

ESAO Resource

Information to Assist with the Development of Policies and Procedures for Working on Indoor Energized Electrical Systems

Contents of Policies and Procedures

Legal references:

1. Ontario Electrical Safety Code (Canadian Electrical Safety Code with Ontario Amendments)
2. CSA 22.2 No.950 / UL1950 – 'Safety of Information Technology Equipment, Including Electrical Business Equipment.'
3. ASTM Specifications for PPE for Electrical Work
4. IEC 1010 and CAT(category) III standards for equipment
5. NFPA 70B - 'Recommended Practice for Electrical Equipment Maintenance'
6. NFPA 70E- 'Standard for Electrical Safety in the Workplace'

ASTM - ASTM International / American Society for Testing and Materials
CSA - CSA International / Canadian Standards Association
IEC - International Electrotechnical Commission
NFPA - National Fire Protection Association
UL - Underwriter Laboratories Inc.

This reference material is titled '*Supplemental Policies*' and '*Supplemental Procedures*' because the assumption has been made that the employer using this information already has an *Electrical Policy and Procedures* as well as a *Lockout Policy and Procedures*.

Some definitions:

'Qualified Person':

The *Ontario Electrical Safety Code* defines a qualified person as:

'Qualified person means one familiar with the construction and operation of the apparatus and the hazards involved'

'Authorized Person':

The *Ontario Electrical Safety Code* defines a qualified person as:

'means a qualified person who, by the nature of their duties or occupation, is obliged to approach or handle electrical equipment; or a person who, having been warned of the hazards involved, has been instructed or authorized to do so by someone having authority to give the instruction or authorization.'

'Competent Person'

The *Occupational Health and Safety Act* defines a competent person as:

"competent person' means a person who,

- (a) is qualified because of knowledge, training and experience to organize the work and its performance,
- (b) is familiar with this Act and the regulations that apply to the work, and
- (c) has knowledge of any potential or actual danger to health or safety in the workplace;'

Some suggested content for:

Policies - Energized Electrical Systems

SUPPLEMENTAL ELECTRICAL SAFETY FOR 'LIVE' EQUIPMENT AND WIRING

General:

Electrical work may only be performed by a knowledgeable worker qualified by the appropriate training and / or knowledge and experience to perform the type of work involved. The worker must know the risks and hazards associated with the process, the equipment, the work area and any adjacent areas affected by the work.

Work 'Permits' or an 'unusual hazards' electrical work approval process should be developed.

The approval process for working on energized (live) equipment or services over 45 volts could be modeled on a 'confined space permit'.

Second Person – 'Safety Monitor'

Where a worker is either working on live equipment;

or

where a worker is near exposed live electrical equipment or wiring and, because of the nature of the work or the conditions and/or the location of the work place, it is necessary for another person to be in the area to ensure the safety of the worker, a second worker who is not engaged in the work must be appointed by the supervisor as a 'safety monitor'.

The function of the 'safety monitor' is to:

- 1) warn other people in the area of the hazard; and
- 2) ensure that all safety precautions and procedures are complied with.

A 'safety monitor' must be:

- 1) informed of the duties of a 'safety monitor' and of the hazards involved in the work;
- 2) trained and instructed in the procedures to follow in the event of an emergency;
- 3) authorized to immediately stop any part of the work that the monitor considers dangerous; and
- 4) not have any other duties or interruptions that might interfere with the duties as 'safety monitor'.

Safety Procedures

All testing or work performed on electrical equipment must be performed by a qualified person or a worker under the direct supervision of the qualified person.

Where the electrical equipment has a voltage in excess of 120 V (?) between any two conductors or between one conductor and ground:

1. the qualified person, and any individuals assisting, must use all required insulated protection equipment and tools necessary to protect themselves from injury during the performance of the work; and
2. all employees working with, or near, the live electrical equipment must be instructed and trained in the use of the insulated protective equipment and tools.

Where electrical equipment is not live, but is capable of becoming live:

1. no employee is to work on the equipment unless it is completely isolated by a locking device,
2. a safety ground is properly connected to that equipment, and
3. the equipment is locked out as required by the (*name of your organization*) lockout procedures.

