Application Guide

Electric Heaters

Quick Estimates of Wattage Requirements

The following tables can be used to make quick estimates of wattage requirements.

For Steel: Use table or metric equation.

$$kW = \frac{\text{Kilograms x Temperature Rise (°C)}}{\text{5040 x Heat-up Time (hrs.)}}$$

$$kW = \frac{\text{Pounds x Temperature Rise (°F)}}{\text{20,000 x Heat-up Time (hrs.)}}$$

Kilowatt-Hours to Heat Steel*—Ref. 17

Amount of Steel (lb.)	Temperature Rise °F						
	50°	100°	200°	300°	400°	500°	600°
	Kilowatts to Heat in One Hour						
25	0.06	0.12	0.25	.37	0.50	0.65	0.75
50	0.12	0.25	0.50	.75	1.00	1.25	1.50
100	0.25	0.50	1.00	1.50	2.00	2.50	3.00
150	0.37	0.75	1.50	2.25	3.00	3.75	4.50
200	0.50	1.00	2.00	3.00	4.00	5.00	6.00
250	0.65	1.25	2.50	3.75	5.00	6.25	7.50
300	0.75	1.50	3.00	4.50	6.00	7.50	9.00
400	1.00	2.00	4.00	6.00	8.00	10.00	12.00
500	1.25	2.50	5.00	7.50	10.00	12.50	15.00
600	1.50	3.00	6.00	9.00	12.00	15.00	18.00
700	1.75	3.50	7.00	10.50	14.00	17.50	21.00
800	2.00	4.00	8.00	12.00	16.00	20.00	24.00
900	2.25	4.50	9.00	13.50	18.00	22.50	27.00
1000	2.50	5.00	10.00	15.00	20.00	25.00	30.00

* Read across in table from nearest amount in pounds of steel to desired temperature rise column and note kilowatts to heat in one hour.

Includes a 40 percent safety factor to compensate for high heat losses and/or low power voltage.

For Oil:

Use equation or table.

$$kW = \frac{\text{Gallons x Temperature Rise (°F)}}{\text{800 x Heat-up time (hrs.)}}$$

OR

$$kW = \frac{\text{Liters x Temperature Rise (°C)}}{\text{1680 x Heat-up time (hrs.)}}$$

1 cu. ft. = 7.49 gallons

Kilowatt-Hours to Heat Oil*—Ref. 18

Amount of Oil		Temperature Rise °F					
Cubic Feet	Gallons	50°	100°	200°	300°	400°	500°
0.5	3.74	0.3	0.5	1	2	2	3
1.0	7.48	0.5	1.0	2	3	4	6
2.0	14.96	1.0	1.0	2	4	6	11
3.0	22.25	2.0	3.0	6	9	12	16
4.0	29.9	2.0	4.0	8	12	16	22
5.0	37.4	3.0	4.0	9	15	20	25
10.0	74.8	5.0	9.0	18	29	40	52
15.0	112.5	7.0	14.0	28	44	60	77
20.0	149.6	9.0	18.0	37	58	80	102
25.0	187	11.0	22.0	46	72	100	127
30.0	222.5	13.0	27.0	56	86	120	151
35.0	252	16.0	31.0	65	100	139	176
40.0	299	18.0	36.0	74	115	158	201
45.0	336.5	20.0	40.0	84	129	178	226
50.0	374	22.0	45.0	93	144	197	252
55.0	412	25.0	49.0	102	158	217	276
60.0	449	27.0	54.0	112	172	236	302
65.0	486	29.0	58.0	121	186	255	326
70.0	524	32.0	62.0	130	200	275	350
75.0	562	34.0	67.0	140	215	294	375

* Read across in table from nearest amount in gallons of liquids to desired temperature rise column and note kilowatts to heat in one hour.

Add 5 percent for uninsulated tanks.

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Kilowatt-Hours to Heat Water*—Ref. 19

Amount of Liquid		Temperature Rise °F						
ft^3	Gallons	20°	40°	60°	80°	100°	120°	140°
		Kilowatts to Heat in One Hour						
0.66	5	0.3	0.5	0.8	1.1	1.3	1.6	1.9
1.3	10	0.5	1.1	1.6	2.1	2.7	3.2	3.7
2.0	13	0.8	1.6	2.4	3.2	4.0	4.8	5.6
2.7	20	1.1	2.2	3.2	4.3	5.3	6.4	7.5
3.3	25	1.3	2.7	4.0	5.3	6.7	8.0	9.3
4.0	30	1.6	3.2	4.8	6.4	8.0	9.6	12.0
5.3	40	2.1	4.0	6.4	8.5	11.0	13.0	15.0
6.7	50	2.7	5.4	8.0	10.7	13.0	16.0	19.0
8.0	60	3.3	6.4	9.6	12.8	16.0	19.0	22.0
9.4	70	3.7	7.5	11.2	15.0	19.0	22.0	26.0
10.7	80	4.3	8.5	13.0	17.0	21.0	26.0	30.0
12.0	90	5.0	10.0	14.5	19.0	24.0	29.0	34.0
13.4	100	5.5	11.0	16.0	21.0	27.0	32.0	37.0
16.7	125	7.0	13.0	20.0	27.0	33.0	40.0	47.0
20.0	150	8.0	16.0	24.0	32.0	40.0	48.0	56.0
23.4	175	9.0	18.0	28.0	37.0	47.0	56.0	65.0
26.7	200	11.0	21.0	32.0	43.0	53.0	64.0	75.0
33.7	250	13.0	27.0	40.0	53.0	67.0	80.0	93.0
40.0	300	16.0	32.0	47.0	64.0	80.0	96.0	112.0
53.4	400	21.0	43.0	64.0	85.0	107.0	128.0	149.0
66.8	500	27.0	53.0	80.0	107.0	133.0	160.0	187.0

* Read across in table from nearest amount in gallons of liquid to desired temperature rise column and note kilowatts to heat in one hour.

