

## CONDENSATION PUMPS

Condensation pumps are in general required when the elevation of the boiler with respect to the heating units is such that the condensate will not return by gravity or when the boiler pressure is greater than that supplied the heating units, as for example, a high pressure boiler installation supplying steam through a reducing valve to the heating units. The condensate is generally returned by gravity to a receiver, ordinarily vented to the atmosphere, from which it flows to the pump and forced into the boiler. This is not a closed circuit and the relative elevation of the heating units and the boiler water line is not important, as it is where the condensate is returned to the boiler by gravity due to the static head of water in the return mains.

Condensation return pumps are assembled with tank or receiver and arranged for either continuous operation or for automatic starting and stopping by float control. Any style of water pump may be employed for this service, and the source of power will determine the mode of drive, either steam or electric. For low pressure heating systems, the motor-driven, automatic, centrifugal pump and receiver has, however, found wide acceptance in practice.

Capacity ratings are given in equivalent square feet (EDR) and are based on condensation values 2 to 3 times the normal rate. An indication of capacities with power requirements for one type of electric condensation pump is given in Table 1. These commercial capacities, however, are for water at a temperature of 180 F. For any higher temperature of condensate, which may be due to steam leaking into the returns, a correction factor is necessary to allow for the inability of the pump to handle its full capacity under this operating condition. The capacity of the unit selected should be increased according to the following factors:

| TEMPERATURE AT SUCTION PUMP<br>(DEG FAHR) | FACTOR |
|-------------------------------------------|--------|
| 190                                       | 1.15   |
| 200                                       | 1.56   |
| 204                                       | 2.00   |

If a special assembly be made so that the receiving tank is some height above the pump suction inlet, to give sufficient static head, it may be possible to handle water temperatures slightly higher than 180 F without increasing the size of pump over that for standard requirements.

## VACUUM HEATING PUMPS

Vacuum pumps differ from condensation pumping units by the additional feature of mechanical or positive means for the removal of air from the system. A vacuum heating pump is therefore a combination for the removal of air and water, and for the return of the condensate to the boiler, or to some other intercepting device that may be employed in plants having mixed systems of heating and other services. Pumps of this classification may be driven by steam or electrical means; they may be continuous in operation, or automatic, with float control or vacuum control in one or more combinations.

## Motor-Driven Vacuum Pumps

Motor-driven return-line vacuum pumps may be classified as follows

1. Separation of air by venting to atmosphere.
  - a. Water piston pumps.
  - b. Water jet pumps.
    - (1) Stationary jet.
    - (2) Rotary jet.
2. Separation of air under a vacuum.

## Separation by Venting to Atmosphere

**Water Piston Pumps.** Pumps operating under this principle may or may not have a receiver between the pump suction and the return system. They are equipped with one rotor, which withdraws air or water, or both air and water, depending on conditions in the receiver or in the system, and this rotor discharges all of the air and water handled into a separating tank. The separating tank is vented to the atmosphere so that the air is freed against atmospheric pressure. The water, after separation, is then handled a second time by a centrifugal rotor and discharged to the boiler.

**Stationary Jet Pumps.** These pumps may or may not be equipped with a receiver between the pump suction and the return system. When the jet type of pump is handling air it is discharging this air and some water withdrawn from the system into a receiver, which is vented to the atmosphere. This water of condensation is then picked up by a second centrifugal water impeller and discharged. At times water handled by the pump for the vacuum producing jet may be by-passed to the boiler by means of a valve operated by a float in the receiver.

**Rotary Jet Pump.** The operation of rotary jet pumps equipped with rotary jets is similar to the operation of pumps equipped with stationary jets. To secure increased air capacity, however, a rotary jet pump employs an impeller which discharges an annular screen of water from its

TABLE 1. CHARACTERISTICS OF CENTRIFUGAL RETURN PUMPS AND RECEIVERS DELIVERING AGAINST VARIOUS PRESSURES

| RATING<br>SQUARE FEET<br>EQUIVALENT<br>CAST-IRON<br>DIRECT<br>RADIATION | ACTUAL<br>MEASURED<br>WATER<br>CAPACITY<br>GALLONS<br>PER MINUTE | MOTOR HORSEPOWERS<br>DISCHARGE PRESSURE, POUNDS PER SQUARE INCH AT PUMP |               |                |                |                |                |
|-------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------|---------------|----------------|----------------|----------------|----------------|
|                                                                         |                                                                  | 10 lb.                                                                  | 20 lb.        | 30 lb.         | 40 lb.         | 50 lb.         | 60 lb.         |
| 2,000                                                                   | 4                                                                | $\frac{1}{4}$                                                           | $\frac{1}{2}$ | $\frac{3}{4}$  | 1              | 1              | 2              |
| 4,000                                                                   | 6                                                                | $\frac{1}{4}$                                                           | $\frac{1}{2}$ | $\frac{3}{4}$  | 1              | 1              | 2              |
| 6,000                                                                   | 8                                                                | $\frac{1}{4}$                                                           | $\frac{1}{2}$ | $\frac{3}{4}$  | 1              | $1\frac{1}{2}$ | 2              |
| 8,000                                                                   | 11                                                               | $\frac{1}{4}$                                                           | $\frac{1}{2}$ | $\frac{3}{4}$  | 1              | $1\frac{1}{2}$ | 2              |
| 10,000                                                                  | 13                                                               | $\frac{1}{4}$                                                           | $\frac{1}{2}$ | $\frac{3}{4}$  | 1              | $1\frac{1}{2}$ | 2              |
| 12,000                                                                  | 16                                                               | $\frac{1}{2}$                                                           | $\frac{3}{4}$ | 1              | $1\frac{1}{2}$ | $1\frac{1}{2}$ | ...            |
| 16,000                                                                  | 22                                                               | $\frac{1}{2}$                                                           | $\frac{3}{4}$ | 1              | $1\frac{1}{2}$ | $1\frac{1}{2}$ | ...            |
| 26,000                                                                  | 35                                                               | $\frac{3}{4}$                                                           | 1             | $1\frac{1}{2}$ | 3              | 5              | $7\frac{1}{2}$ |
| 40,000                                                                  | 60                                                               | $1\frac{1}{2}$                                                          | 2             | 3              | 5              | $7\frac{1}{2}$ | 10             |
| 65,000                                                                  | 90                                                               | $1\frac{1}{2}$                                                          | 3             | 5              | 5              | $7\frac{1}{2}$ | 10             |
| 100,000                                                                 | 150                                                              | 2                                                                       | 5             | $7\frac{1}{2}$ | $7\frac{1}{2}$ | 10             | 15             |
| 150,000                                                                 | 200                                                              | 3                                                                       | 5             | $7\frac{1}{2}$ | 10             | 15             | 15             |