Overloading Electrical Circuits

Electricity has enriched our lives. Despite the many benefits, electricity can also bring danger -- the most common being house fires. It is estimated that over 40,000 residential fires are caused by electrical systems every year in the United States.[1] Causes include arc faults, short circuits, or overloading of electrical circuits. This article discusses overloading electrical circuits.

First, we must understand some basics about typical home electrical systems. The electrical service enters the house and connects to a main electrical panel. From the main electrical panel, wires run in different directions throughout the house to power lights, outlets, ceiling fans, air conditioners, and various other direct-wired electrical appliances. These wire-runs are called branch circuits.

In home construction today, the typical branch circuit consists of three wires -- the hot, neutral and ground wires. When a light or electrical appliance is turned on, electricity begins to flow in the hot and neutral wires of the branch circuit to which that light or electrical appliance is connected.

When electricity flows through a wire, the wire heats up because of its resistance to the flow of electrical current. Both the size of the wire (resistance increases as the wire diameter gets smaller) and how many electrical devices on the circuit are drawing electricity (more devices increase the electrical current) affect the amount of heat generated in the wire. To keep the wire from getting too hot and starting a fire, the designer of the branch circuit wiring does two things:

1. Attempts to size the wire large enough to handle the estimated electrical load on the circuit.
2. Attempts to contain the amount of electrical load on the branch circuit by limiting the number of potential electrical appliances that can be running at the same time on that circuit (i.e. places only so many outlets on one branch circuit or puts larger pieces of electrical equipment on circuits dedicated to that equipment only).

While the electrical codes help with the design assumptions, how the homeowner will use the outlets in the house is just a guess. The homeowner can plug in and run too many appliances on the same circuit at one time and overload the circuit.

This is why electrical fuses and circuit breakers are used in the main electrical panel. Their function is to sense the overloading of circuits (and short circuits) and shut off power to that branch circuit before the wires get too hot and start a fire.

However, circuit breakers can malfunction and fail to trip. Homeowners can try to fix a "nuisance" fuse by placing a larger fuse in the electrical panel that allows more electrical current to flow in the branch circuit than what it was designed for. Homeowners can also use plug adaptors and extension cords to plug in too many electrical appliances into one electrical outlet.

What Can the Homeowner Do?

- If a fuse blows or circuit breaker trips frequently, have a qualified electrician determine what the problem is and fix it.
- If the main electrical panel has circuit breakers, flip them off and back on once a year. This will help keep them working. Better yet, a qualified electrician can test the circuit breakers to make sure they function.
- If extension cords or plug adaptors are being used to plug multiple appliances into the same outlet, have a qualified electrician install more outlets on new or different branch circuits.
- Using power strips (or multiple outlet surge protectors) with their own circuit breaker protection is better than using extension cords to plug in multiple appliances or electronics. The circuit breaker protection assures that not too many appliances are plugged in and drawing electricity at once. Plus, the cords to the power strips and surge protectors usually have larger diameter wires than do typical extension cords which reduces the heat generated in the cord.

  However, the power strip's or surge protector's circuit breaker only protects the device itself. It does not protect the branch circuit wiring. Using several plug strips on outlets on the same branch circuit may overload the circuit and cause a fire.
- Never run appliance cords or extension cords under carpet. They are designed to be kept cool by movement of room air around the cord.
- If any outlet or switch wallplates feel hot to the touch, have a qualified electrician determine the problem and fix it.
- Circuits can only handle a specified total wattage of all electrical devices plugged into and

running on a branch circuit at one time. Here is a guide from the National Electrical Safety Foundation (NESF) to follow:

15-amp branch circuit can carry 1500 watts
20-amp branch circuit can carry 2000 watts

Most home circuits are designed as 15-amp branch circuits. A hair dryer can draw 1400 watts, an iron 1000 watts, a portable heater 1200 watts, a vacuum cleaner 600 watts, deep fat fryer 1300 watts, and a portable fan 150 watts.[2]

There are no hard-and-fast rules as to how often a home electrical system should be inspected. Here are the recommendations from the NESF:

If your last inspection was:

- 40 or more years ago, inspection is overdue.
- 10-40 years ago, inspection is advisable, especially if substantial electrical loads (high-wattage appliances, lights, and wall outlets or extension cords) have been added.
- Less than 10 years ago, inspection may not be needed, unless problems are noticed.

It may be difficult to determine when the last electrical inspection was made. Look on the inside of the door to the electrical panel. The electrician performing the last inspection may have written the date there.[3]

As a homeowner, be aware of your electrical system. Look and listen for problems. If you hear buzzing or crackling coming from outlets or light switches, don't ignore it. If appliance or extension cords are hot to the touch, you have potential problems. Contact a qualified electrical professional to assess the problem and make the necessary repairs.

[1]"1997 Residential Fire Loss Estimates"; Consumer Product Safety Commission; Table 1 Estimated Fire Losses in Residential Structures - Selected Equipment 1997

[2]"A Home Electrical Safety Check"; Plug Into Electrical Safety; The National Electrical Safety Foundation; 1300 N. 17th St., Suite 1847, Rosslyn, VA 22209, (703) 841-3211; http://www.nesf.org/home/safety.pdf

[3]"A Home Electrical Safety Check"; Plug Into Electrical Safety; The National Electrical Safety Foundation; 1300 N. 17th St., Suite 1847, Rosslyn, VA 22209, (703) 841-3211; http://www.nesf.org/home/safety.pdf

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