control and where all or part of the air is from the outside. In such 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

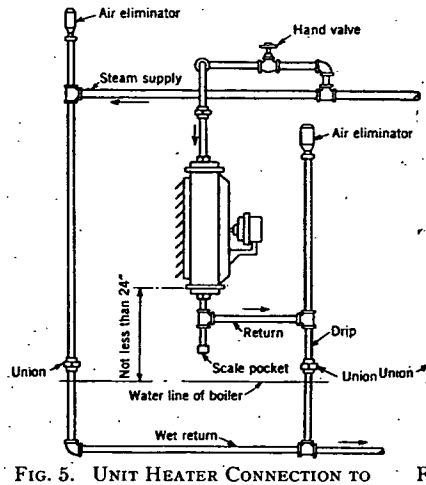



FIG. 5. UNIT HEATER CONNECTION TO ONE-PIPE GRAVITY STEAM SYSTEM

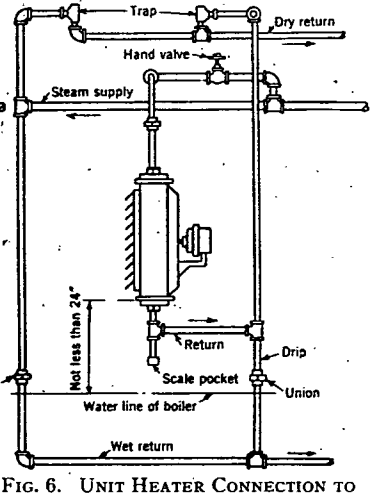



FIG. 6. UNIT HEATER CONNECTION TO GRAVITY SYSTEM WITH WET AND DRY RETURNS

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 should be fitted with a heavy duty or blast trap, and an automatic air valve should be connected into the return header of each unit heater. Provisions must be made for compensating for the pressure drop by elevating the unit heater above the water line of the boiler or of the receiver.





In pump and receiver systems the air may be eliminated by individual air valves on the heaters, or it may be carried into the returns the same as for vacuum systems and the entire return system be free-vented to the atmosphere, provided all units, drip points, and radiation are properly trapped to prevent steam entering the returns.

On vacuum or open vented systems the return from each unit should be fitted with a large capacity trap to discharge the water of condensation and with a thermostatic air valve for eliminating the air, or with a heavy-duty trap for handling both the condensation and the air, provided the air finally can be eliminated at some other point in the return system.

For high pressure systems the same kind of traps may be used as with vacuum systems, except that they must be constructed for the pressure

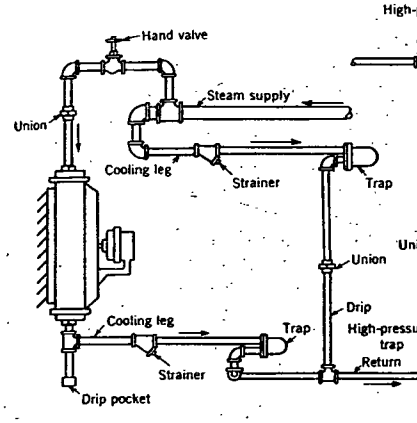



FIG. 7. UNIT HEATER CONNECTION FOR VACUUM OR VAPOR SYSTEM DISCHARGING CONDENSATION INTO DRY RETURN

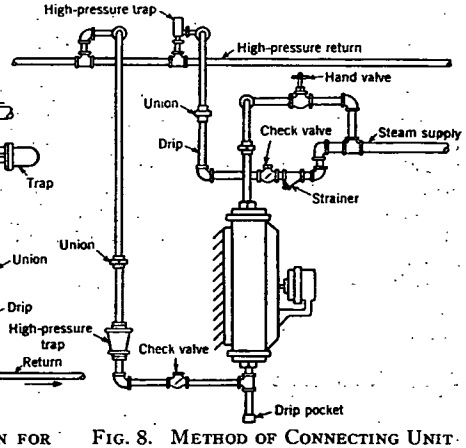



FIG. 8. METHOD OF CONNECTING UNIT HEATER TO HIGH PRESSURE RETURN

used. If the air is to be eliminated at the return header of the unit, a high pressure air valve can be used; otherwise the air may be passed with the condensate through the high-pressure return trap, with its elimination at some other point in the system.

## Application

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