Safety measures in handling electrical circuits

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Introduction to safety measures in handling Electrical circuits

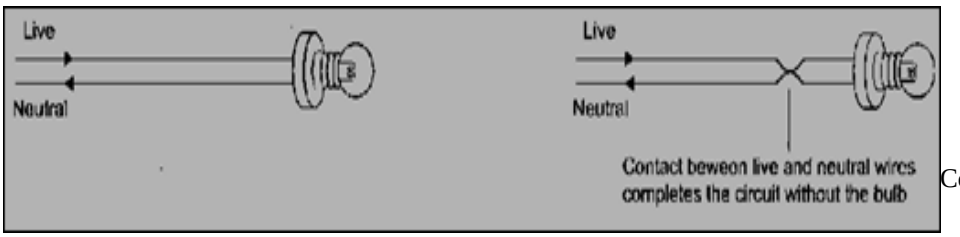
Electrical safety is everyone's responsibility and should be observed every time you even think about touching something connected to an electrical circuit. With the invention of electrical testers, circuits are easy to test, and with circuit breakers and fuses, circuits can be shut off to avoid contact with electricity all together. Electrical safety often comes into play when bad weather strikes. Tornadoes, hurricanes, flooding, and ice storms bring a vast array of dangerous conditions. Reading this introduction can help keep you safe when working with electricity.

Electric wires are heated when current passes through them. If, due to some reason, excessive heating takes place, the wires may catch fire. A fault such as an overload or a short circuit can cause overheating of the wires.

Overload

Different types of wires can safely carry currents up to a certain limit, say 10 A or 20 A, before they start overheating. If the total current drawn through a wire by the appliances connected to it exceeds the safety limit for that wire, it will get overheated. We say that overheating in this case is due to overloading. For example, suppose a live wire entering the switchboard of a room can carry a maximum current of 10 A without overheating. The board has several switches for the fans and lights in the room, and it has a few sockets too. If we switch on all these appliances as well as a heater, toaster, and an iron connected to the sockets, the total current through the live wire entering the board will exceed 10 A. The overloaded wire will then get overheated.

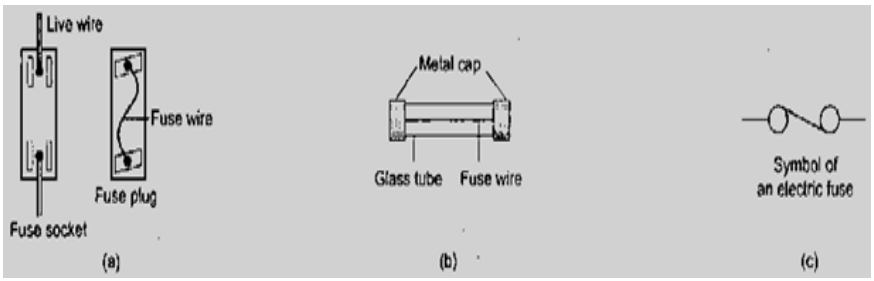
Short circuit



Consider the situation shown in figure 1(a) below. A bulb is connected across the live and neutral wires of the domestic supply. The current flowing through the circuit depends on the resistance of the bulb. Now consider the situation shown in figure 1(b), in which the live and neutral wires have accidentally come in contact. A very large current passes through the circuit because the resistance between the wires is now almost zero. Such an event is called a short circuit. The large current caused by the short circuit leads to overheating, which may even cause a fire. A short circuit may happen due to many reasons, such as the insulations on neighboring wires wearing down, a conductor such as a screw falling across the live and neutral terminals of a socket, and so on.

Safety devices

To prevent accidents due to electrical faults, safety devices are used in circuits. These safety devices break the circuit whenever an abnormally high current flows through it. Common safety devices utilize either the heating or the magnetic effect of electric currents to break the circuit.

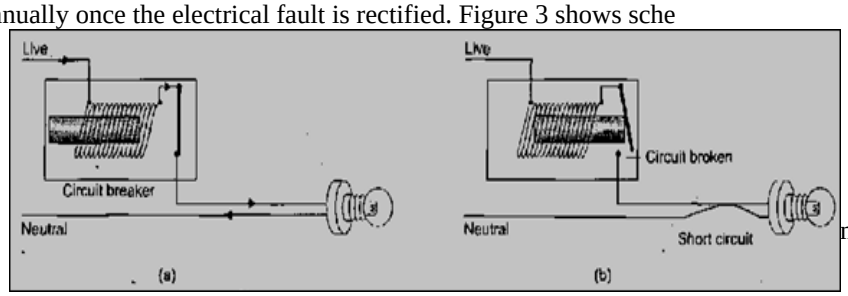


Fuse

The fuse is the most common safety device used in electric circuits. It is connected in the live lines of each section of a building's wiring. A fuse is simply a metallic wire of low melting point, fixed between the terminals of the fuse 'plug'. Fuses are available in various shapes. Figure 2 shows common types of fuses. The one shown in figure 2(a) is used in household wiring. When the fuse plug is in its socket, the live line continues through the fuse wire. The fuse shown in Figure 2(b) is used in electric appliances such as TVs, invertors, amplifiers, etc. The maximum current allowed by such a fuse is printed on it. If there is any overheating in the circuit in which there is a fuse, the fuse wire melts immediately, breaking the circuit and preventing an accident.

Circuit breakers

A circuit breaker can be used in place of a fuse. A circuit breaker has a switch and a solenoid connected in series in the live line of a circuit. A heavy soft-iron core lies partially in the solenoid. When a current greater than a particular value passes through the solenoid, the core gets pulled in. The core hits the switch to open it and break the circuit. The switch can be turned on again manually once the electrical fault is rectified. Figure 3 shows sche



matically how a circuit breaker works.

Fig.3 (a) Under normal circumstances, the core of the circuit breaker lies partially inside the solenoid. (b) A current greater than particular value flowing through the solenoids pulls in the core, which opens the switch

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