Rubber Gloves and Mitts

Gloves and mitts issued, or available, to workers must be tested by the worker before being used. Visual and air testing methods are to be used for daily checks

Gloves and mitts issued to or available for use by a worker are to be electrically retested following the CAN/CSA Z259.4-M standard after a maximum of four months usage. Testing must be carried out by an approved testing facility. For added personal safety, it is strongly recommended that any type 3 (30,000 volts) gloves and all frequently worn rubber gloves be electrically retested every 60 days.

Qualified Person

Where there is a dispute regarding the term 'qualified person' for purposes of this occupational safety and health standard, the following procedure will be used:

1. The worker or other individual(s) with concerns must raise the matter directly with the supervisor in charge of the area or work.
2. The employee's supervisor will review the employee's qualifications, level of knowledge and experience and decide upon the employee's status and work limitations as a qualified person.

Requirements of the 'Electrical Safety Monitor'

Safety monitors must be present during any work that may breach exclusion zones or during work involving energized equipment or wiring. The 'monitor' does not need to be a licensed electrician or be able to perform the electrical work themselves.

The requirements the 'safety monitor' meet are that they:

1. are competent in emergency electrical response;
2. are aware of hazards and risks;
3. be competent to observe, warn and communicate effectively;
4. warn other individuals about unsafe approaches to the electrical equipment;
5. are competent to assist with the electrical work;
6. are authorized to stop the work if necessary; and
7. not be assigned to other duties while monitoring.

To 'assist' means to facilitate the performance of the work and:

1. be competent in isolation techniques;
2. be competent to rescue the person performing the electrical work; and
3. be able to provide direct assistance in an emergency; and if necessary
4. able to provide resuscitation (assessed in the last 6 months).

Live test

When Lockout Procedures are being used no employee is to give a 'guarantee' of isolation for the performance of a test on isolated electrical equipment where an auxiliary power source could make the equipment live. This does not apply when any live test to be performed on the electrical equipment will not be hazardous to the safety or health of the person performing the live test.

Where a 'guarantee' of isolation for the performance of a live test of isolated electrical equipment is given to a person in charge of the test, that person then becomes the person in charge of the tests, the work area and all related equipment, while the test is being performed. That person is also the person in charge of any other work that is being performed on the equipment while the 'guarantee' is in effect.

Every person performing a live test must warn all people who, during or as a result of the test, are likely to be exposed to a hazard.

Unless otherwise specified in writing by a competent electrical safety person; no employee is to work on or near live electrical equipment or wiring unless the employee is wearing outer clothing with full-

length sleeves fastened at the wrists and the clothing is fabricated from tightly woven natural materials as outlined in the electrical work clothing requirements (NFPA 70E).

Testing of insulated clothing, equipment and tools

Determination of the protective clothing and equipment to be used is to be based on the appendices attached to this policy.

Every article of insulated protective clothing, insulated equipment and insulated device or tool referred to in this policy must be designed, constructed and maintained to ensure it remains safe, adequate and reliable under all conditions of its intended use.

Unless each article has been certified by a recognized testing agency before initial use, it must be checked and tested by a qualified person. It also must be tested annually (or more frequently) using an approved method to ensure it retains its integrity.

No employee is authorized to work on electrical equipment unless that employee uses all protective and insulated clothing and equipment as required or is necessary to ensure their safety.

Electrical Test Equipment Inspections

1) Visual:

Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected daily for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item is to be removed from service, and it can not be used until repairs and tests necessary to render the equipment safe have been made.

2) Specification Check:

Look for the 1000-volt, CAT III (or 600-volt, CAT IV - not recommended for main panel boxes) rating on the front of meters and testers, and a 'double insulated' symbol on the back. There should be approval symbols from two or more independent testing agencies, such as CSA, UL, CE or TUV.

Ensure that the amperage and voltage of meter fuses is correct. Fuse voltage must be as high or higher than the meter's voltage rating and able to support the full surge current of the maximum listed voltage at the voltage input terminals. Test equipment must perform properly in the presence of impulses on volts and amps measurement functions. Ohms and continuity functions are required to handle the full meter voltage rating without becoming a hazard.

