

# Amperage and Electric Shock

**Standard Household Electricity is 120v for standard outlets, 240 for large appliances**

<u>Amps</u>	<u>Effect</u>
.001a	perception of pain, tingle
.005a	slight shock, let go range
.006 a .030a	painful shock, “let go range”
.030a .050a	painful shock, “can’t let go” intense muscle contraction, possible death
.050a.150a	extreme pain, respiratory arrest, severe muscle contraction possible death
1a to 4.3a	Ventricular fibrillation, possible death
4.3a - 10a	Cardiac arrest, severe burns, and death

**Lethality of a shock - as voltage increases (remember: PV can have up to 600v DC per series string)**

The voltage necessary for electrocution depends on the current flowing through the body and the duration of the current flow. Using Ohm's law, Voltage = Current × Resistance, we see that the current drawn depends on the resistance of the body. The resistance of our skin varies from person to person and fluctuates between different times of day. In general, dry skin isn't a very good conductor having a resistance of around 10,000 Ω, while skin dampened by tap water or sweat has a resistance of around 1,000 Ω.

The capability of a conducting material to carry a current depends on its cross section, which is why males typically have a higher lethal current than females (10 amperes vs 9 amperes) due to a larger amount of tissue. However, death can occur from currents as low as 0.1 to 0.3 amps.

Using Ohm's law, we may derive the voltages lethal to the human body. This is given in the following table:

Electric current Amps	Voltage at 10,000 ohms Voltage at 1,000 ohms	Maximum power Watts	Physiological effect
0.001 A	10 V	0.01 W	Threshold of feeling an electric shock, pain
0.005 A	50 V	0.25 W	Maximum current which would be harmless
0.01-0.02 A	100-200 V	1-4 W	Sustained muscular contraction. "Cannot let go" current.
0.05 A	500 V	25 W	Ventricular interference, respiratory difficulty
0.1-0.3 A	1000-3000	100-900 W	Ventricular fibrillation. Can be fatal. Sustained ventricular contraction followed by normal heart rhythm. These are the operation parameters for a defibrillator.
6 A	60,000 V    6,000 V	400,000 W	Temporary respiratory paralysis and possibly burns. Death probable.