

roofs or cold surfaces of buildings where process moisture is given off. When such conditions are bad, it is necessary that the 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.

Unit heaters are made to operate on hot water, vacuum or vapor steam systems or steam at any pressure up to 200 lb. or more. When high pressure steam is used, a heater must be selected with the coil especially designed to withstand the maximum pressure that will exist.

It is usual to rate unit heaters in B.t.u. per hour at a given temperature of air entering the heater and a given steam pressure maintained on the coil. Steam at 2 lb. pressure and air entering at 60 deg. fahr. are usually taken as standard. The B.t.u. capacity of a heater increases as the steam pressure increases, and decreases as the entering air temperature increases. The B.t.u. capacity for any condition of steam pressure and entering air temperature may be calculated from any given rating by the use of factors in Table 1.

TABLE 1. B.T.U. CONSTANTS FOR VARIOUS STEAM PRESSURES AND TEMPERATURES OF ENTERING AIR

STEAM PRESSURE LB.	TEMPERATURE OF AIR ENTERING HEATER												
	-10°	0°	10°	20°	30°	40°	45°	50°	55°	60°	65°	70°	75°
0	0.975	0.93	0.89	0.84	0.80	0.76	0.73	0.71	0.69	0.67	0.64	0.62	0.60
2	1.01	0.96	0.92	0.87	0.83	0.79	0.76	0.74	0.72	0.70	0.68	0.65	0.63
5	1.04	1.00	0.96	0.91	0.87	0.82	0.80	0.78	0.76	0.74	0.71	0.69	0.67
10	1.06	1.05	1.01	0.97	0.92	0.88	0.85	0.83	0.81	0.79	0.76	0.74	0.72
15	1.15	1.10	1.05	1.01	0.97	0.92	0.90	0.88	0.86	0.83	0.81	0.79	0.76
20	1.18	1.14	1.09	1.05	1.00	0.96	0.94	0.92	0.89	0.87	0.85	0.83	0.81
30	1.25	1.21	1.16	1.12	1.08	1.03	1.01	0.98	0.96	0.94	0.92	0.90	0.88
40	1.30	1.26	1.22	1.17	1.12	1.08	1.06	1.04	1.02	1.00	0.97	0.95	0.93
50	1.35	1.31	1.27	1.22	1.18	1.13	1.11	1.09	1.07	1.04	1.02	1.00	0.98
60	1.39	1.35	1.31	1.26	1.22	1.18	1.16	1.13	1.11	1.09	1.07	1.05	1.03
80	1.49	1.43	1.38	1.34	1.29	1.25	1.23	1.20	1.18	1.16	1.14	1.12	1.10
100	1.53	1.49	1.44	1.40	1.35	1.31	1.29	1.26	1.24	1.22	1.20	1.18	1.16
125	1.59	1.56	1.51	1.46	1.42	1.37	1.36	1.33	1.31	1.29	1.27	1.24	1.22
135	1.61	1.57	1.53	1.48	1.44	1.39	1.37	1.35	1.33	1.30	1.28	1.26	1.24
140	1.62	1.58	1.54	1.49	1.45	1.41	1.38	1.36	1.34	1.32	1.29	1.27	1.25
150	1.64	1.60	1.55	1.51	1.46	1.42	1.40	1.38	1.35	1.33	1.31	1.28	1.26

Note.—To get B.t.u.'s at any steam pressure and entering temperature, multiply constant from table by rated B.t.u.'s at 0 deg. entering and 5 lb. pressure.

The B.t.u. required to heat a building with unit heaters is determined in the same way as for any other heating equipment. (Use data in Chapter I).

If all or a part of the air is to be taken in from out-of-doors the B.t.u. necessary to heat this air from the outside temperature to the inside temperature must be added. Unit heaters of the number and size needed to furnish this quantity of B.t.u. are then selected from the manufacturers rating tables, using their ratings at the steam pressure to be used and at the temperature at which the air will enter the heater.

For recirculating heaters with intakes at the floor level, use the tem-

perature to be maintained in the room as the temperature of the air entering the heater and where suspended heaters are used without any intake boxes extending down to the floor level, a higher entering air temperature should be used than that at which the room is to be maintained. With suspended heaters taking in air at some distance above the floor, the temperature variation from floor to ceiling has been found to be approximately 1 deg. fahr. for each foot of elevation. Unit heaters taking in recirculated air at the floor level will maintain temperature differentials of less than 1 deg. per foot of elevation. These temperature differences per foot of height are less than the corresponding variations for spaces heated by direct radiation.

Heaters supplied with superheated steam will have less B.t.u. capacity than with saturated steam at the same pressure. When superheated steam is supplied or when the steam in the heater coils is superheated by throttling from a higher line pressure, the heater manufacturer should be asked for a special rating for the conditions of the case.

The present day tendency for straight heating is to use steam at low-pressure when the boiler supplies steam for heating purposes only and when the transmission lines are short. Many industrial plants, however, generate steam at high pressure either for long distance transmission or process uses. When such high pressure steam is available in sufficient quantity for the heating load, it is most often more economical to select heaters with coils good for high pressure. Thus the line pressure may be turned into the coils directly without reducing valves, fewer or smaller heaters can be used and the condensation can be boosted to overhead returns whenever desirable to do so.

Among the unit heaters available are types having from one to four outlets that can be arranged to discharge in selected directions and that will project their heating effect over distances of from 30 to 200 ft. from the heater, depending upon the capacity of the heater and the design of the fans and outlets. This leaves the engineer comparatively free to select the heater location best suited to the production layout.

The smaller capacity propeller fan type heaters with outlet velocities from 300 to 600 ft. per minute may be placed from 60 to 100 ft. apart. The larger capacity housed fan high outlet velocity heaters may be placed up to 400 ft. apart, depending upon their design. Heaters may be distributed through the central portions of a room discharging toward exposed surfaces, or spaced around the walls, discharging along the walls and inward as well, when there are considerable roof losses. In general, it is better to direct the discharge from the unit heater in such fashion that rotational circulation is set up by the system rather than having the heaters discharge in random and counter directions.

Usually hot blasts in the working zone are objectionable, so heaters mounted on the floor should have their discharge outlets above the head line and suspended heaters should not be placed so low or turned in such direction that the heated air stream will not be objectionable in the working zone. In the interest of economy, however, the elevation of the heater outlet and the direction of discharge should be so selected that the heated air is brought as close to the head line as possible, but not into the working zone.