BASIC FACTS

One key fact to remember: Electricity always seeks the easiest path to the ground. This is true regardless of whether the electricity comes from a household lighting circuit, or a home generating plant, or, a high power transmission line, or lightning.
If a person touches two live wires or touches a live wire and the ground at the same time, he or she will become part of an electrical circuit, and may be killed or injured. In this context "ground" includes any metal structure which is itself in contact with the ground.

Electrical Installations

Electricity is generated by power plants at voltages up to 22,000 volts. This voltage is stepped up for efficient transmission over long distances to substations near the load centres. Some transmission lines operate as low as 33,000 volts, others as high as 500,000 volts.
At the substations, voltage is reduced and power is sent on distribution lines to industrial, commercial and residential customers.
Power plants, overhead and ground level substations, and other electricity supply installations differ greatly from the buildings that emergency personnel are usually called upon to enter in emergencies. They present unusual hazards which can seriously handicap firefighting and sometimes endanger the fireman's life if he is not familiar with the surroundings. In all cases, specialised firefighting techniques are required to ensure maximum personal safety and effectiveness. It is therefore important that good communication and co-operation exist between emergency personnel and electricity supply authorities. Electricity supply authorities welcome Emergency Service organisation representatives who wish to visit installations and to learn about the various hazards involved in working near electrical equipment.

Faulty Electrical Equipment

It is obvious that electricity is safe when it's properly used. However, hazards are created when electrical equipment or wires have become faulty as the result of being:

- worn out or deteriorated
- improperly installed
- improperly maintained
- improperly used
- damaged or broken

Any one of the above may cause arcing or overheating of electrical equipment – the two conditions that cause most electrical fires.

Arcing

An electrical arc is a sudden flash of electricity between two points of contact. An arc is extremely hot. As a fire cause it is usually associated with a short circuit or a current interruption at a switch point or loose terminal. Arcing can ignite combustible material in the vicinity, including the insulating material around the conductor. Hot material may be thrown into the adjacent flammable material, starting a fire.

Overheating

Overloading of electrical conductors and motors accounts for most fires caused by overheating. There is danger when the amount of current exceeds that which the conductors and equipment are designed to carry.

Insulators, Conductors and Semi-Conductors

All materials conduct electricity in varying degrees. Material classified as "insulators" conduct electricity in such small quantities it cannot normally be detected. On the other hand, materials classified as "conductors" conduct electricity readily in large amounts.
To cite two examples: Glass is an insulator, metal is a conductor.

Some other materials are classified as “semi-conductors”. These include wood, earth and rubber tyres. Depending on conditions, such as moisture content and contaminants, semi-conductors can conduct large amounts of electricity.
Metal and wire reinforced ladders, metal tape rules and other metal objects are conductors and should not be used in conjunction with live electrical apparatus.
Flame can be a conductor.

Combustible Materials

Fires involving electrical equipment mat result from the presence of combustible materials. For example, most fires that break out in electrical plants originate in fuel systems, oil systems, combustible gaseous atmospheres, combustible buildings or combustible contents.

Common Electrical Terms

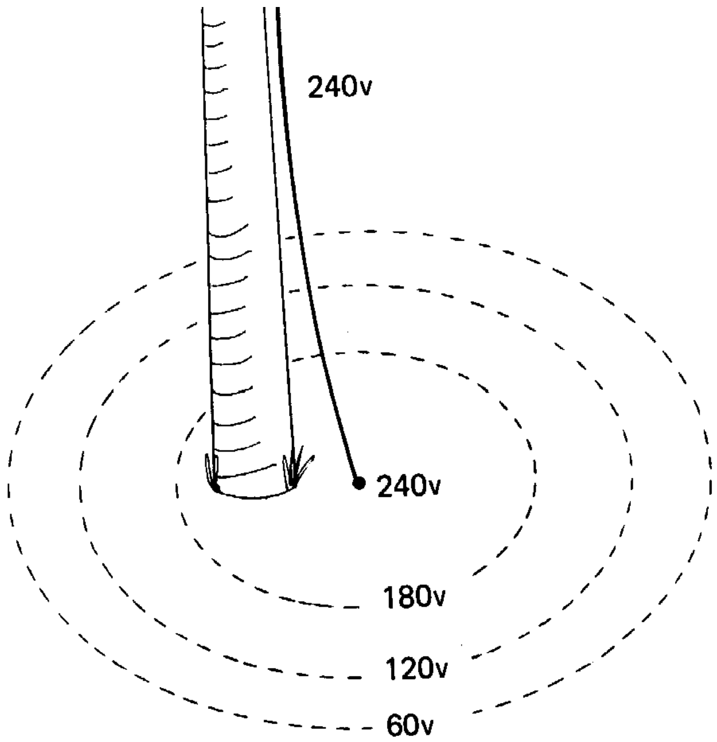
Some words frequently used in connection with electricity are “voltage”, “current” and “resistance”.
“Voltage” can be likened to water pressure. It is the force that causes the flow of electricity.
“Current” can be likened to the rate of flow of water in a pipe.
“Resistance” is similar to the effect of friction on the flow of water in a pipe. (Water flows more freely in a large pipe than in a small one.) Different materials have different resistances to the flow of electricity. Very high resistance materials are called insulators, while the low resistance materials are called conductors.
In an electrical system, the force of pressure in measured in volts and the current flow in amperes (amps). Resistance is measured in ohms.

