Electrical Systems Basics[1]

Electricity is uniquely unforgiving—even the smallest mistake can cause fire, injury or death. This document is an introduction to your home's electrical system, but is by no means inclusive. Contact a licensed electrical contractor for more information about your home's specific electrical system and what changes, if any, should be made.

Common Terms

An *amp*, short for "ampere," measures the amount of electricity moving through a wire. Amps are what give electricity its "shock."

A *volt* is the "pressure" that pushes electricity through wires. This is how electricity gets from the power plant to your house.

The amount of power a device consumes is termed *watts* or wattage. Wattage in most cases is determined by multiplying the amperage by the voltage. Electrical use is measured in *kilowatt-hours* (kWh)—wattage multiplied by time, divided by 1000.

Electrical current is carried in wire from the point of generation to the point of use. Wire is sized according to the amperage it is designed to carry; codes specify the maximum current-carrying capacity that is safe for wires of different diameter.

Note: When the price of copper soared in the early 1960s, manufacturers responded by making residential electrical wires out of aluminum. Between 1962 and 1972, nearly 2 million homes were wired with aluminum, and many of these have not been upgraded. Consult a licensed electrical contractor if your home was built during this time period or if you think you have aluminum wiring, as corrosion can lead to fire hazards.

Receptacles (also known as outlets) supply power to electrical equipment used in houses. Up until the mid-1960s, ungrounded receptacles were installed in most homes, but grounded receptacles are now the rule. Grounding ensures that if a short circuit occurs, electrical current flows through the ground system and trips a breaker or blows a fuse. A grounded outlet has three holes for each plug; in a properly wired outlet, the rounded slot is the ground connection.

Protecting Your Home's Electrical System

Look at your home's service panel—a fuse box or circuit panel, usually located in a metal box. This panel serves two functions—as a master switch for turning off all of the power in the house, and to direct utility-supplied electrical power into branch circuits to safely distribute power throughout the house. Each fuse or switch controls the electricity flowing through a specific area of the home and serves to cut off the power when a circuit is overloaded. Without adequate protection, overloaded wires heat up, which can lead to a fire.

(It's a good idea to "map" your circuit panel—that is, label each fuse or switch with the room or area it serves.)

The National Electrical Code (NEC) lists the specific fuse/breaker size and the wire gauge that it is meant to protect. The 2004 Florida Building Code, Residential adopts the NFPA 70A, *National Electrical Code Requirements for One- and Two-Family Dwellings*, by reference.

When a fuse blows or a breaker trips, it means there is something wrong. The problem could be from outside your home—such as a power surge during a lightning storm—or it could be from inside—too many devices used in a single circuit; incorrectly installed wiring; appliances drawing more current than the circuit is rated for, etc.

Ground Fault Circuit Interrupters (GFCI)

Whereas standard circuit breakers and fuses are meant to protect the wiring of a house, the GFCI is meant to protect life. A GFCI can be an electrical receptacle, a circuit breaker, or a portable device.

A GFCI works by monitoring the current going to the load and comparing it with the current returning. If very small leakage currents are detected, the GFCI acts quickly to shut off the circuit. By interrupting the flow of electricity, GFCIs may prevent serious injury or death. The NFPA 70A requires GFCIs to be used in certain locations.

U.S. manufacturers must produce new versions of GFCIs beginning July 28, 2006, that indicate either by visual or audible means, or by stopping the flow of electricity, that the device needs to be replaced. Distributors can sell, and electrical contractors can install, old GFCIs until their supplies run out.

[1]*DISCLAIMER – This piece is intended to give the reader only general factual information current at the time of publication. This piece is* ***not*** *a substitute for professional advice and should not be used for guidance or decisions related to a specific design or construction project. This piece is not intended to reflect the opinion of any of the entities, agencies or organizations identified in the materials and, if any opinions appear, are those of the individual author and should not be relied upon in any event. Applicable to 2004 Florida Building Code.*

Arc Fault Circuit Interrupter (AFCI)

An AFCI is a newer device that detects electrical arcing. Arc faults occur when electrical products or wires are damaged, aged, or improperly used—for example, an extension cord that is repeatedly pinched by a door closing, or a wire punctured by a nail. The NFPA 70A requires certain rooms to be protected by AFCIs.

