

Electric Fires “Causes and Prevention”

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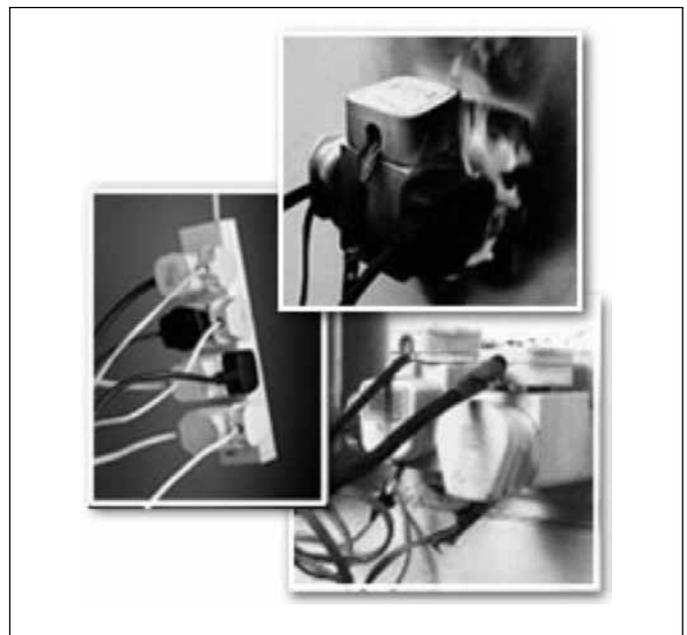
Executive Summary

Increase of dependency in Electricity and the rampant use of electrical apparatus, have given way to the dangers of Electric Fires. Use of modern construction materials have also added fuel to fires originating from electrical appliances, which gets heated beyond their operating temperatures. This paper covers in brief the **Causes and Prevention of Electric Fire**.

Causes of Electric Fire

Whenever Fires due to Electricity is reported by authorities or press, they attribute it to Short Circuit. The term Short Circuit is a misnomer as a electric short always results in tripping of protective devices, be it a circuit breaker or a fuse. Exceptions are shorting of terminals in a fully charged Battery or a Capacitor. So what causes Electric fire? Well it is failure of insulation due to overheating of the wires or appliances. In most cases the overheating takes place at the plug, if the plug is loose and is not tight

in the socket. There is always a tell tale mark which needs to be noticed for prevention of Electric fire. It can be discoloration of the plug, or the pins or the socket. Improper size of current carrying wires also result in electric fire.



I Short Circuits

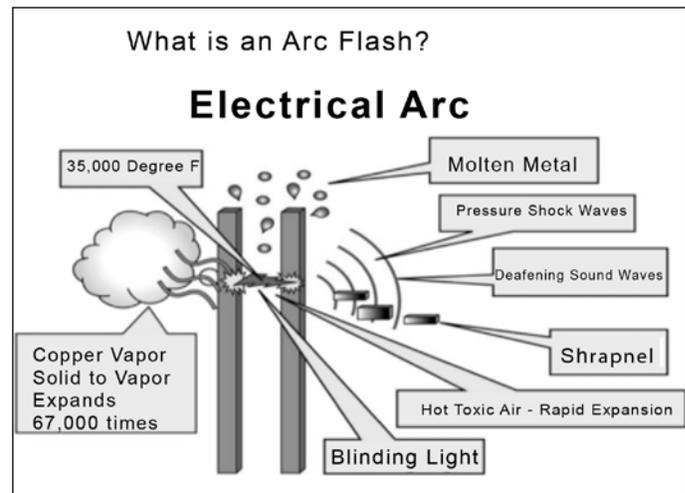
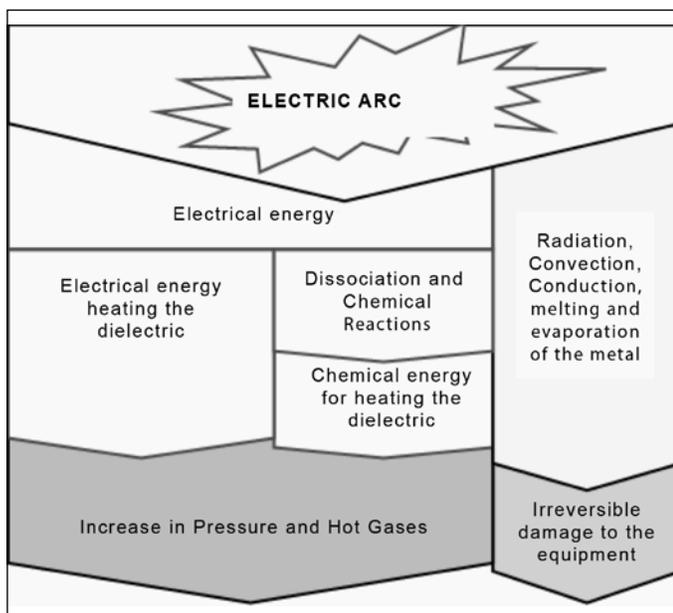
- One example of an electrical heat source is a short circuit. There exists two main types of short circuits; a dead short circuit and a limited short circuit.
- **A dead short** occurs when a live wire comes in contact with a common or ground wire (or the positive and negative wires are connected in a DC circuit) and the circuit is subsequently energized. In properly fused circuits this will cause the fuse to blow and the circuit to de-energize. This type of situation does not create sufficient heat to ignite combustibles. However, it is possible that

the circuit is not fused properly. If this occurs, the current can continue to pass through the wires causing them to significantly overheat. This type of situation can ignite surrounding combustibles causing a fire.

