

Amperage & Ohms Measurements

Kilowatts	Watts	Voltage	Amps	Ohms
11 (dual)	11000	240	45.8	5.24
11 (single)	11000	240	43.6	5.5
8	8000	240	33.3	7.21
5.5	5500	240	22.9	10.4
4.5	4500	240	18.75	12.8
4	4000	240	16.7	14.4
3	3000	240	12.5	19.2
2.5	2500	240	10.4	23.04
2	2000	240	8.3	28.8
1.5	1500	120	12.5	9.6
1	1000	120	8.3	14.4
0.65	650	120	5.4	22.15

Unit Weights and Unit Conversions

1 cubic foot of water weighs 62.4 pounds
 1 cubic foot of water equals 7.5 gallons
 1 gallon of water weighs 8.35 pounds

Multiply	By	To Get
Gallons of Water	8.35	Pounds of Water
Pounds of Water	27.65	Cubic Inches
Gallons	231	Cubic Inches
Watts	0.001341	Horse Power
Amps	Volts	Watts

Fahrenheit and Celsius Conversions

To convert Fahrenheit temperature into Celsius:

- Begin by subtracting 32 from the Fahrenheit number
- Divide the answer by 9
- Then multiply that answer by 5

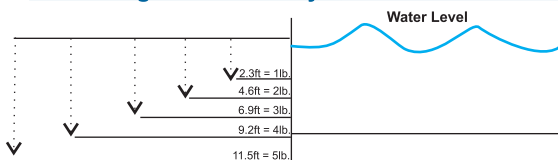
To convert Celsius temperatures into Fahrenheit:

- Begin by multiplying the Celsius temperature by 9
- Divide the answer by 5
- Now add 32

PSI Conversions

Multiply	By	To get
Inches of Water	0.03612625	PSI
PSI	27.6807	Inches of Water

PSI settings for control systems below water level



Current Capacity (Amps) of Wire

Wire Size	Amperes	
	Copper	Aluminum
14	20	-
12	25	20
10	30	25
8	40	30
6	55	40
4	70	55

Ohm's Law

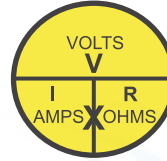
Ohm's Law is made from 3 mathematical equations that shows the relationship between electric voltage, current and resistance.

$$V = I \times R \text{ (Voltage = Current multiplied by Resistance)}$$

$$R = V / I \text{ (Resistance = Voltage divided by Current)}$$

$$I = V / R \text{ (Current = Voltage divided by Resistance)}$$

Knowing any two of the values of a circuit, one can determine (calculate) the third, using Ohm's Law.



The Wheel:

Volts V (on top of the divided line)
 Amps I (lower left below the divided line)
 Resistance R (lower right below the divided line)
 X represents the (multiply by sign)

To use, just cover the known quantity you need with your minds eye and what is left is the formula to find the unknown.

Temperature Rise

Based on Gallons and Heater Wattage

TEMPERATURE RISE METHOD

V = Volume of water

kW = Kilowatt rating of heater

ΔT = Temperature rise in °F Per Hour

$\Delta T = \frac{kW \times 411}{V}$ This formula is used to determine the temperature rise a kilowatt rating will achieve.

$kW = \frac{V \times 8.3 \times \Delta T}{3413}$ This formula is used to determine the kilowatt required to achieve a desired temperature rise.

1.5kW	Gallons of Water	102	123	155	205	250	305
	Water Temperature Rise in °F Per Hour*	6.0	5.0	4.0	3.0	2.5	2.0

5.5kW	Gallons of Water	113	126	151	205	281	375
	Water Temperature Rise in °F Per Hour*	20.0	18.0	15.0	11.0	8.0	6.0

11kW	Gallons of Water	181	226	302	450	900	1120
	Water Temperature Rise in °F Per Hour*	25.0	20.0	15.0	10.0	5.0	4.0

*Temperature rise as listed above does not account for heat loss - actual heat up times may vary.

Spa Blower Information

HORSEPOWER

To Get This	Divide This	By This
Horsepower	Kilowatts	0.75
Horsepower	Watts	746
Horsepower	Torque (ft.lbs.) x RPM	33000
Horsepower	Torque (ft.lbs.) x RPS	550
Horsepower required to pump water at a given rate to given height, assuming 100% eff. AKA Water Horsepower	GPM x TDH (ft.)	3960
	GPM x TDH (psi)	103000
Brake hp	Water hp	Pump eff.

