REFERENCE GUIDE

fast heat®

WATT DENSITY TABLE

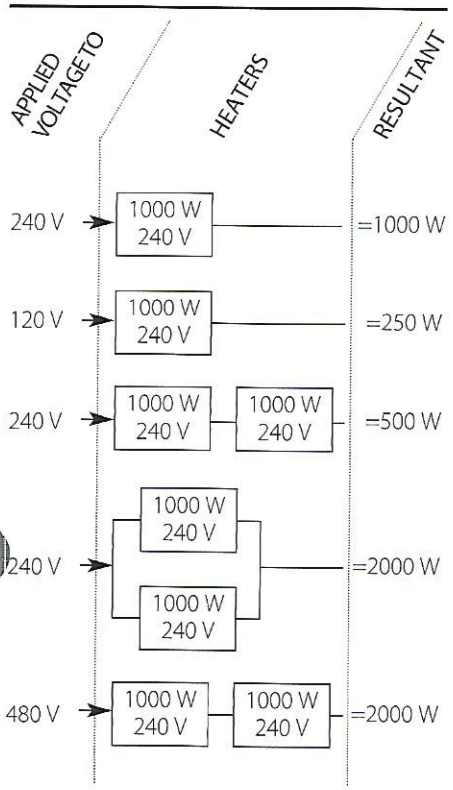
MATERIAL	MAXIMUM OPERATING TEMPERATURE	MAXIMUM WATTS PER SQUARE INCH
Acid Solutions	180	40
Alkaline Solutions and Oakite	212	40
Ammonia Plating Solutions	50	25
Aroclor	600	20
Asphalt, Tar or Heavy Compounds	200	10 circ. 5 non circ.
	300	8 circ. 4 non circ.
	400	7 circ. 4 non circ.
	500	6 circ. 3 non circ.
Bunker "C" Fuel Oil	160	10-15 fast circ. 4-7 non circ.
	210	45
Caustic Soda 2 %	210	25 and down
Caustic Soda 10 %	180	25 and down
Caustic Soda 75 %	185	20
Citrus Juices	275	20
Degreasing Solution Vapor		
Dowtherm A		
Liquid Phase	750	18 and down
Vapor Phase	750	12 and down
Dowtherm E	400	12
Electro Plating Solutions	180	40
Ethylene Glycol	300	30
Fatty Acids	150	20
Freon	300	3
Fuel Oil/Preheating		
Light Grade	180+	25-30 circulating
Heavy (see bunker c)		
Gasoline	300	2-5
Glycerine	50	40
Heat Transfer Oil	500	20
	600	15
Lead Stereotype Pot	600	35 on casting
Linseed Oil	150	50
		20-25 circ.
Machine Oil SAE 30	250	15-20 non circ.
Metal Melting Pot	500-900	20-27
Mineral Oil	200	20
	400	16
Molasses	100	4-5
Molten Salt Bath	800-900	25-30
Molten Tin	600	20
Oakite (see alkaline solutions)		
Oil Draw Bath	600	20
	400	24
Oils (see type of oil)	SOLID	4
Paraffin or Wax	150	16
Percholr-Ethylene	200	20
Potassium Hydroxide	160	25
Propylene Glycol	150	20
Sodium, Cyanide	140	40
Sodium, Hydride	720	28
Steel Tubing Cast into Aluminum	500-750	50
Steel Tubing Cast into Iron	750-1000	55
Socony Vacuum Type		
Transfer Oil	600	20
Sulphur, Molten	600	10
Therminols and	500	20
Heat Transfer Oils	600	20
	650	15
Trichlorethylene	150	20
Vapor Degreasing Solution	275	20
Vegetable Oil and		30-40 circ.
Shortening in Liquid	400	15-25 non circ.
State Below 100° F (37.7° C)		5
		100-125 circ.
Water (process)	35-150	75-100 non circ.
	212	75 circ.
		50 non circ.
	300	low flow vol. 10
		high flow vol. 25-30
Steam	500	low flow 5-10
		high flow 20-25
	700	low flow 5
		high flow 15-20

NOTE: Watt densities will vary with flow rates, densities and temperature. Apply these values with caution in some applications.

