South Carolina Budget & Control Board, General Services Safety

Guidance on Proper Use of
EXTENSION CORDS, POWER STRIPS & SURGE PROTECTORS

Extension Cord

Power Strips

Surge Protector

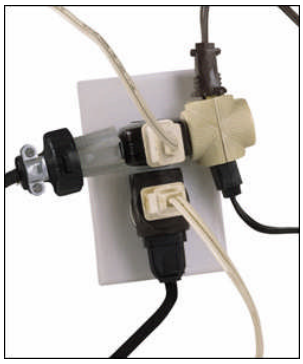
When there's no place to plug in that new piece of equipment, what do you do? You probably are tempted to use one or more extension cords to reach the nearest unused outlet or add a power strip to get more "outlets." Almost certainly most of us do not think of them as dangerous but the U.S. Consumer Product Safety Commission declares extension cords among the most dangerous of electrical appliances.

What's wrong with using an extension cord, a power strip or even a surge protector to run more electrical equipment? If too many pieces of equipment are plugged into the same outlet and they're all on at the same time, more current may be running through the outlet than it can handle creating an electrical fire hazard.

Extension cords can be used for up to 90 days but must be used properly. Surge protectors are recommended over power strips and extension cords. However, a sufficient number of well located three-wire/grounded outlets will eliminate the need for extension cords or power strips.

The following information describes potential hazards associated with extension cords, what to look for to recognize dangerous electrical conditions associated with extension cords, and recommendations for their proper use and other options.

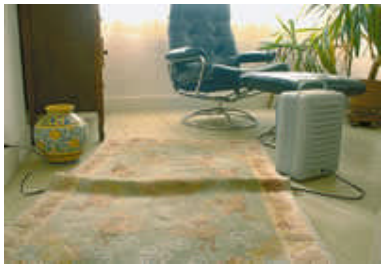
Potential Hazard: Overloaded circuits can cause an electrical fire.



What To Look For: Outlet or wall is warm to the touch; outlet is discolored; circuit breakers frequently trip, or fuses frequently blow; a burnt smell of insulation is noticeable.

Remedy:

- An extension cord, power strip or surge protector is only to be plugged directly into an outlet (not another extension cord, power strip or surge protector i.e., not strung together in series or "daisy-chaining"). Equipment or appliances should also be plugged directly into an outlet but, if necessary, may be plugged into a surge protector. Extension cords or power strips without surge protection are not recommended.
- Extension cords and cords from power strips or surge protectors, equipment and appliances are not to be run under rugs or carpets. The heat build-up is a potential fire hazard.



Left photo: Only plug extension cord, power strip or surge protector directly into an outlet.

Middle photo: Do not daisy-chain extension cords, power strips or surge protectors in series.

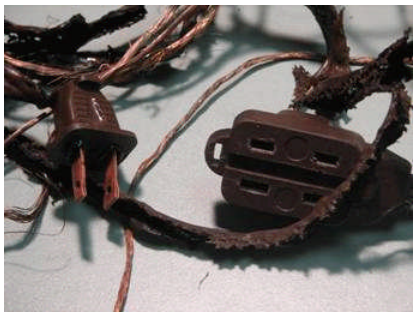
Right photo: Power cords are not to be run under rugs due to tripping and fire hazards. NOTE: Portable space heaters usually are not authorized in government buildings (see separate policy).

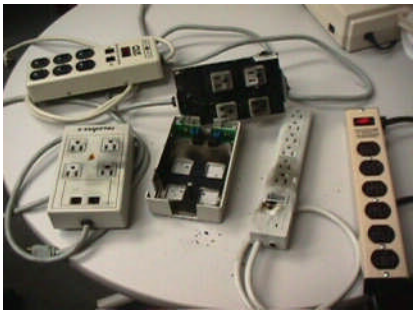
- **WARNING**: Surge protectors and uninterruptible power supply devices protect equipment, but they do not protect from the potential hazards of an overloaded circuit.

