



# SHAPE SAFETY BULLETIN #23

(Safety & Health In Arts Production & Entertainment)

## WORKING WITH LIGHTING SYSTEMS AND OTHER ELECTRICAL EQUIPMENT

This Safety Bulletin is intended to assist all production personnel with understanding the Regulations and to warn of potential electrical and fire safety hazards related to use of the electrical equipment. It is also intended to recommend safe practices for trained personnel. This Safety Bulletin is not intended as a design specification or an instruction manual for untrained persons.

### SUMMARY OF ELECTRICAL SAFETY REGULATIONS IN BRITISH COLUMBIA

According to the regulations all electrical work done in the Film and Television Industry is deemed to be "regulated work" involving all "electrical equipment", whether it is energized or not. The Regulations constitute a part of the BC Safety Standards Act. The Electrical Safety Regulation also includes the Canadian Electrical Code adopted for use in BC. Act and regulations are available on the British Columbia Safety Authority web site ([www.safetyauthority.ca](http://www.safetyauthority.ca))

Only employees qualified under the Regulations and authorized by the employer to do so must do electrical work (i.e. to connect, disconnect, or operate electrical equipment and systems).

#### 1) Supervision by Field Safety Representatives (FSR)

- a) All electrical work, whether in the studio or on location, must be performed under a valid electrical permit (see Permits) and under the supervision of a person with a valid Field Safety Representative (FSR) certification relevant to the work being performed.
  - i) The FSR must be present as the work is being done, guiding and assisting the work being performed.
  - ii) The ratios for supervision of Restricted Class work (ie. an FE) are specified in the Regulations as one FSR is permitted to supervise no more than two qualified individuals. The required supervision ratios must be maintained at all times.

#### 2) Regulated Work

- a) All sets and set pieces that require energizing must be wired by a qualified electrician with a certification corresponding to the work being performed, using approved and supervised electrical equipment.

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- b) The work must be completed under a valid electrical permit (see Permits) for the jurisdiction involved (City, Municipality or Province) and is subject to inspection by the authority issuing the permit (the Authority Having Jurisdiction, or AHJ).
- c) All electrical work must be performed by qualified and certified employees of the production, or by individuals who are employees of the production that are supervised in accordance with the regulations.

**3) Permits**

- a) For the purposes of all electrical permits please use the following information when applying to the various jurisdictions (City, Municipality or Province) for electrical permits:
  - i) The application must list only the production company as the applicant or contractor.
  - ii) All full time FSR's must be listed on the application as the "Field Safety Representatives" on various AHJ application forms.
  - iii) The production company address and phone numbers must be used for contact information on the application.
  - iv) Annual permits for the studio should list the Gaffer, Generator Operator and Rigging Gaffer as FSRs, if possible and as applicable.
  - v) All applications for electrical permits must be approved by the responsible FSR before being submitted. The FSR must maintain copies of all electrical permit information and documentation.
- b) As an example please refer to the City of Vancouver's Electrical Permit information Bulletin at <http://vancouver.ca/commsvcs/LICANDINSP/bulletins/2000/2000-018.PDF>

**4) Approval Marks**

- a) All electrical equipment must have an approval mark acceptable in British Columbia, such as CSA, cUL, etc. The list of acceptable certification organizations and Special Inspection bodies can be found on the BCSA website. This means all assembled equipment must be "approved" (i.e. either inspected and/or certified) before they can be energized. This includes, but is not limited to, Set Decorations, Props, Special Effects, Locations Equipment and Vehicles with shore power systems.
- b) All Set Dec, construction, paint and locations equipment and cables must be of a type that is acceptable under the provisions of the Canadian Electrical Code (CEC).
- c) Please contact your production's FSR for an inspection of your equipment and cables.

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Contact SHAPE: 280 - 1385 West 8<sup>th</sup> Ave, Vancouver, BC V6H 3V9

Tel: 604-733-4682 Fax: 604-733-4692 Email: [info@shape.bc.ca](mailto:info@shape.bc.ca) Website: [www.shape.bc.ca](http://www.shape.bc.ca)



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**5) Fines and Penalties**

- a) Be aware that the latest Regulations and Safety Standards Act contain areas of offenses and fines/penalties. These fines and penalties apply not only to the person performing the work, but to anyone in the supervisory path, regardless of department. It also includes a section on *Offences by Corporations*.

