

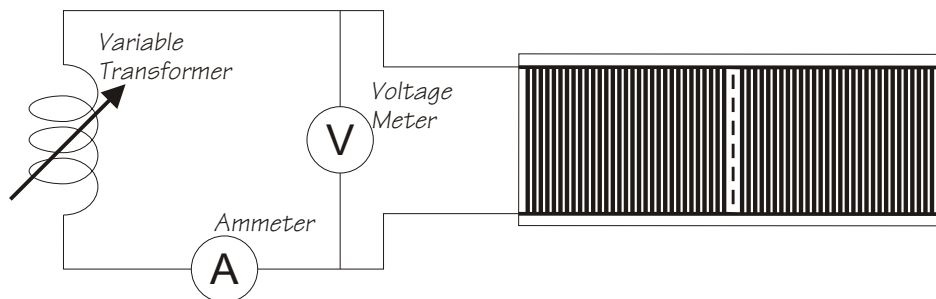
## Using A Variac To Determine Desired Power Density

Since the operating temperature of the CalorIQ heating element depends on its application, it may become necessary to test various power densities to determine the optimum wattage. One of the easiest ways to do this is to use a Variac (variable transformer) to change the input voltage (V) of the heating element. Because the resistance (R) of the heating element remains the same, the output power of the element (W) changes according to the following formula:  **$W=V^2\div R$**

The nominal Voltage ( $V_n$ ) is the voltage rated on the element's data sheet. If you need to make the heating element hotter, raise the voltage above  $V_n$ ; if you need to make the element cooler, lower the voltage below  $V_n$ . Because the power is dependent on the square of the voltage being put into the element ( $V^2$ ), the change in power when you raise or lower the voltage will go much more quickly than will the voltage: i.e. if you double the input voltage ( $2 \cdot V$ ), the power will go up by a factor of 4 [ $(2 \cdot V)^2$  or  $(4V^2)$ ]. The following table will help you see the relationship between input voltage and output power. Input power is shown as a ratio to the nominal voltage - i.e. if the heater generates 100 watts at its nominal voltage of 120, the first input voltage listed (0.1V) would be 12 volts and the heater would generate 1 watt (0.01  $\cdot$  100 watts).

Input (Test) Voltage	Output Power	Input (Test) Voltage	Output Power	Input (Test) Voltage	Output Power	Input (Test) Voltage	Output Power
0.1V	0.01	1.1V	1.21	2.0V	4.00	7.0V	49.00
0.2V	0.04	1.2V	1.44	2.5V	6.25	8.0V	64.00
0.3V	0.09	1.3V	1.69	3.0V	9.00	9.0V	81.00
0.4V	0.16	1.4V	1.96	3.5V	12.25	10.0V	100.00
0.5V	0.25	1.5V	2.25	4.0V	16.00	11.0V	121.00
0.6V	0.36	1.6V	2.56	4.5V	20.25	12.0V	144.00
0.7V	0.49	1.7V	2.89	5.0V	25.00	13.0V	169.00
0.8V	0.64	1.8V	3.24	5.5V	30.25	14.0V	196.00
0.9V	0.81	1.9V	3.61	6.0V	36.00	15.0V	225.00
1.0V	1.00	2.0V	4.00	6.5V	42.25	16.0V	256.00

Connect the element according to this diagram:



The voltage and amperage readings will indicate exactly what the operating power of the element is. CalorIQ needs the following information to formulate and produce a custom element to your power requirements:

Product Number of Element Tested, Test Voltage, Resistance of Element, Length of Element used, Desired Operating Voltage, or

Product Number of Element Tested, Test Voltage, Amperage, Length of Element used, Desired Operating Voltage.