Check the instrument's specifications to verify that the ohms and continuity circuit is protected to the same level as the voltage test circuit. If the manual does not include that information, the supplier should be able to determine whether the meter complies with IEC61010 or ANSI S82.02.

Separation of access to hazardous and non- hazardous wiring and equipment

Every reasonable attempt must be made to keep electrical wiring and equipment used for communications and covered by CSA standard 22-950 separate from higher voltage electrical power wiring and equipment.

Where any of the following conditions occur:

- 1) electrical power is supplied to communication equipment using hard wiring into a panel box; or
- 2) the electrical power panels are located in the same electrical room; or
- 3) the wiring for the electrical power supply and the wiring for the communications system share the same or similar conduits or raceways.

the panel boxes and / or wiring must be clearly identified as to the hazard and voltages.

Electrical power panel boxes, breaker boxes and any equipment which could be a hazard must be isolated or secured in a manner which prevents a communication specialist, or an unqualified person,

from accidentally; or within reason; intentionally opening any box or accessing any other source of voltage over the voltages determined to be safe as defined by CSA standard 22.2 No 950.

The power lines into the communication panels must be protected in a manner so that a communication specialist, or an unqualified person, can not make accidental contact with any voltage defined as hazardous in CSA standard 22.2 No 950

Some suggested content for: Procedures - Energized Electrical Systems

SUPPLEMENTAL ELECTRICAL SAFETY FOR 'LIVE' EQUIPMENT AND WIRING

When working on an electrical system always consider exposed electrical parts to be 'live' until you have personally ensured that they have been properly disconnected and locked/tagged out and it has been verified that the equipment is off and all components which could store a charge have been discharged!

Electrical wiring and equipment may be:

1. De-energized:
Which means that any source of energy (electrical, mechanical, pneumatic, chemical, hydraulic) has been removed, lock/tagged out, and the removal or 'isolation' has been verified or 'guaranteed' before the work is started. *Lockout/Tagout* (see Lockout Procedures) is the placement of a padlock and/or a warning tag on an energy-isolating device (disconnect) which ensures that equipment being controlled cannot be operated until the lockout device is removed.
2. Energized (live):
This means that the equipment is energized, or some energized parts of the equipment, have either not had all sources of electrical power turned off, or are not locked/tagged out, or are in the 'on' position.
Live parts which a worker could make contact with must always be turned off and de-energized unless:
 1. The de-energization of the equipment is not possible, due to the design of the equipment or the necessity of checking a power source or power function.
 2. The de-energization of the equipment will cause an additional or increased hazard such as deactivation of emergency alarm systems, shutdown of hazardous location ventilation systems, or removal of illumination for an area.

If it is determined that work on energized electrical equipment is necessary, safe work practices, as outlined in these policies and procedures, must be followed to prevent injury or death while the work is in process. Safe work practices include following safe procedures, using the correct personal protective equipment, using insulated tools, ensuring a 'safety monitor' is present, and having an emergency plan in place and ensuring appropriate on the job training had taken place.

Personal Protective Equipment

All workers who work in/around energized equipment and have the potential to come into contact with 'live' exposed parts must be provided with and use Personal Protective Equipment (PPE).

The following guidelines must be followed:

- 1) PPE must be used whenever there is a chance of coming into contact with exposed electrical parts. This includes simple operations such as resetting a switch inside a piece of equipment or a panel box that contains exposed live wires, connectors or contacts. .
- 2) The PPE used must be appropriate for the work being performed. Ensure that electrical rated gloves, insulated tools, and other test equipment or protective devices are rated in excess of the voltage levels they will be used around. Electrically rated tools must be clearly labeled with the level of voltage for which they are approved. Never exceed the tool's electrical rating!
- 3) Always inspect electrical tools and PPE before each use to make sure they are in good condition and work properly. If a tool has been damaged, or the PPE has tears or holes, replace the item(s) before conducting the assigned work. In order to protect electrical

insulated gloves from puncture, they can be worn under thicker, heavier electrically rated leather gloves.

