ELECTRICAL
Safety Guideline for the Live Performance Industry in Ontario

This guideline deals only with those electrical issues that involve either the temporary elements of a show moving into a permanent facility, or the setup of a temporary performance venue.

Employers have a duty under section 25(2)(h) of the Occupational Health and Safety Act to take every precaution reasonable in the circumstances for the protection of a worker. The measures and requirements set out in this guideline may be considered to be reasonable precautions. Much on the subject of electrical installations concerning permanent theatre equipment can be found in the Ontario Electrical Safety Code (OESC). The OESC deals in detail with permanent theatrical electrical installations. This Guideline highlights sections of the OESC that apply to the temporary and innovative nature of the live performance industry.

In most cases, where a specific aspect of the installation is not clear within the OESC, the installation should use alternative methods to achieve an equivalent level of safety while creating the desired effect.

Electrical equipment must, by law, be approved by and bear the certification mark of a certification organization, accredited in accordance with the Standards Council of Canada Act.

Ontario Ministry of Labour (MOL) has the right to enter any workplace for the purpose of enforcing the Occupational Health and Safety Act, and related regulations. The MOL has the right to shut down any equipment or systems which do not comply with the Act or related Regulations and present a hazard to a worker.

Electrical Safety Authority (ESA) enforces the OESC and has the right to enter any premises which uses electrical power and to shut down any equipment or systems which do not comply with the Code and which present a hazard to the public.

See the Electrical Safety Authority website for examples of current certification organizations at http://www.esasafe.com/GeneralPublic/epa_002D.php.

DEFINITIONS (primarily based on Ontario Electrical Safety Code)

Ampacity. The capacity of a substance to carry an electrical current. It is measured in amperes.

Ballast. A resistor, transformer, or electronic circuit used to limit the current to a discharge type of light source. Typically used with fluorescent tubes, HID, HMI, CID, XENON, etc. luminaires.
**Bonding.** A low impedance path obtained by permanently joining all non-current-carrying metal parts to assure electrical continuity and having the capacity to conduct safely any current likely to be imposed on it.

**CAM-LOK*(TM).** A trade name that has become generic. A brand of single pin locking connectors with molded rubber or Santoprene*(TM) insulators, commonly used for mains portable power distribution on stage, studio and location projects.

**Cordset.** An assembly of a suitable length of flexible cord or power-supply cable provided with an attachment plug at one end and a cord connector at the other end.

**Competent.** A 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 the Occupational Health and Safety 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.

**Electrical Cable.** A flexible cord used to supply electrical power.

**Electrical Distribution Box.** A device which permits the branching of power to two or more loads or additional distribution boxes. Usually consists of breakers or fuses feeding 120V single-phase female connectors (line, neutral and ground). Per Table 1 and 1A of the Electrical Safety Authority Spec 003 at http://www.esasafe.com/pdf/Specifications/ESA-SPEC-003-R6.pdf.

**Grounding.** A permanent and continuous conductive path to the earth with sufficient ampacity to carry any fault current liable to be imposed on it, and of a sufficiently low impedance to limit the voltage rise above ground and to facilitate the operation of the protective devices in the circuit.

**Luminaire.** A lighting fixture consisting of a light source, socket, enclosure, electrical wiring and connector. It may include switches, reflectors, lenses, ballasts, supporting devices, and other apparatus for altering the quantity and quality of light emitted by the apparatus.


**Power Source.** Anything that can provide voltage and electrical current, that is, electrical power.
**Polarized Connector.** A connector that is designed so that its contacts will engage in one way only.

**Polarized Receptacle.** A female contact device installed at an outlet for the connection of one attachment plug.

**Single-Pin Connectors.** An approved locking outdoor-rated connector with one pin, rated up to 400 amps. Generally colour coded to designate phasing. (See #5 Equipment in this Guideline and Ontario Electrical Safety Code OESC 66-456(2)).

**Temporary Installation.** Any electrical installation that is not fixed to a facility. For example, equipment that is rented, or equipment that is installed for a production, to be removed when such a production is over or moved.

**Wire Connector.** A device which connects two or more conductors together, or one or more conductors to a terminal point, for the purpose of connecting electrical circuits.

### GENERAL RULES

1. All electrical installations must be acceptable to the Electrical Safety Authority. This may be determined by a direct inspection, or by other arrangements that have been made with the Electrical Safety Authority.

2. The Electrical Safety Authority offers a Continuing Safety Services program. It may be helpful to contact the Electrical Safety Authority for further information about this program.

