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LOSS CONTROL ALERT

Electrical Extension Cord Safety

The most common, convenient and easiest way to provide electrical power to an appliance, tool, or piece of equipment that cannot reach an outlet is through an extension cord. These highly common insulated and flexible devices are available in almost any sundry retail store, hardware, or home supply facilities. Consisting of an outlet, plug and length of flexible insulated wiring, extension cords are used in most homes, businesses, industries, and construction. While providing a great benefit in supplying electricity to where it is needed, the common extension cord is one of the most abused and misused piece of equipment. They are often used to supply current exceeding their capacity, in conditions beyond their design and are more susceptible to damage than fixed wiring. Extension cords are a leading cause of electrical fires, and can cause injury and death if used improperly. According to data from the Consumer Product Safety Commission, the Occupational Safety & Health Administration (OSHA) and the National Fire Protection Association, each year electric extension cords account for:

- 3,300 residential fires killing and injuring over 300 people - The most frequent causes of these fires are short circuits in the cord, overloading, damage or misuse.
- 4,000 cord related injuries treated in hospital emergency rooms. About half of these injuries are from people tripping over the cord.
- $1.4 billion in property damage.
- 1,100 electrical burns and 1,480 electrical shocks to workers.
- A large percentage of work related electrical accidents on construction jobsites.
- A large proportion of structure fires are caused by cord damaged or overloading.

These injury and property damage statistics can be avoided through the use of some fairly basic safety practices when using electrical extension cords. Key safety practices include:

<u>Add outlets where needed:</u>
Obtain a licensed electrician to install power outlets in those areas where extension cords are used as permanent solutions. A heavy reliance on extension cords is an indication of too few outlets supplying electrical needs. Extension cords are only intended for temporary use, generally defined as not exceeding 90 days.

Continual use of extension cords can cause their insulation to rapidly deteriorate, creating a dangerous shock and fire hazard. Additionally, while the cord may have been properly sized, power demands may grow over time exceeding the rated capacity of the cord. Using under-rated cords increases electrical resistance causing heat which can result in a fire or burn.

<u>Select the right cord for the job:</u>
Using an under-sized cord for the power demands (overloading) or using a cord not rated for the environment or the application for which it is to be used are very common mistakes. Overloading can cause a cord to heat up to the point that its insulation either melts or carbonizes creating a fire, burn or shock hazard.

Extension cords are rated in many different ways. The first is where the cord is to be used. OSHA requires three-wire cords designed for hard or extra-hard usage. Hard-service cords are marked with letters such as S, SE, SO, ST. See ***Appendix 2*** for a listing of these and other markings.

Light duty, or more commonly, ungrounded flat-wire cords cannot be used on construction sites or for industrial settings because they do not provide the same abrasion and electrical protection as double-insulated heavy duty cords. Light duty cords should never be used for powering multiple items at the same time, such as space heaters, toasters or hair dryers that have a high energy demand and those with exterior metal surfaces that need to be grounded.

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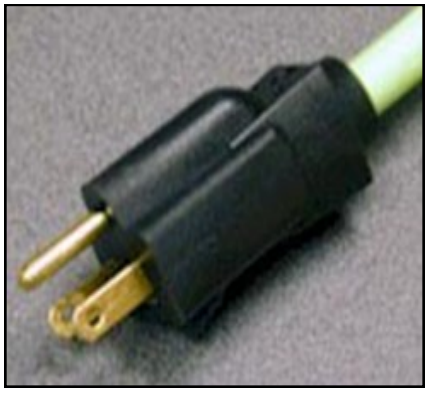
When buying extension cords make sure they have been certified by a nationally recognized testing laboratory such as UL, CSA, or ETL, and read the manufacturer's instructions carefully to assure the cord will meet your needs.

Extension cords should be selected based on the electrical current it will be required to carry (amperage or amps) and the length of the cord. Using a low amp rated cord for an application requiring a higher power demand will cause the cord to heat. The current carrying capacity of extension cords is determined by the diameter of the wire (gauge) and the cord length. Wire diameter and the number of amps it can carry, increases with a decrease in gauge number.

