

SEVEN FACTORS IN ELECTRIC SHOCK

1. Voltage. More danger at higher voltages, but 110 VAC can be fatal. If current limited to less than one ma one can tolerate many kilovolts.
2. Current. Minimum threshold is about 0.1 ma
1-5 ma involuntary electric shock response
> 5 ma gives sensation of pain
10 ma can temporarily paralyze the nervous system so that a victim is unable to free oneself from the source of the shock. Currents above 10 ma cause burns in a relatively short time.
3. Resistance of the path. Voltage, current and resistance are linked by Ohms Law. Thus if resistance of the path is very high a sufficiently low current can flow so that a victim might survive an electric shock of several thousand volts. Resistance is concentrated at the skin surface. Resistance of large area contacts between the knee and leg can be as low as 600 ohms. Dry or caloused skin can have a resistance of more than 100K ohms. Resistance also depends on the contact area. Resistance of sweaty skin is much lower than dry skin due to the presence of salt. A person standing with wet hands in a tub or puddle of water can be killed by 110 VAC because the path resistance is so much lower.
4. Path of Current. More than 10 ma through the heart can stop heart action. More than 10 ma through the central nervous system can stop breathing so that a person suffocates without prompt artificial respiration. 10 ma through an arm or leg, however, is not fatal.
5. Duration of Contact. $I^2R \times \text{Time}$ is ENERGY so that more damage occurs the longer the contact. Once the skin is broken (burnt) the resistance of the path drops markedly so that current rises and burn damage accelerates. A person must be freed, or the electric power turned off as soon as possible. Long contact to electric shock can cause burn damage or permanent damage to the central nervous system. 50 ma DC will roast a standard hot dog in 5 minutes.
6. Physiological factors. A younger person has a better chance of survival than than older person. One in better health has an advantage over one in poorer health.

7. AC or DC. AC appears more dangerous since the alternating current is more prone to kick the heart into a uncontrolled heart-beat (fibrillation or heart-beat race) which leads to death.

Several horror stories of electric shock: Kid in the tree on Maple Street in Paxton grabbing a 2300 volt line. Kid survived, but with extensive burn damage to his hands and the soles of his feet. Required extensive skin grafting to replace damaged tissue.

The highschool kid on drugs who climbed up a high tension tower. Survived but is permanently crippled and defaced by electric burns.

The Graduate student in biology at Brown U. who was electrocuted by a DC power supply he backed into in the laboratory. He did not survive.

EE Prof during a lecture demonstration in AK116 (1950's) came in contact with 240 VAC and could not let go of the cables, but was able to walk backward away from the power panel so that the cables slipped through his immobilized hands and dropped to the floor. Students were unaware the Prof had been shocked, and the Prof too embarrassed to acknowledge the episode to his class.

People each year are killed by strikes of lightning.

FAMILIARITY BREEDS CARELESSNESS

Almost every year an electric power lineman (who work regularly on live power lines) dies from electrocution.

FIRST AID IN CASE OF ELECTRIC SHOCK

1. TURN OFF THE POWER IF THIS IS POSSIBLE.
2. IF THE VICTIM IS IMMOBILIZED USE SOMETHING THAT IS A GOOD INSULATOR TO PUSH VICTIM FREE OF THE POWER SOURCE WITHOUT JEPARDIZING YOUR OWN SAFETY.
3. IF THE VICTIM IS UNCONSCIOUS ADMINISTER ARTIFICIAL RESPIRATION UNTIL NORMAL BREATHING IS RESTORED. (IF EXTENSIVE NERVE DAMAGE HAS OCCURRED THIS MAY TAKE HOURS). DELAY OR PREMATURE STOPPAGE OF ARTIFICIAL RESPIRATION WILL CAUSE DEATH BY SUFFOCATION. MAKE SURE THE VICTIM'S THROAT PASSAGES ARE CLEAR FOR BREATHING.
4. GET SOMEONE TO CALL FOR MEDICAL ASSISTANCE.