3. All electrical equipment shall be approved.

4. All personnel involved with the use of electrical equipment shall be competent in the job they are required to perform.

5. Personnel required to draw power from a power grid to any electrical equipment shall be able to determine the electrical needs of each component of that power grid back to the power distribution grid within the facility.

6. Before work is begun, a competent person should plan (using inquiry, observation, and measurement) to avoid bringing any person, tool or machine into a hazardous situation, electrical or otherwise.

7. Workers and other personnel in a facility should be warned to stand clear when a temporary installation has its power supply connected and activated for the first time.
8. Re-lamping should be done with the power supply to the lamp turned off. If the re-lamping operation would expose a worker to a possibly energized bare part of the electrical equipment, the equipment shall be de-energized and locked out before re-lamping takes place.

9. Lighting and other electrical fixtures shall be de-energized and locked out before being opened for repairs or maintenance.

10. Each receptacle should identify the circuit that powers it. Each connector in a multiple-circuit cable should identify the circuit to which it is connected.

11. Equipment used outdoors or in damp or wet locations shall be suitable for those conditions. The power supply in such locations shall pass through a Type A ground fault circuit interrupter (GFCI)\(^a\). The Type A GFCI is designed to trip at 5 milliamps.

**TEMPORARY POWER DISTRIBUTION**

1. Continuous grounding and bonding must be provided throughout any electrical distribution system. No local grounding shall be permitted. No down-stream bonding of the neutral shall be used.

2. Portable switch boards and dimmers should be:
   - accessible for emergency power shutdown;
   - located so they will not obstruct any exit; and
   - protected from damage from objects or persons that are near or must pass near them.

3. Care should be taken not to walk on or drive over electrical cables. All cables subject to vehicular or extensive pedestrian traffic shall be protected in an appropriate manner.

4. Proper protective equipment should be worn and used.

5. Where premises are serviced from two electrical sources, the electrical sources should have a common ground.

6. The power supply panel should be readily accessible to allow power shutdown.

7. All power feeds should be covered or guarded to avoid a tripping hazard in pedestrian walkways or roadways.

8. All distribution boxes, electrical outlets, and cable connectors shall be installed in locations for which they are approved, unless suitably protected from damage.

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\(^a\) Not an OESC requirement
9. Portable distribution panels, switch boards and dimmer packs should:
   • be properly connected to an approved fused or breaker supply panel;
   • be connected with a cable of sufficient size and ampacity to carry the full rating of the supply fuse or breaker; and
   • never be connected to bypass the fusing of the supply panel.

EQUIPMENT

1. Equipment connected to a power source shall bear an electrical approval label. The Electrical Safety Authority (ESA) maintains a list of recognized certification marks and certification agencies on their website at http://www.esasafe.com/GeneralPublic/epa_002B.php?s=19

2. Electrical equipment should be inspected before use and should have regular inspection and maintenance to preserve manufacturer specifications.

3. At no time should grounded equipment have its connector replaced with a polarized connector, nor should it be plugged into a non-grounded circuit.

4. All electrical devices that become hot during use should be shielded or kept a suitable distance from flammable or combustible materials.

5. Electrical equipment should be protected from exposure to excessive moisture, gases, vapours, fumes, liquids, heat, cold, or other agents which could have a deteriorating effect on the electrical insulating qualities of the equipment.

6. Electrical equipment shall be installed only in locations for which it is approved, unless suitable precautions are taken to protect it from damage.

LIGHTING

1. Scaffolds and other metal grids/pipes/structures used to support lighting or power distribution shall be effectively bonded to ground.

2. Lighting fixtures, lamp holders, lamps, props and receptacles should not have live parts exposed.

3. Workers using high voltage or high pressure light sources (HMI, HID, CSI, neon and fluorescent fixtures) should:
   • be trained in their use;
   • be familiar with the ballasts used; and
   • ensure that all safety devices are in proper working condition.

4. When changing and handling any lamp, personnel should follow all the manufacturer’s safety recommendations.
5. Any open-faced lighting fixture using a quartz halogen lamp, or other high pressure lamp, should have protection against the shrapnel effect caused by an exploding lamp. Such protection may be in the form of a safety glass or safety screen. Workers should ensure that the safety device is reinstalled properly after re-lamping or adjustment.

6. A suitable secondary fall restraint should be used to prevent a fixture or its accessories from falling. The fall restraint should have a breaking strength great enough to stop the dynamic load of the falling fixture and/or accessories.

