
Electrocution and the Human Body

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It has long been recognized that there is a direct correlation between safety and knowledge, and yet the most fundamental questions on the electrical risk of AC versus DC cannot be answered by the average electrical worker.

The need to carry out power quality measurement on today's power distribution and application equipment results in an increased exposure to lethal levels of electrical energy in both AC and DC forms. The last decade has seen a rise in serious electrical injuries as an increasing number of technical personnel are making live measurements of electrical distribution systems.

The power quality engineer/electrician engaged in live electrical measurements takes a risk with each and every measurement, no matter how experienced the individual is.

Virtually everyone involved with electricity knows that you can get a "Shock" from electricity. Yet most people lack the understanding of the relative risks involved. The authors believes this lack of knowledge leads to a

general attitude of "a little shock from 120 volts AC won't hurt and really isn't dangerous." This type of attitude has led to many serious injuries and deaths here in the United States. Over thirty thousand individuals receive permanent serious injuries and approximately one thousand people are electrocuted annually

Why do some people receive an electrical shock with no permanent damage one day, and die in the same circumstances later? The answer will become apparent after we examine the effects of electricity on the body.

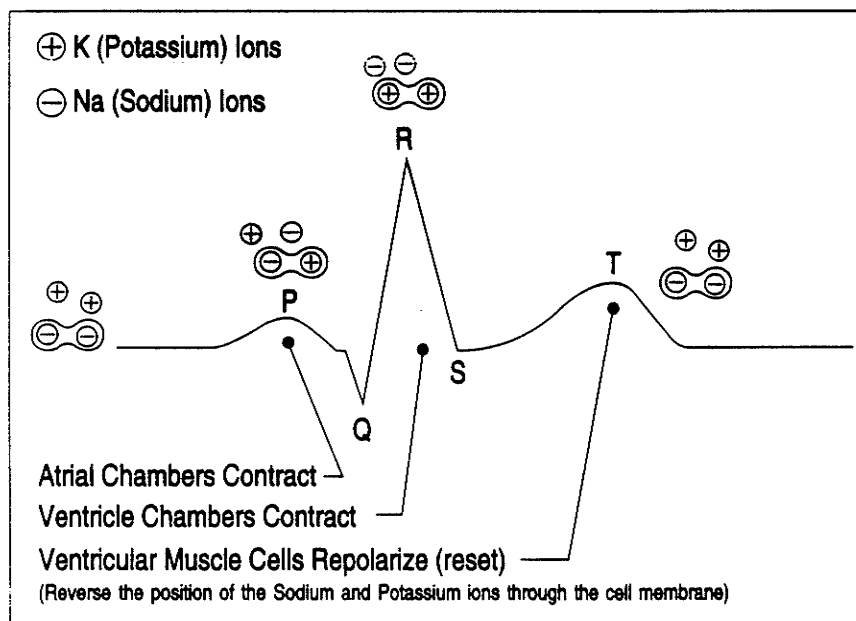


Figure 1. A Normal Heart Beat Showing Waveform and Ions.

Physiological Effects

Like all mammals, the human heart is a two-stage pump involving four chambers. Each side of the heart involves two chambers, a smaller arterial chamber and a larger ventricular chamber. During the first stage of pumping the left and right arterial chambers contract, pushing blood through a set of heart valves into the larger ventricular chambers. During the second stage of pumping action, when the large ventricle chambers contract, the left ventricle

Electrocution

resistance level varies over a broad range based on size, skin conditions, perspiration, the center of the bell of distribution curve is usually identified as 1,000 ohms. Using Ohm's law, an AC circuit would be required to be at a level of 100 volts to produce a current of 100 milliamps. The DC circuit would require 5-times that amount to reach 500 milliamps.

Primary protective mechanisms for avoiding low-current electrocutions are as follows:

- Increase body path resistance; wear gloves, rubber shoes, and stand on rubber mats.
- Avoid wet working conditions: wet ground, tools, feet, hands and gloves.
- Meter the status of wires, cables and housings; beware of sheet-metal panel covers, they can "oil can" and make deadly contact with conductors.
- Avoid working with hot equipment unnecessarily; follow maintenance lockout and tagout rules.

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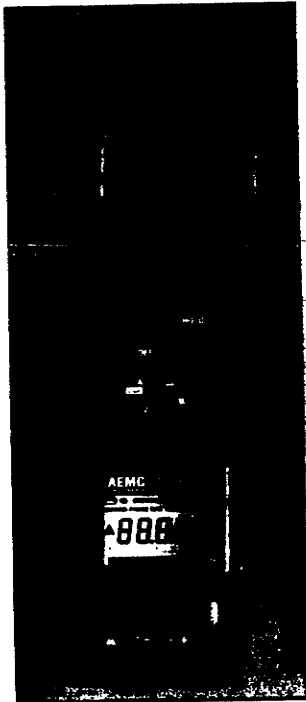
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Electrocutions with 120 Volts AC in common circumstances

- Circleville, Ohio. James K. Little, Jr., 20, was killed in an electrical accident at Everts Middle School. Little was climbing a ladder when he touch a metallic conduit for support/balance. The conduit was shorted and Little was electrocuted by current passing through him and the metal stepladder.
- Ozark, Alabama, Garry Holcomb, 41, died from electrocution while working on an airconditioning unit at a nursing home. There was apparently a short in the compressor unit and Holcomb was standing on wet ground.
- Ruston, Louisiana. A 33-year old woman was killed at her home when an orange exterior-use extension cord became entangled on the sharp edge of a metal toolbox which was sitting on the ground.
- Riviera Beach, Florida. A 44 year old West Palm Beach man was found dead from electrocution next to the washing machine he was installing.

There is no middle ground of damage, either people receive a temporary stunning effect or their heart stops beating and they are found dead. People who were electrocuted rarely show any electrical burns on the body.

- Use Ground Fault Circuit Interrupters (GFCI) on extension cords.
- Do not work alone or isolated from others.
- Religiously follow all established operational procedures.

Using the information gained in this article and the above simple guidelines, you will reduce your personal risk of electrocution. The best and most important guideline to follow is that you should never lose sight of the dangers involved when working with electricity. Electricity should be respected and when working with electricity keep focused on your work and avoid distractions. Good luck, and work safely.

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