



Safety Measures ELECTRICAL

“Elimination is the first priority!
Ensure a risk assessment is completed before
energized work tasks are completed.”

Can An Extension Cord Kill Me?

By Terry Becker, P.Eng., CEM, IEEE Senior Member

Interesting question. The answer is yes. Portable cord-and-plug-connected electrical equipment and extension cords are electrical equipment that all workers on a worksite may use every day. If specified and used properly they are safe. If they are not specified properly, are susceptible to damage with improper use and are placed in an abnormal electrical equipment condition there is an increased risk of receiving a potentially fatal electric shock at 120VAC single phase. Extension cords are used for temporary power only.

As a secondary hierarchy of risk control method a ground

fault circuit interrupter (GFCI) may be installed on a receptacles that extension cords and portable cord-and-plugged-connected electrical equipment are plugged into, the ultimate last line of defence. But before plugging into a GFCI receptacle we need to test and reset the GFCI to confirm it is functional. Do workers on a worksite test and reset the GFCI? Do workers on a worksite pre-use inspect portable cord-and-plug-connected electrical equipment and extension cords for any damage before they use them? Are extension cords used only for temporary power? Is any worker allowed to use electrician's



Damaged Extension Cord, Copper Exposed

Current mA (milli-amps, 60 Hz)	Physiological Effect On Human Body	Human Perception & Effect On Human Body
< 1mA	None	Imperceptible
1 mA	Perception threshold	Mild sensation
1-10 mA		Painful sensation
10 mA	Paralysis threshold of arms and hands	Cannot release hand grip “no let go” threshold
30 mA	Respiratory paralysis	Breathing may stop
75 mA	Heart fibrillation possible	Heart action discoordinated
250 mA	Heart fibrillation	99.5%, ≥5 second exposure
4 amps	Heart paralysis threshold	Heart stop for duration of current flow
≥5 amps	Tissue burns	Most likely fatal – vital organs are burned or damaged, can lead to amputation of limbs

Table 1. Effects of Electrical Current Flow Through The Human Body

tape to repair a damaged cord? Is using electrician’s tape to repair a damaged cord actually allowed based on the CE Code Part II, Product Standard for extension cords?

All workers on a worksite are at risk of receiving an electric shock that could be fatal. Single phase 120VAC power can provide enough current flowing into a human body and if the current passes through the heart for enough time a worker can be electrocuted (reference Table 1).

Only specific Qualified Persons are exposed to an abnormal

arcing fault and arc flash. In Canada an electrocution may be occurring several times a month or more. Historically a worker that has received an electric shock never reports it, it is an invisible injury. If statistics were available there are most likely thousands if not tens of thousands, possibly hundreds of thousands of electric shocks occurring in North America every day. Globally electric shock and electrocution are in the millions per day and most likely hundreds of thousands of fatalities. We need more focus on the electric shock hazard!



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Extension Power Cord Management

How can the risk of receiving an electric shock when using portable cord-and-plugged-connected electrical equipment and extension cords be reduced? With extension power cord management, including training, issuing frequent safety bulletins and discussions in safety meetings.

The following items are essential to ensuring the use of portable cord-and-plug-connected electrical equipment and extension cords does not pose a high risk of electric shock and potentially electrocution.

1. Extension cords must be rated for the environment they are used in. They must be a three-pronged plug with a grounding prong. Extension cords must be designed for hard or extra hard usage. The rating or approval must be visible on the cord. Do not exceed the electrical rating of the cord.

Extension Cord Jacket Designation Chart

Designation	Letter Meaning
S	Indicates a flexible cord designed for general use
W	Indicates the cord is rated for outdoor use
J	Indicates a cord with standard 300 volt insulation. If there is no J in the designation, the cord has thicker, 600 volt insulation designed for heavier use
P	Indicates parallel wire construction, used in air conditioner cords and household extension cords
T	Indicates the cord jacket is made from vinyl thermoplastic
E	Indicates the cord jacket is made from thermoplastic elastomer rubber (TPE)
O	Indicates the cord is oil-resistant

2. Extension cords may only be used to provide temporary power and shall not be used in place of permanent wiring.
3. Do not connect extension cords in series with another extension cord or multi-tap outlets. Daisy chaining extension cords is not allowed.
4. Do not pull on the cord at the plug to disconnect, hold the plug to pull from the outlet.
5. Portable cord-and-plug-connected electrical equipment must be handled in a manner that will not cause damage. Do not handle portable cord-and-plug-connected electrical equipment using the extension cord to carry the equipment. Flexible extension cords connected to portable cord-and-plug-connected electrical equipment may not be used for raising or lowering the equipment.

6. Extension cords must be covered by a cord protector when extended into a walkway or other paths of travel to avoid creating a tripping hazard and to reduce the risk of damage.
7. Use the proper power receptacle for each application. Receptacle “adapter” devices which change the original plug configuration are not permitted.
8. Extension cords shall not go through walls, doors, windows, or be draped across ceilings or partition walls. Extension cords must be protected from damage.
9. Personnel performing work in damp or wet locations must use extension cords plugged into ground fault circuit interrupters (GFCIs) permanently installed or of the portable type.
10. Job made extension cords by un-qualified personnel are not permitted.
11. Test all cord-and-plug-connected GFCI devices before using the by hitting the test and reset push button.
12. Cords on portable electrical equipment and extension cords must be visibly inspected before each use for external and internal defects. If defects are identified, the equipment or extension cord must be removed from service immediately and rendered unusable.

Why have we not effectively managed extension cords? Are their credible human performance issues that may be why? Why do we allow unqualified personnel to use electrician’s tape to repair damaged cords?

Extension cords are found in permanent use when they are intended for “temporary power” only and are prone to higher risk of damage. Extension cords need to be removed from service after use, unplugged at the receptacle, rolled up and stored to protect them from damage when not in use. Proper extension cord use, and management training and procedures are required. Specifying an extension cord for the service (e.g., extra hard usage, appropriate wire gauge and outdoor cold temperature) can reduce the likelihood of damage.

More focus on electric shock is required for all workers on a worksite, but specifically Non-Electrical Workers using portable cord-and-plug-connected electrical equipment and extension cords. A GFCI test and reset is required and this needs to be emphasized in training and safety communication.

Yes an extension cord can kill you!



Terry Becker, PEng., CESC, IEEE Senior Member is a founding member and the First Past Vice-Chair of the CSA Z462 Workplace electrical safety Standard Technical Committee and currently a Voting Member and Clause 4.1 and Annexes Working Group Leader. Terry is also a Founding Member and a Voting Member on the CSA Z463 Maintenance of electrical systems Standard and a Voting Member of the IEEE 1584 Guide for Performing for Arc-Flash Hazard Calculations. Terry has presented at Conferences and Workshops on electrical safety in Canada, the USA, India, Australia and Italy. Terry is a Professional Engineer in the Provinces of BC, AB and ON. Terry is an Electrical Safety Specialist, Management Consultant, and can be reached at 587.433.3777 or by email terry.becker@twbesc.ca.