7. The distance that a fixture may fall before being stopped by its fall restraint shall be such that no strain would be placed upon its electrical cord.

8. Emergency lighting shall conform to Section 46 of the OESC.

**ELECTRIC CABLES**

1. All electrical cables and connecting components:
   - should be provided by an approved manufacturer;
   - shall be approved for the purpose;
   - should have polarity identified;
   - should be grounded; and
   - should be properly assembled.

2. Electrical cables shall be adequately secured so as not to put strain on the connector or cause undue wear or damage to the cable, insulation of the cable, terminals of any electrical apparatus, devices, or joints as per OESC 12-100, for Types of Conductors and OESC 12-120, for Supporting of Conductors.

3. Connectors and cabling of single pin distribution systems shall be provided with standard colour coding:
   - Red, Blue, Black: Live
   - White: Neutral
   - Green: Ground

4. Where single, i.e. not bundled, conductor cables are used, the colour codes shall be applied with coloured tape at both ends of each cable before the cables are connected.

5. Electrical cables should be in good repair.

6. Electrical cables should be protected from wear and damage such as crushing, abrasion, and shearing. If electrical cables or the insulating casing are found to be damaged they are to be replaced or not used.
7. Electrical cables should not be fastened or suspended in such a way that the insulating cover could be damaged.

8. Cables should not be spliced.

ENVIRONMENT

1. When working on or close to energized electrical equipment, ladders made of conductive materials shall not be used (Regulations for Construction Projects O. Reg. 213/91, s. 194).

2. Prior to climbing any temporary structure that carries elevated electrical equipment, an inspection should be made to ensure that the structure is stable and properly erected.

3. In outdoor locations, particular care should be taken to bond to ground any structures which support electrical equipment.

EMERGENCIES

1. No repairs or alterations shall be carried out on any live equipment except where complete disconnection of the equipment is not practicable.

RESOURCES

The Electrical & Utilities Safety Association of Ontario (E&USA) provides a variety of electrical safety awareness programs for electrical and non-electrical workers. For example, the Electrical Safety and Awareness training program familiarizes participants with electrical oriented operations and pinpoints both general and electrical hazards. An Electrical Lockout/Tagout training program is also available.

E&USA may be contacted by phone at 1-800-263-5024 or at their website www.eusa.on.ca.

Reference to external resources and websites are offered for convenience of users in accessing related information. These references and links do not necessarily constitute an endorsement of the resources or websites. The Ministry of Labour takes no responsibility for the views, contents or accuracy of the information presented by external sources.
MORE INFORMATION

- Ministry of Labour
  www.labour.gov.on.ca/english/hs/topics/performance.php
- Health and Safety Ontario (health and safety association):
  www.healthandsafetyontario.ca/
- Workplace Safety & Insurance Board:
  www.wsib.on.ca
- Canadian Standards Association (CSA) standards referenced in occupational health and safety legislation:
  ohsviewaccess.csa.ca

CALL TOLL-FREE

Call 1-877-202-0008 anytime to report critical injuries, fatalities or work refusals. For general inquiries about workplace health and safety and to report potentially unsafe work conditions, call 8:30 a.m. – 5 p.m., Monday to Friday. In an emergency, always call 911 immediately.

ACKNOWLEDGEMENTS

The Ontario Advisory Committee for Health and Safety in Live Performance is made up of professionals in live performance from across the province – large and small, commercial and not-for-profit, service organizations and professional associations. We have had input from individual experts both national and international. The Advisory Committee and the Ministry of Labour would like to thank the following people for their help in making this guideline possible.

* Indicates a main committee member at the time the sub-committee was active.

- Bonnie Armstrong*
- Rick Boychuk, Theatre Safety Consultants
- Ron Foley, SCENEWORK
- Jim McManamy, Ryerson Theatre
This guideline has been prepared to assist the workplace parties in understanding their obligations under the Occupational Health and Safety Act (OHSA) and the regulations. It is not intended to replace the OHSA or the regulations and reference should always be made to the official version of the legislation.

It is the responsibility of the workplace parties to ensure compliance with the legislation. This guideline does not constitute legal advice. If you require assistance with respect to the interpretation of the legislation and its potential application in specific circumstances, please contact your legal counsel.

While this guideline will also be available to Ministry of Labour inspectors, they will apply and enforce the OHSA and its regulations based on the facts as they may find them in the workplace. This guideline does not affect their enforcement discretion in any way.