No additional allowance need be made for covered mains or risers, but exposed mains or risers used as heating surfaces should be included in calculating the equivalent square feet of direct radiation.

## PUMP SPECIFICATIONS

Reciprocating and power driven pumps should be specified as to make, size, water and steam working pressures, piston speed, temperature of water to be handled, electric motor characteristics, etc.

TABLE 15. MOTOR DRIVEN CONDENSATION PUMP CAPACITIES FOR DELIVERING AGAINST VARIOUS PRESSURES

| Radiation in Sq. Ft. of Direct Radiation | Minimum Gallons per Min. | Maximum Boiler Pressure Lb. | Motor H. P. | Suggested Size of Piping Inches | Radiation in Sq. Ft. of Direct Radiation | Minimum Gallons per Min. | Maximum Boiler Pressure Lb. | Motor H. P. | Suggested Size of Piping Inches |
|---|---|---|---|---|---|---|---|---|---|
| 4000 | 6–8 | 10 | ¼ | 1 | 15,000 | 25–30 | 10 | ¾ | 2 |
| 4000 | 6–8 | 15–40 | ½ | 1 | 15,000 | 25–30 | 15 | 1 | 2 |
| 4000 | 6–8 | 50–60 | ¾ | 1 | 15,000 | 25–30 | 20–30 | 1½ | 2 |
| | | | | | 15,000 | 25–30 | 40 | 2 | 2 |
| | | | | | 15,000 | 25–30 | 50–60 | 3 | 2 |
| 6000 | 9–12 | 10 | ¼ | 1¼ | 20,000 | 30–40 | 10 | ¾ | 2 |
| 6000 | 9–12 | 15–40 | ¾ | 1¼ | 20,000 | 30–40 | 15 | 1 | 2 |
| 6000 | 9–12 | 50–60 | 1 | 1¼ | 20,000 | 30–40 | 20 | 2 | 2 |
| | | | | | 20,000 | 30–40 | 30–40 | 3 | 2 |
| | | | | | 20,000 | 30–40 | 50–60 | 5 | 2 |
| 8000 | 12–16 | 10 | ½ | 1¼ | 25,000 | 40–50 | 10 | 1 | 2½ |
| 8000 | 12–16 | 15 | ¾ | 1¼ | 25,000 | 40–50 | 15 | 1½ | 2½ |
| 8000 | 12–16 | 20 | 1 | 1¼ | 25,000 | 40–50 | 20 | 2 | 2½ |
| 8000 | 12–16 | 30–60 | 1½ | 1¼ | 25,000 | 40–50 | 30–40 | 3 | 2½ |
| | | | | | 25,000 | 40–50 | 50–60 | 5 | 2½ |
| 10,000 | 15–20 | 10 | ½ | 1½ | 30,000 | 50–60 | 10 | 1 | 2½ |
| 10,000 | 15–20 | 15 | ¾ | 1½ | 30,000 | 50–60 | 15 | 1½ | 2½ |
| 10,000 | 15–20 | 20–30 | 1 | 1½ | 30,000 | 50–60 | 20 | 2 | 2½ |
| 10,000 | 15–20 | 30–40 | 1½ | 1½ | 30,000 | 50–60 | 30–60 | 5 | 2½ |
| 10,000 | 15–20 | 50–60 | 2 | 1½ | | | | | |

The kind of drive should be specified for power driven pumps.

Centrifugal and rotary pumps should be specified as to make, type, capacity, temperature of water to be handled, speed and motor characteristics including:

(1) Name of motor manufacturer; (2) Manufacturers rated Horse Power; (3) The maximum temperature rise for any part of the motor above the temperature of the surrounding air; (4) Full Speed in R. P. M; (5) Current characteristics; (6) Whether the motor is open, semi-enclosed or fully enclosed.

The following should also be included in the specifications, total head to be pumped against including suction lift, friction head, velocity head and head against which the pump must discharge. The vacuum under which return pumps are required to operate and as to whether two or more units are to operate in parallel or separately.

All pumps should be set on substantial foundations and be provided with heavy cast iron sub-bases, securely anchored to foundation and provided with drip ring with drain properly connected to sump or sewer.





TABLE 16. ONE PUMP ONE MOTOR RETURN LINE SYSTEM

| Size | Sq. Ft. Direct Equivalent Radiation Surface | Diameter Orifice Vacuum 10 In. | Air Capacity Cu. Ft. per Min. | Water Capacity Gals. per Min. 10 Lb. Pressure 180° F. | Actual H. P. | R. P. M. | H. P. of Motor |
|---|---|---|---|---|---|---|---|
| A | 8000 | 9–64 | 6 | 11 | 0.9 | 1800 | 1 |
| B | 16,000 | 3–16 | 11 | 22 | 1.4 | 1800 | 1½ |
| C | 26,000 | 1–4 | 19 | 35 | 2.0 | 1800 | 2 |
| D | 40,000 | 9–32 | 25 | 60 | 2.8 | 1200 | 3 |
| E | 65,000 | 3–8 | 42 | 90 | 3.9 | 1200 | 5 |
| F | 100,000 | 1–2 | 75 | 140 | 9.0 | 1200 | 10 |
| G | 150,000 | 9–16 | 90 | 200 | 10.0 | 900 | 10 |
| H | 250,000 | Three 1–2 | 180 | 400 | 10.0 | 720 | 20 |

TABLE 17. TWO PUMP ONE MOTOR RETURN LINE SYSTEM VACUUM PUMPS

| Capacity Sq. Ft. of Direct Radiation | Capacity G. P. M. | Pressure at Pump | Motor H. P. |
|---|---|---|---|
| 6000 | 9 | 10 | ¾ |
| 6000 | 9 | 15 | 1 |
| 8000 | 12 | 10 | 1 |
| 8000 | 12 | 15 | 1½ |
| 12,000 | 18 | 10 | 1 |
| 12,000 | 18 | 15 | 1½ |
| 18,000 | 27 | 10 | 1½ |
| 18,000 | 27 | 15 | 2 |
| 30,000 | 45 | 10 | 2 |
| 30,000 | 45 | 15 | 3 |

TABLE 18. TWO PUMP TWO MOTOR RETURN LINE SYSTEM VACUUM PUMP

| Capacity Sq. Ft. of Direct Radiation | Capacity G. P. M. | Pressure at Pump | Motor H. P. | |
|---|---|---|---|---|
| | | | Air | Water |
| 6000 | 9 | 10 | ½ | ¾ |
| 6000 | 9 | 15 | ½ | ¾ |
| 8000 | 12 | 10 | ½ | ¾ |
| 8000 | 12 | 15 | ½ | 1 |
| 12,000 | 18 | 10 | ¾ | ¾ |
| 12,000 | 18 | 15 | ¾ | 1 |
| 18,000 | 27 | 10 | ¾ | 1 |
| 18,000 | 27 | 15 | ¾ | 2 |
| 25,000 | 38 | 10 | 1 | 1½ |
| 25,000 | 38 | 15 | 1 | 2 |
| 30,000 | 45 | 10 | 1 | 1½ |
| 30,000 | 45 | 15 | 1 | 2 |

The exhaust from steam driven pumps supplying steam for heating purposes should be taken through an efficient oil separator before entering any part of the heating system or other apparatus.

Motors should be not less than ⅓ greater in horsepower than that actually required to drive the pump under full load conditions.