**6) Safety and First Aid**

- a) Assistant Directors, Locations department employees, First Aid attendants and other Safety personnel should be aware that that one of the qualified and certified employees of the Lighting/Electrics Department should be called immediately if an accident or incident occurs involving electricity, in order to ensure the safety of the accident scene.
- b) As per the Regulations, all electrical accidents and incidents involving injury and/or property damage must be reported by the FSR to the Authority Having Jurisdiction over the location of the accident/incident. This could result in an investigation being conducted by the AHJ under the *Safety Standards Act*.

**WORKING PRACTICES WHEN USING LIGHTING SYSTEMS AND OTHER ELECTRICAL EQUIPMENT**

This portion of the document is intended solely for individuals qualified and authorized to perform electrical work.

All electrical systems and electrically energized equipment are potentially hazardous whether AC or DC.

**1) Rigging a system**

- a) Use proper lifting techniques when lifting or moving heavy objects such as cable or lighting equipment. Do not step directly on equipment such as cable as it can roll underfoot and cause a slip or fall.
- b) When installing the power distribution equipment, do so with all power off whenever possible. Test the system with a continuity tester to check for faults before energizing.

**2) Connecting Order of Single Conductor Cables**

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a) All single conductor connections shall be connected in the following order:

- 1st - Grounds (all AC and on DC)
- 2nd – Neutrals (Identified Conductors)
- 3rd – Hots (Energized Conductors)

b) Disconnect in the reverse order:

- 1st – Hots (Energized Conductors)
- 2nd – Neutrals (Identified Conductors)
- 3rd - Grounds (all AC and on DC)

**3) Colour Coding**

a) Portable cables and conductors must be colour coded in compliance with the C.E.C.

**4) Devices And Cables**

- a) Cables and devices must be protected from foot and automobile traffic. Where practical, use cable mats or similar approved systems. Where it is not practical to use cable mats, cables must be routed to avoid foot and automobile traffic as per the C.E.C.
- b) When it is necessary to have electrical distribution systems that may come into contact with water, such systems shall be designed and approved for use in wet locations.
- c) Non-approved clamps shall not be used in conjunction with any electrical system or equipment.
- d) All gang boxes (distribution boxes) that are supplied by a connector plug rated higher in ampacity than the receptacles in the gang box shall contain fuses, or breakers, sized according to the ampacity of those receptacles.
- e) All AC multi-pole connectors shall be grounded and polarized.
- f) All AC multi-pole connectors shall provide for "first make, last break" of the ground pole, as per the CEC.
- g) All cable used shall be of a type listed by an approved by the CEC.
- h) Single conductor connectors shall be attached to the conductors in compliance with the CEC and approved by the appropriate inspection authority.
- i) All cable used will display an inspection mark accepted by the Regulations and the CEC.

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5) Guarding of Live Parts

- a) Any part that is live or non-insulated must be covered with appropriate insulation material or protected or barricaded to protect it from any possible contact by persons or objects.
- b) When branching off a system that is energized, shut off the power and lockout all switches that may energize the circuit that you are working on, if possible.
- c) Appropriate precautions shall be taken when tying on to an energized system. Be sure that all equipment being hooked up is de-energized. Be sure to connect in the same order as shown above in *Connecting Order of Single Conductor Cables*. Wear the appropriate safety glasses and gloves and use insulated tools. Have someone at the main switch standing by in case of an emergency when doing the actual hook-up.

6) Portable And Vehicle Mounted Generators

- a) Only a qualified and certified operator shall operate a generator, or supervise the operation of a generator. Thoroughly read any operational manuals provided with the generator. If you do not understand any of the instructions, do not attempt to operate the generator, instead contact your FSR or supervisor. The generator should have as much open space as possible on all sides to allow maximum ventilation and minimum interference. It is important that all generating sets be protected from the elements and from unauthorized access.
- b) Extra precaution must be taken when re-fueling the generator. Use only approved fuel nozzles (ie. CSA, UL, or similar) to prevent the build-up of static electricity, which could create a spark and explosion. Make sure that all exhaust fumes are ventilated away from closed areas, personnel and air conditioning intake ducts. Be aware of hot surfaces and moving parts when servicing the generator.
- c) One of the most obvious and serious dangers associated with electrical generating equipment is the potential for electric shock. Even a small current can produce severe shock or can prove fatal. There should be suitable barriers between buss-bars, and a substantial mat of non-conductive material or cover over the completed connections to prevent accidental contact. Areas should be guarded from access of non-qualified personnel and the public.
- d) When tying on to a portable AC generator, the non-current carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame. The generator neutral conductor shall be bonded to the frame, and if the generator is mounted on a vehicle, the frame of the generator shall be bonded to the frame of the vehicle.