High, Medium, and Low Voltage

In the electricity industry, voltages above 650 volts are classified as high voltages, voltages between 650 and 250 volts are classified as medium voltages and voltages below 250 volts are classified as low voltage.
Nearly all domestic appliances and most industrial equipment operate at 230 volts.
Although the hazard is greater with high voltage installations, it is important for emergency personnel to realise the hazards of even relatively low voltage. In fact, most electric shocks and injuries occur when persons come in contact with low voltage.

Voltage Gradient on the Ground Surface

Because electricity always seeks the quickest, easiest path to the ground, electrical systems use conductive earthing rods to ensure that any stray electricity is returned to earth safely. These rods are driven two metres or more into the ground to ensure deep dispersal of power. However, if electricity is released into the ground surface, such as when a “live” wire lies on the ground, the electricity will fan out from the point of contact.
This is a rippling effect that can be likened to dropping a pebble into calm water. In the pool of water, the wave created at the point of contact gets smaller as it rings out. Similarly, in this “pool” of electricity, the energy is at full system voltage at the point of ground contact, but as you move away from the contact point, the voltage drops progressively. This effect is known as “ground gradient”- and a knowledge of how it operates may some day save your life.



Step Potential and Touch Potential

The ground gradient, or voltage drop, creates two problems known as “step potential” and “touch potential”.
Let us assume that a live downed wire is touching the ground and has created a “pool” of electricity. If you were to place one point near the point of ground contact (at x voltage) and your other foot a step away (at y voltage), the difference in voltage would cause electricity to flow through your body driven by a voltage of (x-y) volts. This effect is referred to as “step potential”.
Similarly, electricity would flow through your body if you were to place your hand on a live source, while your feet were at some distance from the source. The difference in voltage in this case is referred to as “touch potential”.
You can avoid any danger in this situation if you stay at least 8 metres away from the point of contact.

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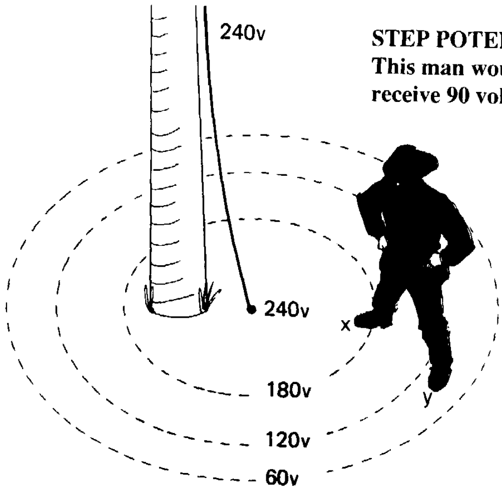

STEP POTENTIAL
This man would receive 90 volts

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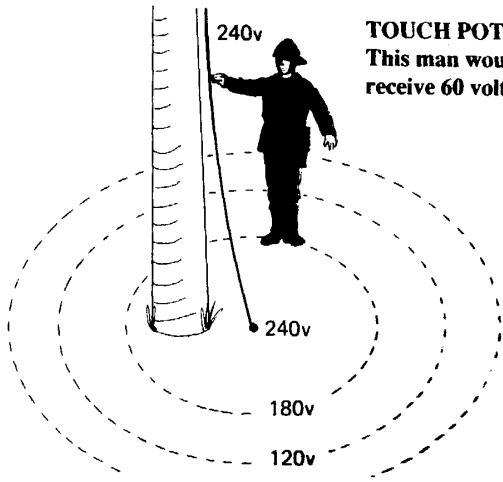

TOUCH POTENTIAL
This man would receive 60 volts