- If you have converted an older building, home or room into an office, it is important that the electrical system can handle the load. Many state buildings are over 40 years old. Their electrical systems weren't built to today's more rigid codes. Such systems' capabilities are taxed and can be exceeded beyond intended load design when we try to accommodate more modern electronic equipment. Also, simply using any system causes it to age (heating and exposure to the elements causes rubber and plastic insulation to become brittle and damaged). Heavier demand increases aging. A Consumer Product Safety Commission study has found older electrical systems are still performing well when they were used for expected purposes.
    - Make sure the power demand of new office equipment is not too great, i.e., will not overload your circuits. A licensed electrician can check your electrical system and provide guidance on the capacity of electrical circuits in your office.
- Have a licensed electrician run a new dedicated circuit and/or install a sufficient number of well located three-wire grounded outlets to eliminate the need for extension cords.

Potential Hazard: Overloaded extension cord can cause an electrical fire.

What To Look For: Extension cord is warm to the touch, discolored or has burnt smell.





Remedy:

- Make sure that extension cord ratings are at least as high as the appliances they power (use an extension cord with the same or larger wire size as the equipment/appliance cord).
    - Consider the load, i.e., a small load like a desk lamp or a heavy load like a portable hand saw.
    - Consider the distance from the outlet. Use the shortest length of extension cord possible to minimize current loss and heat build-up.
    - According to the American Wire Gauge (AWG) system, the smaller the wire gauge number, the more current the cord can safely handle. For example, an extension cord made from 12-

gauge wire can safely handle more current that an extension cord made from 16-gauge wire.

- Unwind / uncoil extension cords fully before use to prevent heat build up.
- Since extension cords are designed for temporary use (90 days or less), have an electrician run a dedicated circuit and/or install a sufficient number of well located three-wire grounded outlets to eliminate the need for extension cords.

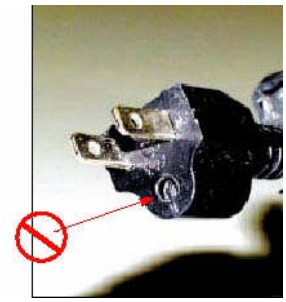
Potential Hazard: Electrical shock from a short circuit due to ungrounded outlets.

What To Look For: Equipment cord has a three-prong plug, but the nearest outlet has only two slots for the plug.

3-prong grounded plug will not fit into old 2-hole outlets

Remedy:

- Never remove the ground (third) prong of a three-pronged extension cord, or attempt to insert it into an ungrounded (two-pronged) outlet or adaptor.
- Have a licensed electrician inspect the outlet to replace the existing outlet with one that accepts a three-prong plug which may require a new circuit with ground.



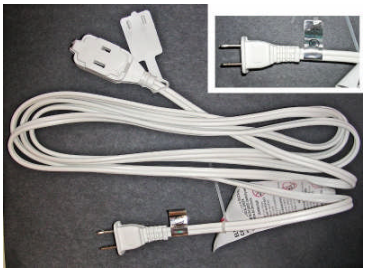
Do not remove ground prong

Prohibited adaptors and power splitter

Grounding is a method to protect employees from electrical shock by providing an intentional low-resistance path from the electrical system to the earth with sufficient current-carrying capacity to prevent the build up of hazardous voltages. Cord and plug-connected equipment must be grounded if it is located in a hazardous wet environment, if operated at more than 50 volts, or if it is a certain type of equipment (such as refrigerators and air conditioners). Though smaller office equipment generally does not have to be grounded, newer office equipment, as a precaution, typically is made with grounded (three-pronged) plugs.

- Use equipment only listed by the Underwriters Laboratories (UL) or other recognized testing laboratories.
- Heed recalls from the Consumer Product Safety Commission.

Homemade extension cords are prohibited



CPSC recalled counterfeit cord

Potential Hazard: Electrical shock from damaged extension cords.

What To Look For: Damaged extension cords that have been knotted or kinked (causing wires to break internally), frayed, cut or burned. Extension cords running through walls, under carpet or furniture, through doorways, across walkways or draped over heaters or equipment can become easily damaged.

Remedy:

- Inspect extension cords for wear and damage before you use them.
- Remove extension cords by pulling on the plug instead of the cord.
- Damaged extension cords should be destroyed and discarded.

Potential Hazard: Electrical shock from extension cord contact with water.