To determine the correct cord based on electrical current needs, check the amperage ratings on the nameplates of the power tools, appliances or equipment to be connected by the cord. Use an extension cord with the appropriate wire gauge to handle the highest amperes tool. Using an extension cord with a small gauge (larger wire) for a small power tool is not a problem.

Cords should be no longer in length than is necessary. The longer the cord, the more resistance is created to carry the same amount of amps. Resistance means heat. The more resistance, the more heat is created posing a fire, burn or shock hazard. Remember the famous statement from Star Trek, *"Resistance is not futile. It is amps divided by volts."*

Cords are also manufactured with two or three wires. 2-wire or ungrounded extension cords should have a polarized plug and receptacle. Polarized plugs have different width blades that only allow it to be inserted one way into an outlet to prevent electric shock by properly aligning circuit conductors. If a plug does not fit, have a qualified electrician install a new outlet. Never file or cut the plug blades of an extension cord or appliance to plug it into an ungrounded outlet.



3-wire or grounded extension cords use a 3-prong plug to connect to a grounded receptacle. Do not connect a 3-wire plug from a grounded tool or appliance into a 2 wire extension cord and never remove the grounding prong from the appliance, tool or extension cord.

The number of wires, amp rating and duty type are usually marked along the length of the extension cord. If the tool is rated in watts, a good rule of thumb is to divide the watts number by 125 to get amps. For example, a 1250 watt rated tool requires 10 amps of power. The below chart lists extension cord specifications based on gauge (ga), amps, and length.

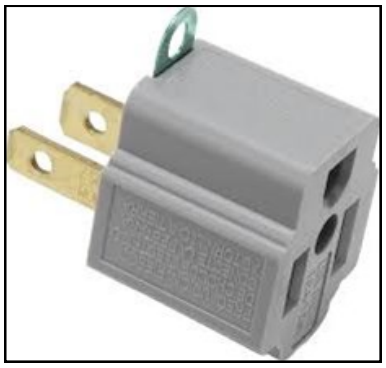
Cord	Load Ampere (Current) Rating					
	0-2	2-5	5-7	7-10	10-12	12-15
25 ft	16 ga	16 ga	16 ga	16 ga	14 ga	14 ga
50 ft	16 ga	16 ga	16 ga	14 ga	14 ga	12 ga
100 ft	16 ga	16 ga	14 ga	12 ga	12 ga	
150 ft	16 ga	14 ga	12 ga	12 ga		
200 ft	14 ga	14 ga	12 ga	10 ga		

Based on the above, it is not a good practice to connect smaller gauge cords together to make a larger one unless the power demand is less than the load carrying capacity of the entire combined cord length. For example, if a 12 amp tool needs power and is 200 feet to the nearest outlet, connecting four, 50 ft., 14 gauge cords will exceed the design current carrying capacity of each cord, creating a fire and safety hazard.

Other ratings include outdoor and indoor applications, use in wet areas, around oils, or sustained sunlight. Cords rated for outdoor use have tougher insulation and are designed to be more abrasive and crush resistant overall. Any outdoor-rated cord can safely be used indoors.

Outdoor rated cords should have a built-in ground fault circuit interrupter (GFCI) unless it is used in conjunction with a GFCI protected outlet. Outdoor electrical outlets and ones in moist areas should already be on GFCI circuits. A GFCI interrupts electrical flow in the event of current loss as might occur during an electric shock.

Other types of extension cords have a built-in circuit breaker. This will protect the tool and keep the cord from overheating if too much electrical current is being drawn. If the motor in an electric tool stops due to excessive loading, the amount of current it draws skyrockets.



While devices such as the three prong-to-two-prong adapter are available, their use should be discouraged due to frequent misuse. These devices are intended to allow a three prong tool to be plugged into an older two prong outlet. Proper usage requires that the grounding tab be connected to the center screw in the outlet, bonding the adapter ground to the frame of the outlet body. This step is often neglected. Additionally, these adapters are often used to connect a three prong device to a two wire/prong extension cord. When this occurs, electrical grounding is not possible.

Most flat 2-wire extension cords are only rated for indoor use because the outer plastic covering functions as both the insulation and the protective jacket. Outdoor cords have wire insulation plus an outside jacket.