CONVERSION FACTORS
1 cu. ft. = 1728 cu. in. = 7.48 gal.
1 gallon = 231 cu. in. = .1337 cu. ft.
1 gallon of water = 8.3 lbs. = 3.785 kg.
1 cubic ft. of water = 62.5 lbs.
1 kilowatt hour = 3412 BTU per hour
1 kw/hr. will raise 22.8 lb. of water from 62°F to 212°F
1 BTU/lb = 1.8 cal/gram
1 lb. = .453 kg.
1 gal. = 3.785 liters
1 inch = 25.4 mm
1 in^2 = 6.45 cm^2
1 in^3 = 16.39 cm^3
°F = 9/5°C + 32
°C = 5/9 (°F – 32)

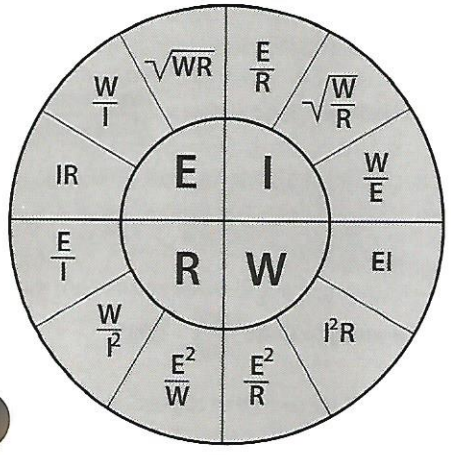
GENERAL CIRCUITS

Sketches illustrate how different voltages affect the resultant wattage when applied to single, series or parallel connected heaters .



OHM'S LAW

E = VOLTS I = AMPS R = OHMS W = WATTS



STD. WEIGHTS & DIMENSIONS OF WELDED WROUGHT-IRON PIPE

NOM. SIZE O.D." (MM)	WALL THICKNESS" (MM)	WT./FT. PLAIN ENDS, LBS.	ID SCHEDULE NO.
1/8" .405" (10.28)	.069" (1.75)	.24	40
	.096 (2.43)	.31	80
1/4 .540 (13.71)	.090 (2.28)	.42	40
	.122 (3.09)	.54	80
3/8 .627 (15.92)	.093 (2.36)	.57	40
	.129 (3.27)	.74	80
1/2 .840 (21.33)	.111 (2.81)	.85	40
	.151 (3.83)	1.09	80
3/4 1.050 (26.67)	.115 (2.92)	1.13	40
	.157 (3.98)	1.47	80
1 1.315 (33.40)	.136 (3.45)	1.68	40
	.183 (4.64)	2.17	80
	.369 (9.37)	3.66	...
1 1/4 1.660 (42.16)	.143 (3.63)	2.27	40
	.195 (4.95)	3.00	80
1 1/2 1.900 (48.26)	.148 (3.75)	2.72	40
	.204 (5.18)	3.63	80
2 2.375 (60.32)	.158 (4.01)	3.65	40
	.223 (5.66)	5.02	80
2 1/2 2.875 (73.02)	.208 (5.28)	5.79	40
	.223 (5.66)	5.02	80
3 3.500 (88.9)	.221 (5.61)	7.58	40
	.306 (7.77)	10.25	80

UL®/CSA® LISTING

Fast Heat heating elements are recognized under the component program of Underwriter's Laboratories, Inc. file no. E80914 and are also certified by the Canadian Standards Association file no. LR53641-2. The accompaning chart is for reference only. The maximum watts per square inch shown is for standard configurated heaters.

Higher watt densities and voltages are available. Contact Fast Heat.

