found to originate from the action of corrosion and were found to contain little material from the boilers. The cause of the excessive corrosion was found to be the in-leakage of air into the vacuum return system. The amounts of oxygen and carbon dioxide associated with the steam were shown to be of insignificant importance as corrosive agents by the application of the Law of Henry and Dalton. Causes of corrosion trouble in heating systems were reported in the operation and, to a small extent, in the design of the system and not in the quality of steam used if that quality equals that encountered in these studies.

²Corrosion in Steam Heating Systems, by F. N. Speller (A.S.H.V.E. TRANSACTIONS, Vol. 34, 1928).

³Some Fundamental Considerations of Corrosion in Steam and Condensate Lines, by R. E. Hall and A. R. Mumford (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932).

A study of water supply as related to *air conditioning equipment*⁴ indicated that the characteristics of waters used vary widely. Certain waters are corrosive while others are scale forming⁵. Waters often bring about high rates of depreciation of apparatus and lower operating efficiencies. Chemical analysis of waters followed by chemical conditioning may obviate many of the difficulties encountered.

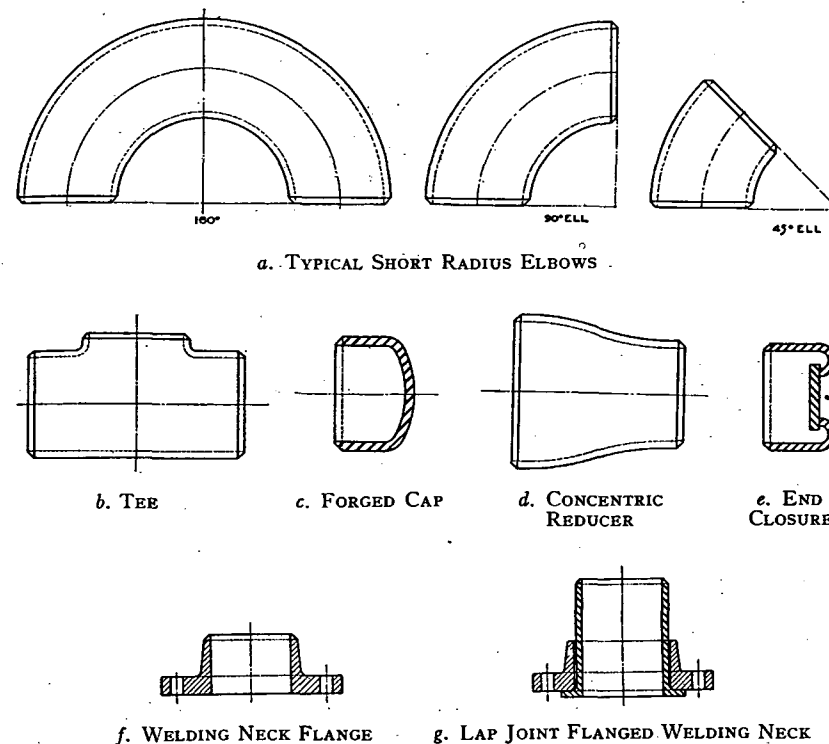


FIG. 2. WELDING FITTINGS

PIPE WELDING

Fusion welding in the heating and ventilating industry is an improved method of fabrication and installation widely used and accepted as competitive to the screwed and flanged joint in piping, and the rivet and bolt assembly in sheet and plate construction.

The process of fusion welding is easily understood. Two pieces of metal are brought substantially together and melted, with the addition of filler

⁴Corrosion as related to Air Conditioning Equipment, by R. M. Palmer.

⁵For additional information on corrosion, see 1933 report of National District Heating Association on this subject.