AFCIs "sense" the particular signature of an arc—where electricity has to jump a gap—and act immediately to shut off the circuit, preventing a fire hazard. These arcs can occur along circuits in residential electrical systems, and at outlets and switches behind walls. Such hidden electrical fires can spread rapidly undetected by smoke alarms, thus reducing the chances of survival.

Caution: Note that some electrical systems will not work correctly with certain receptacles, GFCIs, AFCIs, etc. Always consult with a licensed electrical contractor.

Electrical Safety Guidelines

Many home electrical fires are caused by faulty wiring or overloaded circuits. Many electrocutions in the home are caused by improper or careless use of appliances. Here are a few suggestions to minimize risk:

- Periodically check the cords and connections on all electrical equipment for signs of wear.
- Never overload circuits with too many electrical devices.
- Use extension cords only on a temporary basis, and make sure they are rated for the type of tool being used. Tape down cords that cross pathways to prevent tripping or accidental unplugging. Never run cords under carpets or furniture.
- If you need to shut off power at the service panel, be sure to flag the breaker or fuse to notify other occupants.
- Keep all tools and equipment in good repair —dirt and dampness increase the risk of shock.
- Look out for overhead power lines when using ladders, poles or other devices.
- Keep all electrical devices away from water and damp areas.
- Avoid using items like "cheater" adapter plugs and inexpensive power strips.
- Use extreme caution with standby generators and space heaters. A qualified professional should install these devices, and they should never be used in an unventilated area.
- Teach children not to poke things into electrical outlets. Protect children from injury by using plastic outlet guards.

Hiring an electrical contractor

- Hire a licensed electrical contractor. Call the Florida Department of Business and Professional Regulations at 850-487-1395 to verify licensure, the number of years licensed, and the licensee's complaint history. Or, do your own verification on the internet by going to www.myflorida.com/dbpr
- Before having any kind of electrical work done in your home, consult the local building official to determine current requirements pertaining to residential electrical systems. Be sure the electrical contractor obtains a permit, if needed. Ask to see the permit. This permit is your guarantee that the work will be inspected and that the professional is responsible for the work performed.
- Ask to see a copy of the licensee's liability insurance. Insurance is required by state law and reputable professionals carry it.
- Get more than one bid for your job. Competition promotes fairness.
- Call several companies. Get referrals from friends, family or neighbors. Contact a trade association for a list of member companies in your area.
- Agree *in writing* to the scope and price of the work to be completed.

Special Note: As electrical systems age they can deteriorate and become overloaded. It is important that consumers have their electrical systems inspected by a licensed electrical inspector or electrical contractor to identify and correct hidden hazards before they become tragedies. An electrical inspection should be an essential part of purchasing a new home. It should also be included whenever planning any additions, alterations or repairs that affect the home's electrical system.

Sources and Resources:

Alliant Energy, Electrical Safety and Energy Basics www.powerhousetv.com/stellent2/groups/public/documents/pub/phtv_000453.pdf

Electrical Safety Foundation International www.electrical-safety.org

Florida Department of Business and Professional Regulation, Licensing Board www.myflorida.com/dbpr

National Fire Protection Association and National Electrical Code (NFPA 70) www.nfpa.org

Underwriters Laboratories, Inc. www.ul.com

U.S. Consumer Product Safety Commission www.cpsc.gov

U.S. Department of Housing and Urban Development, Vol. 7 The Rehab Guide www.toolbase.org/docs/SubsystemNav/ElectricalElectronics/4412_rehab7_elec.pdf

Your county or municipal building department (please see the government section of your telephone book—look under "building," "plans," "inspections," or "zoning.")

Don't know where to go for an answer to a specific question?

Contact: Building A Safer Florida, Inc. 1-850-222-2772 or www.buildingasaferflorida.org

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