For Heating Flowing Water:

kW = GPM x Temperature Rise (°F) x 0.16

OR

kW = Liters/min. x Temperature Rise (°C) x 0.076

For Heating Water in Tanks: Use equation or table.

$$\text{kW} = \frac{\text{Gallons x Temperature Rise (°F)}}{\text{375 x Heat-up Time (hrs)}}$$

OR

$$\text{kW} = \frac{\text{Liters x Temperature Rise (°C)}}{\text{790 x Heat-up Time (hrs)}}$$

1 cu. ft. = 7.49 gallons

Kilowatt-Hours to Superheat Steam Ref. 20

1. Plot points on lines P, Q and S.

   P represents the inlet temperature (and saturation pressure) of the system.

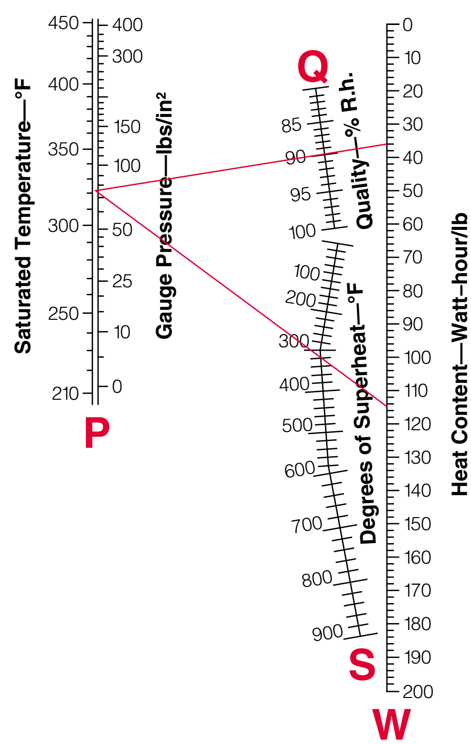
   Q represents the liquid content of the water vapor.

   S indicates the outlet temperature minus the saturated temperature.

   W indicates the heat content of the water vapor.
2. Draw a straight line from P through Q to W. Read W_1.
3. Draw a straight line from P through S to W. Read W_2.
4. Required watts = Weight (lbs.) of steam/hour x (W_2-W_1)

Watt density is critical. Review temperature and velocity prior to heater selection.

Reference is 80 percent quality at 20 psig.



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Kilowatt-Hours to Heat Air—Ref. 21

Amt. of Air CFM	Temperature Rise °F										
	50°	100°	150°	200°	250°	300°	350°	400°	450°	500°	600°
100	1.7	3.3	5.0	6.7	8.3	10.0	11.7	13.3	15.0	16.7	20.0
200	3.3	6.7	10.0	13.3	16.7	20.0	23.3	26.7	30.0	33.3	40.0
300	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	60.0
400	6.7	13.3	20.0	26.7	33.3	40.0	46.7	53.3	60.0	66.7	80.0
500	8.3	16.7	25.0	33.3	41.7	50.0	58.3	66.7	75.0	83.3	100.0
600	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	120.0
700	11.7	23.3	35.0	46.7	58.3	70.0	81.7	93.3	105.0	116.7	140.0
800	13.3	26.7	40.0	53.3	66.7	80.0	93.3	106.7	120.0	133.3	160.0
900	15.0	30.0	45.0	60.0	75.0	90.0	105.0	120.0	135.0	150.0	180.0
1000	16.7	33.3	50.0	66.7	83.3	100.0	116.7	133.3	150.0	166.7	200.0
1100	18.3	36.7	55.0	73.3	91.7	110.0	128.3	146.7	165.0	183.3	220.0
1200	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	180.0	200.0	240.0

Use the maximum anticipated airflow. This equation assumes insulated duct (negligible heat loss). 70°F inlet air and 14.7 psia.

For Air:

Use equation or table.

$$kW = \frac{\text{CFM* x Temperature Rise (°F)}}{3000}$$

OR

$$kW = \frac{\text{Cubic Meters/Min* x Temperature Rise (°C)}}{47}$$

For Compressed Air:

$$kW = \frac{\text{CFM** x Density** x Temperature Rise (°F)}}{228}$$

OR

$$kW = \frac{\text{Cubic Meters/Min** x Temperature Rise (°C) x Density (kg/m}^3\text{)**}}{57.5}$$

*Measured at normal temperature and pressure.

**Measured at heater system inlet temperature and pressure.