***Please specify when ordering if U.L. and/or C.S.A. approval is required.**

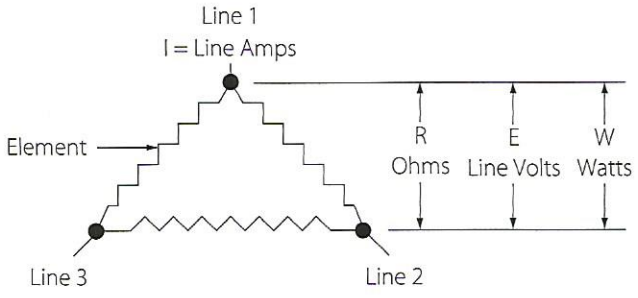
HEATER TYPE	MAX. WATTS/IN²	MAX VOLTAGE	UL	CSA	COMMENTS
Standard Cartridge	40	240	YES	YES	
Hi-Temp Cartridge	UL - 100 / CSA - 200	240	YES	YES	
Square Cartridge Std.	35	240	YES	YES	
Ceramic Strip	35	480	YES	YES	
Mica Strip	40	480	YES	YES	
Better Strip	100	240	YES	YES	
Finned Strip	30/Side	480	YES	YES	
Mica Band	40	480	YES	YES	
Better Band	100	240	YES	YES	
Knuckle Band	40	240	NO	NO	
Ultima Strip	40	240	YES	NO	NOTE 1
Permaheat	35	240	NO	NO	NOTE 2
Tubular	40	240	YES	NO	NOTE 3

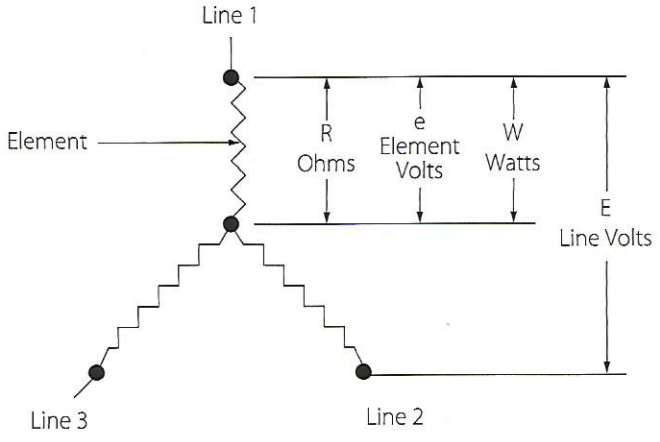
NOTE 1 - UL recognized where leads exit heater from end on thickness.

NOTE 2 - Only tubular heater is UL recognized.

NOTE 3 - Applies to .315" and .430" diameter tubulars.

ELECTRICAL DATA FOR 3 PHASE WIRING





The following table will help on the computation of actual operating wattage.

APPLIED VOLTAGE	RATED VOLTAGE	TO OBTAIN OPERATING WATTAGE MULTIPLY RATED WATTAGE BY
110	115	.92
110	120	.82
115	110	1.09
115	120	.92
120	110	1.19
120	115	1.09
220	230	.92
220	240	.84
230	220	1.09
230	240	.92
240	220	1.19
240	230	1.09
440	480	.84
480	440	1.19

DELTA CONNECTION

When elements are designed for 3 phase delta connection, wattage output may be reduced to 1/3 by rewiring to 3 phase WYE.

Element Volts = e = Line Volts (E)

Element Watts = W = Total Watts 3

Hot Resistance of Elements = R (OHMS) = E x E
W

Element Current = W E = i

WYE OR STAR CONNECTION

e = element volts = Line Volts (E) 1.73

Hot Resistance of Element = R (OHMS) = e x e
W

W = element watts = Total Watts 3

WATTAGE OUTPUT AT OTHER VOLTAGES

When heaters are used at voltages other than the rated voltage, the actual power can be calculated as follows:

$$\text{Actual wattage} = \text{Rated wattage} \times \frac{(\text{Actual voltage})^2}{(\text{Rated voltage})^2}$$

For instance, if a heater is rated 1000 W at 220 volts but the actual operating voltage is 240 V, the actual wattage of the heater will be

$$\text{Actual wattage} = 1000 \times \frac{(240)^2}{(220)^2} = 1190 \text{ W}$$

Care must be taken that the actual power does not exceed the rated current-carrying capacity of the lead wires and of the resistance wire.