SIZING CHART

Blower Motor Size	Volts	Amps	Maximum In. of Water Depth
1 HP	120	4.4	35"
1 ½ HP	120	5.8	45"
1 HP	240	2.4	30"
1 ½ HP	240	3.1	40"

SIZING FORMULA

Measure total depth of water in spa (not total spa depth)

Add 1" water for each 10ft. of air pipe

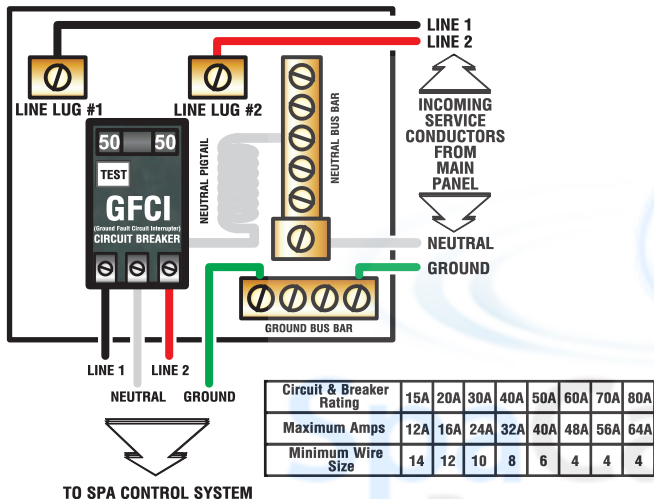
Add ½" water for each 90 deg. elbow

Compare your total with maximum inches of water column and select that size or the next size higher blower than your total, in your selected voltage.

GFCI Breaker Connection / Electrical Wiring Information

The number one cause for repeated tripping of a GFCI breaker on a new install is that the breaker has been incorrectly wired. The illustration above shows a typical installation. Note that the Neutral "pigtail" is connected at the neutral bus bar and the Neutral wire coming from the spa control system is connected directly to the breaker. Connecting the Neutral wire from the spa control system to the Neutral bus bar will cause the repeat tripping.

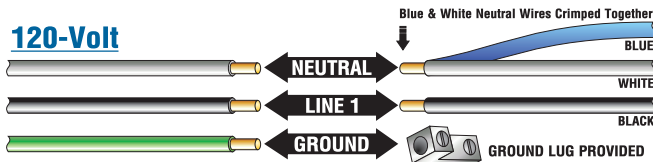
Warning - The illustration is meant to be used as a guide ONLY. This does not in any way supercede any manufacturers installation instructions.



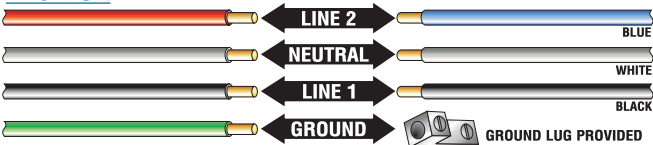
Universal Control System Wiring Instructions

Incoming Voltage

120-Volt



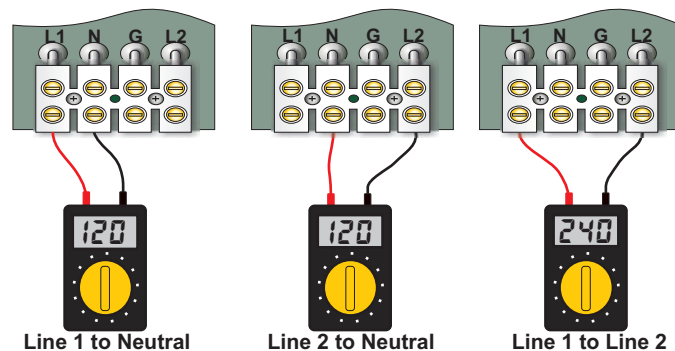
240-Volt



Control Box

Blue & White Neutral Wires Crimped Together

Normal Voltage Test Readings



System Error Messages

FLO	Pressure switch open when system expects it to be closed
FLC	Pressure switch closed when system expects it to be open
HL	The spa water has exceeded 119 degrees
OH	The spa water has exceeded 112 degrees
Prr	Temperature sensor malfunction

Receptacle Color Chart