A good safety practice is to purchase and use three-prong grounded extension cord even if most of your power tools, appliances, or equipment have a two-prong plug. Those tools will work fine with the three-prong extension cord, and you never know when you may use a power tool with a three-prong plug.

<u>Protect the cords and those that may contact them:</u>

Cord insulation, particularly light-duty two-wire cords is easily damaged by being pinched between furniture and floors or walls or by being crushed or abraded by foot traffic exposing the energized wires creating a fire and shock hazard. The damage may not be easily visible. If the insulated metal wires are damaged, such as by the cord being crushed in a door, it can form a hot spot creating a fire hazard. For these reasons, the National Electrical Code does not permit cords to pass through wall holes, suspended or dropped ceilings, floors, doorways, windows or similar openings. Similarly, insulation of cords placed close to heating appliances may also be damaged, melting or burning it away.

Keep extension cords out of high traffic areas like doorways or walkways where they pose a tripping hazard or secure them in place with tape along the entire exposed length or use cord molding designed to protect the cord and prevent tripping. Do not run cords through moisture, or tie them to a structure such as an over-head pipe. Never run cords across traveled roads, under carpets or through water.

While OSHA's General Industry regulations allow the temporary use of cords to be run through doorways or other pinch points, such as windows or other similar openings, they must be protected from damage. They cannot be used as a substitute for the fixed wiring of a structure or run through holes in walls, ceilings, or floors, be attached to building surfaces or concealed behind building walls, ceilings, or floors.

Cords connected to equipment should not be used to raise, lower or move the equipment. All cords should include a strain-relief design to minimize the pull force on the wires at the plug and receptacle ends. Yanking on the cord to remove it from a receptacle or tool is a common type of abuse which over time can loosen, expose or dislodge the wires from their ends, creating a safety hazard. The strain relief design acts as a shock absorber to minimize the pull forces on the wires at the connecting terminal ends.

Animals, whether they are pets or pests, may chew on the wires and remove some of the insulation. In any of these cases, if the damage is not noticed and the cord is not repaired or taken out of service, the damage can lead to arcing or a short circuit between the wires, which can cause a large amount of heat, igniting nearby materials and presenting a shock hazard to those contacting it.

Any cord with exposed wires should be immediately destroyed and replaced with a new cord. Touching even a single exposed strand can result in an electric shock or burn. Always insert plugs fully so that no part of the prongs are exposed when the extension cord is in use. Do not nail or staple cords to walls or baseboards or hang them in such a fashion that will not damage the outer jacket or insulation.

When not in use, cords should be unplugged and stored out of direct sunlight as UV radiation can deteriorate the outer jacket. Place them on shelves racks or hooks that will not cut, pinch or abrade their outer covering. Never hang cords on wall nails as the nail head may damage the jacket. If the receptacle end is equipped with a plastic cover for unused openings, use them to prevent debris or moisture from entering the unused outlets.

Repair or Replace:

Worn, frayed or damaged cords should be removed from service and destroyed to prevent their re-use. The damaged cord should then be replaced with a new cord.

While the use of electrical tape to cover minor damage such as a superficial nick to the outer protective cover can be done according to OSHA, this practice is not recommended. While taping these incidental abrasions and cuts does not necessarily violate any OSHA or NEC standard, it is not a good safety practice. The tape could change or alter the cord's original flexibility and lead to internal damage. Second, the depth of the abrasions and cuts cannot be monitored to see if they get worse without removing the tape. Lastly, cord damage that is bad enough to require taping may have also caused damage beyond the exterior jacket.

The jacket is designed both to prevent damage to the conductors and insulators inside and to further insulate the conductors. Taped repairs usually will not duplicate the cord's original characteristics; in most cases neither the jacket's strength nor flexibility characteristics will be restored. Therefore, tape repairs of the jacket will not bring a cord into compliance with its original specifications.

Power Strips:

A power strip is a variation of an extension cord, where the cord terminates in a row or group of receptacles. Power strips are commonly used to provide multiple receptacles for several tools, appliances or pieces of equipment. When using power strips make sure the combined power use do not exceed current rating for the strip.