- The other type of short circuit is a **limited short circuit**. In this case, wires come in contact such that the volume of material through which the current flows is smaller than the fusible link. This will create a spark or flash and result in melting of the copper of the wiring. Characteristic beading of the copper wire is normally observed. This situation can also cause ignition of combustibles provided the mass of the combustibles contacting the heat source is small enough that the heat source can cause it to reach ignition temperatures and initiate a self-sustaining exothermic oxidation reaction or fire.

II Electric Arc

- ◆ Electric fire due to arc is noticed in switchgears.
- ◆ Happens when insulation fails, and protection devices, delay opening of remote breakers.
- ◆ Normally this takes place after maintenance of breakers or switchgear, where in screw drivers or spanners are left behind inadvertently.



III Overloaded Circuits

- Another electrical heat source can be created when a circuit is over fused. Over fusing of a circuit can result in high current flow through the wires overloading the circuit. Although electrical wiring is designed to carry current at much higher than its rated capacity, increasing current above this rated capacity causes the wire to generate excess heat. This is not a problem as long as the heat can be dissipated from the wire. However, if the wire is enclosed within a small insulated space, such as the holes through which wires run through floor joists in a home, the heat in these areas may not be able to dissipate as quickly as it is being generated. As a result, the surrounding combustibles can pyrolyze and eventually ignite, causing a fire.

IV Leakage Current

- ◆ Fires can also be caused electrically through what is called leakage current. Leakage current occurs when water is in the presence of electricity. Exposed wiring, which exists primarily at connectors and switches, can come in contact with water. Since water conducts electricity, a current will flow through the water between contacts or from the live to ground or common. Over time, the water will accumulate salts which increases its ability to conduct a current. This current can eventually develop to a point where it generates a significant quantity

of heat which begins to pyrolyze and carbonize the combustibles in the area. This can eventually result in a situation where a carbon bridge is formed, creating a continuous arc or significant generation of heat. Ignition of surrounding combustibles can result in a fire.

V Electrical Contacts

- ◆ Electrical contacts can also fail resulting in uncontrolled heating. Each time a contact is opened or closed, a small spark is generated. This causes degradation of the surface of the contact. Contacts can fail “open” in which case the circuit simply becomes inoperable. However, they can also fail “closed” and weld together resulting in uncontrolled heating.

VI Electrical Spark

- ◆ A simple spark can initiate a fire or devastating explosion if a combustible gas/air mixture is located at the position of the spark. As discussed previously, a spark is usually created whenever a contact is opened or closed. For this reason, specially designed switches and contacts are required for installation in an environment in which you can reasonably expect combustible gaseous mixtures to be present.

Prevention of Electrical Fire

- ◆ Maintenance checks may be carried out at least once a year, or when abnormalities are noticed.
- ◆ Check the condition of your electrical system.
- ◆ Check the natural gas/LP gas system in your home. Replace the rubber hose as advised by the gas company or when surface cracks are noticed.
- ◆ Whenever gas leak is smelt, do not switch ON the light to investigate, use a torch instead. Switch OFF the Electric mains and open all the windows, and doors for trapped gas to escape. Isolate the gas cylinder and call the gas company for rectification.
- ◆ Check the air conditioning and heating unit in your home.

- ◆ Check your appliances.
- ◆ Be very careful with space heaters.
- ◆ **Never use extension cords for air conditioners.** An overheated cord is like an out-of-control electric heater.
- ◆ Never store flammable liquids near ignition sources.

Inspect your home. You may need to recruit, or even hire, someone experienced in home electrical wiring, plumbing (gas), heating, and air conditioning to ensure that it is thoroughly inspected. You can also do the checks outlined in the following steps.

- Look in the attic and crawl spaces for wiring which has been damaged by pests or insects. Some old wiring is insulated with a material which insects eat or chew on.
- Look for overloaded circuit breakers, panel boxes, or fuse boxes. Check for breakers or fuses which may have circuits “back to back” on them. These are rated for single circuit protection, but sometimes in outdated or undersized panel boxes, people will put two or even more wires in the terminal of a single breaker or fuse.
- Notice flickering lights, or intermittent power surges. These conditions may be caused by outside influences, but if they occur often, they may indicate a bad connection or a short in the circuit.
- Note breakers which “trip”, or fuses that “blow” frequently. This is almost always a sign of an overloaded circuit or other wiring problem, usually of a most serious nature
- Be especially careful to notice any connections in wiring other than copper. Installed correctly, and with tight connections, aluminum wire is not excessively dangerous, but when connections are made to copper wires, an electrolytic reaction may occur, causing increased resistance in the connection which will generate excessive heat. If you are able to apply an antioxidant compound to aluminum connections, it will help decrease the risk of oxidation causing a short circuit at these locations