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- e) The generator operator is responsible to ensure that all personnel are clear of the equipment before the distribution system is energized.

**7) Generator Grounding Connections**

- a) Generators must be grounded in compliance with the CEC.
- b) When mobile generators supply power to location production systems in addition to the building's electrical system, the generators grounding connection shall be interconnected with the main building grounding electrode system at the service, or other means acceptable to the AHJ. This requires that the Generator Operator (FSR) must have access to the buildings electrical panels to make this connection. The Locations Department should facilitate this access as required
- c) Bonding conductors shall be sized as per the CEC.
- d) The Generator Operator (FSR) is required to ground every generator and bond together all non-current carrying metallic parts of your production's electrical systems. This means wherever production parks a generator the Generator Operator (FSR) must either bury a ground plate 600 millimeters (two feet) deep or drive in two ten foot ground rods. Allowance must be made to provide this at every place production operates a generator.

**8) Grounding Alternating Current/AC Systems And Equipment**

- a) All AC systems used by the motion picture and television industry shall be bonded and grounded as per the CEC.
- b) All AC supplied equipment shall have all non-current carrying metal parts bonded by a continuously connected equipment bonding conductor, back to the source of power. This conductor shall be sized according to the CEC.
- c) When tying onto utility power, the grounding conductor must originate from the ground bus in the same panel board that supplies the power.

**9) Connecting To Premises/Utility Electrical Power Source**

- a) Connecting to (tying onto) a premises/utility electrical power source, such as a panel board, can create the risk of a serious or fatal accident. Such connections must only be made by a certified person specifically authorized to do so.
- b) An electrical permit must be obtained before such work is done. If the building employs a house electrician, the connection must be done by, or under the direction of that electrician, as they are the holder of the building's electrical permit.

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- c) First, you must calculate the existing demand on the electric panel and determine if there is sufficient capacity left for your equipment. This will prevent over-loading the panel, tripping the main, and shutting down the building.
- d) You must use a spare circuit breaker or disconnect switch. Use only approved lugs or devices when tying onto the panel. Non-approved clamps **are not** an acceptable device for this work. **Never** tie on ahead of the main circuit breaker, fuse box, or meter.
- e) Remember, when removing a panel cover, there will be exposed, live parts. Use suitable matting of non-conductive material and barriers to protect against accidental contact. Maintain one meter of clearance around the panel, as per the C.E.C.
- f) Attach the cables in the proper order: GROUND (first); NEUTRAL (second); LINE or HOT (last). Disconnect in the reverse order.
- g) Over current protection devices **must** be used in compliance with the CEC. Fault currents due to ground faults or short circuits from premises/house power can be at extremely high levels. Be certain your distribution equipment, including the over current protection, is sufficient to handle such high currents.
- h) After you have finished with the utility power and you have disconnected your cables, put back all covers and screws that you removed.

**Additional References:**

The British Columbia Safety Authority:

<http://www.safetyauthority.ca>

Electrical Safety Regulations:

[http://www.qp.gov.bc.ca/statreg/reg/S/100\\_2004.htm](http://www.qp.gov.bc.ca/statreg/reg/S/100_2004.htm)

Safety Standards General Regulation:

[http://www.qp.gov.bc.ca/statreg/reg/S/105\\_2004.htm](http://www.qp.gov.bc.ca/statreg/reg/S/105_2004.htm)

City of Vancouver Infosheet on Electrical Permits for the Entertainment Industry:

<http://vancouver.ca/commsvcs/LICANDINSP/bulletins/2000/2000-018.PDF>

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District of North Vancouver Electrical Permits for Movie Sets and Location Shoots:

<http://www.dnv.org/article.asp?c=100>

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