Verify, Before You Buy:

Extension cords and power connectors over 50 volts must be tested and labeled by a recognized testing laboratory such as UL, CSA , or ETL. Each cord should bear one of these labels. Review the label carefully. There are a number of counterfeit and non-certified products on the market. Also review the list of recalled products published by the CPSC. This government agency, in conjunction with product manufactures will recall unsafe consumer products including extension cords.

Inspect:

Due to their high use and high abuse, extension cords should be visually inspected for damage prior to each use on any work shift and when their electrical current use changes such as adding additional power sources or relocating the cord to a new outlet. Look for external defects such as:

- deformed or missing pins
- missing grounding pins
- damage to outer jacket or insulation
- loose plug or receptacle ends
- pinched or crushed outer jacket
- broken plug head
- use of duct or electrical tape

Verify that the right type and length of cord is being used for the application, environment, and power demands. Check the outer jacket and cord ends. If they feel warm or hot, immediately discontinue cord use. This may indicate overloading or internal damage. Internal damage may also be present if the outer jacket was pinched or crushed, the ends are damaged or tape has been placed over the outer covering. See ***Appendix 1*** for a *Model Extension Cord Inspection Checklist*.

References:

For additional information on extension cord safety and regulations governing their use refer to:

- Occupational Safety & Health Administration
- National Fire Protection Association
- Consumer Product Safety Commission

Conclusion:

Extension cords provide a convenient way to deliver electrical power where it is needed. These valuable and common devices are also subject to significant abuse and misuse. Misuse and abuse can lead to fires and injuries. Cord users need to select the proper cord and use it safely to prevent these adverse outcomes.

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Appendix 1
Model Extension Cord Inspection Checklist

Name of Company:				**Date of Inspection:**					
Name of Inspector:									
Cord Identifier									
Gauge									
Amp Rating									
3 or 2 Wire	☐ 3-wire ☐ 2-wire			☐ 3-wire ☐ 2-wire			☐ 3-wire ☐ 2-wire		
Type	Yes	No	N/A	Yes	No	N/A	Yes	No	N/A
Polarized pins or grounding prong									
Strain relief									
Rated for designed use (e.g. hard or extra hard)									
Rated for environment being used (wet, outdoor)									
Certified by UL, CSA, or ETL									
Use									
In use < 90 days									
Meets total amp demand									
Cord length appropriate									
GFCI protection if outdoors or in a wet environment									
No 3 to 2 prong adaptors									
No evidence of misuse such as hoisting equipment									
Kept away from heat, sparks or open flame									
Condition									
Free of nicks, fraying, abrasion, cuts, or burns									
Free of splices, tape									
Not warm or hot to the touch									
Placement									
Does not present a trip hazard									
Not run through walls, ceilings or floors									
Protected from sharp edges									
Protected or free of pinching/crushing/cutting hazards									
Not stapled or nailed in place									
Storage									
Out of sunlight									
Protected from sharp surfaces and nail heads									
Overall									
Acceptable	☐ Yes		☐ No	☐ Yes		☐ No	☐ Yes		☐ No
Removed / Destroyed	☐ Yes		☐ No	☐ Yes		☐ No	☐ Yes		☐ No

Appendix 2
Cord Markings

Extension cords larger than a typical lamp cord size are marked continuously along their length with several items of information. The most important marking item is the one that tells the size of the wires in the cord. This marking usually appears in a form such as "14/3," which indicates a three-conductor #14 gauge cord.

The marking item that usually follows the wire gauge identifies the type of cord, meaning the physical construction. The two types of construction likely to be found are "S" (hard service) and "SJ" (the J is for "junior," a lighter duty, less-rugged version of the type S cord). Additional letters may follow the S or SJ to indicate other performance characteristics such as:

T: Thermoplastic insulation, instead of a rubber-type material.

E: Thermoplastic elastomer insulation (more rubber-like than thermoplastic).

O: Oil resistant.

W: Moisture and sunlight resistant.

Multiple letters are often found, such as SJT or SJTOW or SEOW. Other markings include maximum voltage with which the cord may be used and the markings of a certifying lab such as UL.