- 4) Wear non-conductive head protection if working in a location that presents a possible electrical hazard to the head (bumping into exposed lines, parts, etc.).
Head Protection: Class 'E' (Electrical): is tested using 20,000 volts; or
Class 'G' (General): is tested using 2,200 volts
- 5) Wear eye and face PPE, such as an approved electrical face shield and safety glasses, (on higher voltages a chin cup is required) whenever there is a possibility of electrical arcs or explosion. Non-conductive safety glasses with side shields should always be worn underneath a face shield. A face shield alone does not provide enough protection.
- 6) All test instruments and equipment (volt, amp, ohm meters) and associated leads, cables, power cords, probes, and connectors must be visually inspected for external defects and damage before the equipment is used. If any defect or damage is noted remove the item from service.
- 7) All electrical workers are required to wear electrically rated steel-toed boots, identified with the omega symbol (Ω), at all times.
- 8) Utilize approved electrical tools and fuse handling equipment that is insulated in excess of the circuit voltage indicated on the box. Never use a non-insulated tool to remove a fuse.
- 9) You may need to utilize insulating materials, such as non-conductive matting and insulated blankets. They are intended to provide a barrier between your body and the energized parts.

Safe Work Practices

The following work practices are part of all live electrical work procedures:

- 1) When normally enclosed live parts are exposed for maintenance or repair, they must be guarded to protect people from making accidental contact. Barricades can be used. If barricades are not sufficient, then an 'Electrical Safety Monitor' must be used.
- 2) Safety signs and tags must be used to warn employees of electrical hazards.
- 3) Never approach, or take any conductive object without an approved insulating handle, closer than 1 meter to any exposed energized parts. Approved electrical gloves, sleeves and/or tools must be utilized if approaching closer than 1 meter.
- 4) Conductive items must not be worn in the vicinity or while working on exposed energized parts.
Examples of items to avoid - jewelry, body jewelry, watch bands, bracelets, rings, key chains, necklaces, hair bands, conductive buttons, metal zippers or zipper parts, coins, etcetera.
- 5) Always use non-conducting ladders intended for electrical work when working around electricity. Ensure the ladder is clear of oils, grease or spilled liquids which could conduct electricity.
- 6) Do not work on circuits in wet locations or on outside outlets which don't have GFCI's (ground fault circuit interrupters) to prevent the worker's body from becoming the path to ground for 'leaking' current.
- 7) Ensure that all electrical boxes remain accessible at all times and never place equipment, etc. in front of them. Flammable and combustible materials should not be stored in electrical equipment rooms at any time.
- 8) Use instructions, signs, or barriers to protect people from electrical hazards. Always consider electrical equipment energized unless proven otherwise.
- 9) Never modify electrical devices beyond the intent of their design.

Rescue Procedures

A person working on live power voltage should never be working alone. A 'Safety Monitor', who can assist the worker, but not in the hazardous zones should be present.

Electricity, even at voltages of 115V, can cause severe injury or death by causing a person's heart or lungs to stop working. Electricity can also cause minor to severe burns. Serious electrical burns often appear to be minor since most of the damage to body tissues and organs is internal.

If a worker has come into contact with electricity the worker may not be able to remove themselves from the electrical source.

DO NOT ATTEMPT TO PULL THE PERSON FROM THE ELECTRICAL SOURCE WITH YOUR BARE HANDS, YOU MAY BE ELECTROCUTED.

The human body is a good conductor of electricity. If you touch a person while they are in contact with the electrical source, the electricity will flow through your body causing electrical shock. Always attempt to turn off the source of the electricity (disconnect). If the electrical source can not readily and safely be turned off, **use a non-conducting object**, such as a fiber glass object or a wooden pole, to remove the person from the electrical source. Emergency medical services should be called as soon as possible.

When the victim has been removed from the electrical source, check to see if the person is breathing and if they have a pulse. If necessary, administer CPR (if you are trained) until emergency personnel arrive at the scene.

Never go near a victim that has been electrocuted by a high voltage transformer or line, even if they are no longer in direct contact with the power source, because electricity from the line or other source can arc several feet through the air and you could be electrocuted.