

motor drives were installed on machines. It has been found under these conditions that high temperatures prevail at the ceiling while low temperatures prevail in the working space. Not only operators have been affected under these conditions but also the output of the individual machines. Best results are obtained when the radiators are placed under the windows and adjacent to doors to the outside. The air heated by the radiators under the windows, rises, mixes with the cold infiltrating air from the windows, circulates across the ceiling, gradually settles to the floor, is drawn up by the radiator and the cycle continues. The advantage of placing radiators adjacent to the door is that the infiltration at this point is compensated for, the infiltrating air being warmed before it enters the heated space.

Placing a radiator close to an outside wall heats the wall immediately behind the radiator, but the infiltrating air through this wall absorbs this heat in part, the rest being used to compensate for the transmission losses through the wall.

SPECIFICATION CLAUSES

Specifications for radiation should contain the following clauses:

1. Manufacturers must guarantee that the heat emission per radiator shall not fall below the values given in Tables 18 to 30.
2. Radiation must be free from flaws on surface and leaks at nipple connections, and guaranteed to stand a hydrostatic test of not less than 100 lb. per sq. in.
3. Radiation must be thoroughly cleaned of all core sand, and if for vapor or modulation steam systems must be washed out and the openings plugged before shipment.
4. Radiation must not be placed where dirt can get into the interior and if to be placed in the weather or damp location must be given a priming coat of paint before shipment or immediately upon delivery at location.
5. Long or low radiators should be crated, and the crating not removed until placed in final location.
6. Radiators supported from the wall or ceiling shall be supported on steel or wrought iron hangers.

CHAPTER III

STEAM HEATING SYSTEMS

PIPING systems for steam heating—one broadly classified as one-pipe, two-pipe, vapor and vacuum systems; condensation returning to boiler by gravity or mechanical devices.

One-pipe system may be installed as a circuit or as a divided circuit, the steam mains rising close to the basement ceiling above boiler and then grades down from this high point, carrying with it steam and condensate. When the last radiator has been served the main may drop below the water line of boiler, when its size is reduced as the run back to the boiler carries only water, this run is called a "wet return." This return may be run above the water line of boiler, then, it is called a "dry return." In this system the condensate from the radiators returns to the steam main through the feed branches and risers as there is but one connection to the radiators. The air from the system is ejected through air valves properly placed on radiators at the end opposite steam supply, also, on mains properly placed near ends.

Two-pipe systems have two connections to the radiators, one for steam and the other for condensation, air being ejected through air valves properly placed as in the one-pipe system.

Vacuum systems employ a vacuum return pump to produce a vacuum in the system and return the condensation to the boiler.

Vapor or air return systems are two-pipe systems in which all the air and condensation are returned from the radiator through a dry return to a central point, from which point air is ejected from the system and condensate returned to boiler.

This system may or may not use thermostatic traps on the return end of radiators and the pressures used are generally not over a few ounces. Graduated supply valves may or may not be required. There are many variations employing various specialties which are usually patented and determine the name of the patented system. Owing to their specialized nature, none are illustrated here but catalog data on several systems are given in this volume.

Gravity Circulation is the term used to indicate any system where the condensate returns to the boiler by natural flow. Wherever this is the case a certain distance must be allowed between the water line in the boiler and the low point of the steam main and the dry return in order to allow for the pressure drop in the piping system and the proper return of condensate to boiler.

Material for this section compiled by Perry West, consulting engineer, Newark, N. J.; R. V. Frost, consulting engineer, Norristown, Pa., and S. E. Dibble, professor of heating, ventilating and sanitation, Carnegie Institute of Technology, Pittsburgh, Pa.