What To Look For: Electrical outlets within 3 feet of sinks or other water sources; outdoors

Remedy:

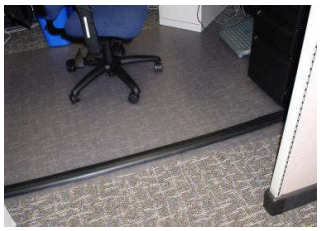
- Extension cords used near sinks, water fountains or wet environments (with water leaks or high humidity) should be plugged into an outlet with Ground Fault Circuit Interruption (GFCI) or use a supplemental GFCI to prevent persons from receiving an electrical shock.
- Ensure that the only extension cords you use outdoors are rated for outdoor use with a built-in or supplemental GFCI.

Wall outlet next to sink has GFCI

Supplemental GFCI

Potential Hazard: Trip hazard due to extension cords in inappropriate places.

What To Look For: Extensions cords running under carpet or furniture and across doorways or walkways.



Remedy: Keep extension cords away from foot traffic and doorways to prevent damage to the cords as well as a tripping hazard. To help prevent tripping, tape down or cover the extension cord with a cable cover, or rearrange office furniture. Better yet, add more outlets to eliminate the need for an extension cord.

POWER SURGES - Temporary power surges (transient voltage losses, increases or spikes) can damage equipment and cause computer programs to lock up and become corrupted.

Causes of Power Surges: Many people assume that power surges are caused mainly by electrical storms and lightning strikes. Other external causes can include the startup or shutdown of nearby heavy equipment, fallen power lines, or even the normal "switching" of a nearby electrical substation. However, 80 percent of them are generated from within the structure. Common sources of power surges include appliances such as air conditioners, washing machines, clothes dryers and refrigerators. Office equipment, including laser printers, photocopiers and fluorescent lights also generate temporary power surges.

Brownouts, a more frequent occurrence than **Blackouts** (total loss of power), are drops in voltage in an electrical power supply, so named because it typically causes lights to dim. Systems supplied with three-phased electrical power also suffer brownouts if one or more phases are absent, at reduced voltage, or incorrectly phased. Such malfunctions are particularly damaging to electric motors. Brownouts can also damage office equipment and cause the loss of important data. Some of our facilities have backup power in the form of standby generators which automatically start up when electrical power is lost, which would allow enough time to either complete your work or to initiate a controlled shutdown of their process and/or evacuation or personnel. Good solutions are a line conditioner or an uninterruptible power supply (UPS) which is a line conditioner with a battery backup. Not only does a UPS device allow time for an orderly shutdown of a computer when the power goes out, it also regulates the

flow of electricity, smoothing out the current before it goes to equipment. Some UPS devices also incorporate surge protection.

How to protect your office computer and equipment from power surges: A "surge protector" is a power strip with protective devices to regulate the current to connected equipment by either blocking or shorting to ground any "unsafe" voltage. The higher the quality the better is recommended for sensitive electronic equipment. Cost: $20 -$200 depending on amount of surge protection and whether protection for telephone and data lines are included. Even the most robust surge protector is unlikely to protect you from a nearby or direct lightning strike. The best way to prevent damage during a lightning storm is to actually unplug devices that could be damaged, including your phone line, until the storm passes.

Surge Protector

UPS

Standby Generator

Before buying a "bargain" surge protector, closely examine the performance figures to make sure it will be adequate for your needs; consider the following:

- **Response time**: Look for a device that responds in less than 1 nanosecond.
- **Clamping voltage:** Look for a rating under 400V; the lower the number means better protection.
- **Energy absorption/dissipation**: This figure, in joules, tells you how much energy the device can absorb before it fails; the higher the better. Look for a minimum of 200 - 400 joules rating; 900 joules or more for computers (some "home theatre" protectors are rated at over 3,000 joules!)
- **Connected Equipment Warranty**: The value connected to your equipment's worth ($10,000? $100,000?) and for how long (a year or a lifetime?) the warranty covers.

References:

1. OSHA Standard 29 CFR 1910 Subpart S – Electrical; 1910.305
2. NFPA 70 National Electrical Code
3. *Facilities Safety Management* (E-Magazine), Aug 2007; "Power Stripped? Office Equipment Safety: Don't Overload Circuits; **"** http://www.fsmmag.com/Articles/2007/08/Power%20Stripped.htm . ***Source:*** *The Elecrical Safety Foundation International and The Leviton Institute, the educational arm of the Leviton Manufacturing Company.*
4. PC World (on-line guide to): Surge Protectors (http://www.pcworld.idg.com.au/article/173224/surge_protectors?pp=4)