general, the higher the elevation of the unit, the greater the volume and velocity required to bring the warm air down to the working zone, and consequently, the lower the required temperature of the air leaving the unit.

Determining Unit Heater Requirements

The formulae given in the section on Unit Ventilators may be used to determine unit heater capacity requirements.

Application of Unit Heaters

Unit heaters are used principally for commercial and industrial applications such as garages, factories, laboratories, etc. They may also be

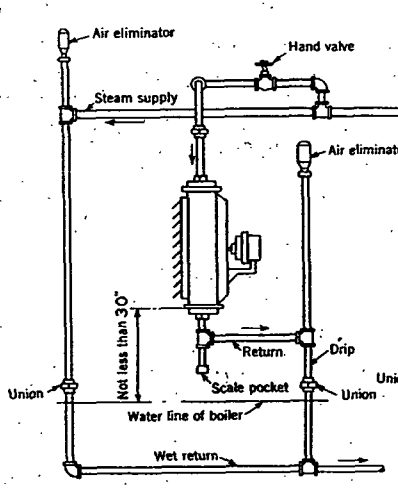

FIG. 5. UNIT HEATER CONNECTION TO ONE-PIPE GRAVITY STEAM SYSTEM

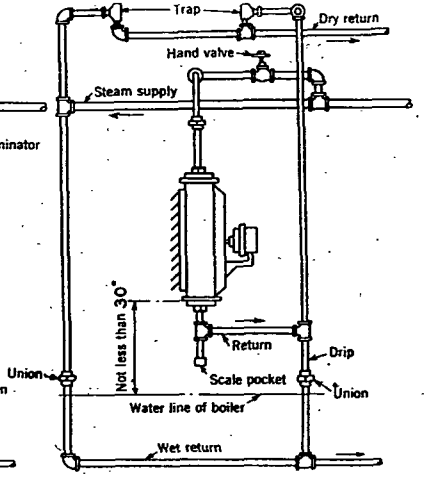

FIG. 6. UNIT HEATER CONNECTION TO GRAVITY SYSTEM WITH WET AND DRY RETURNS

used for heating finished rooms if properly applied and concealed, and if some consideration is given to the problem of noise.

Unit heaters may also be adapted to a number of industrial processes, such as drying and curing, with which the use of heated air in rapid circulation with uniform distribution is of particular advantage. They may be used for moisture absorption, such as fog removal in dye houses, or for the prevention of condensation on ceilings or other cold surfaces of buildings in which process moisture is released. When such conditions are severe, it is necessary that the unit heaters draw air from outside in enough volume to provide a rapid air change and that they operate in conjunction with ventilators or fans for exhausting the moisture-laden air. See discussion of condensation in Chapter 4.

There are three major factors to consider in the application of unit heaters, namely: (1) location of unit, (2) air distribution, and (3) heating medium.

Piping Connections for Steam Unit Heaters

Piping connections for steam unit heaters are similar to those for other types of fan blast heaters. The piping of unit heaters must conform

strictly to the system requirements while at the same time permitting the heaters themselves to function as intended. The basic piping principles for steam systems are discussed in Chapter 14.

Rapid condensation of steam, especially during heating-up periods, is characteristic of this type of equipment. The return piping must be planned to keep the heating surfaces free of rapid condensation, while the steam piping must be ample to carry a full supply of steam to the surfaces to take the place of that condensed. An adequate size of pipe is therefore essential for all heating surfaces over which there is a flow of forced air. Especially is this true where the fan is operated under start-and-stop control and where all or part of the air is taken from the outside. In such

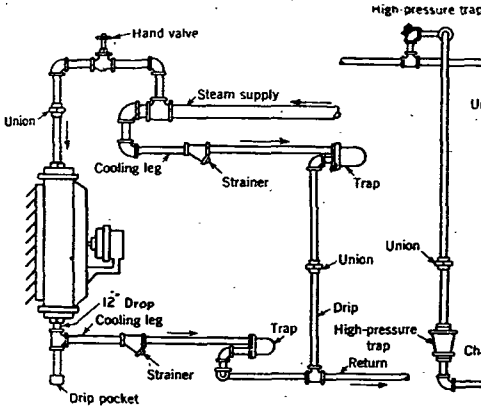

FIG. 7. UNIT HEATER CONNECTION FOR VACUUM OR VAPOR SYSTEM DISCHARGING CONDENSATION INTO DRY RETURN

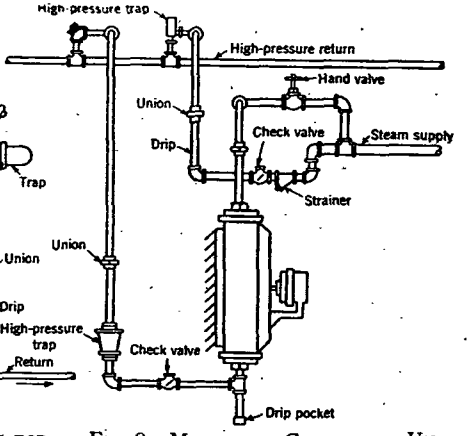

FIG. 8. METHOD OF CONNECTING UNIT HEATER TO HIGH PRESSURE RETURN

installations the condensation rate may vary rapidly and the necessity for ample pipe capacity is particularly important.

A method of connecting a unit heater to a one-pipe gravity system is illustrated in Fig. 5. In cases where the return main is located above the boiler water line, an artificial water line must be created by providing an equalizing loop to prevent steam passing into the return and thus into other units.

Where there is a wet and dry return, a method of pipe connection is shown in Fig. 6. In this case the condensate from the heater and the drip from the supply main drop to the wet return by gravity, while the air passes upward through traps to the dry return and is vented from the entire system by a master trap in any suitable location.

A piping arrangement where both the air and condensate pass through a common return to a boiler, with vent trap or condensate pump and receiver, is shown in Fig. 7. The traps must pass air and condensate rapidly to keep the return piping partially full of water.

Since unit heaters are often constructed with sufficient strength to resist high pressures, use of high pressure steam in them is a common practice. In Fig. 8 the condensate and air reach the return overhead through traps, and check valves are located in the return piping.

For two-pipe closed gravity return systems, the return from each unit