Television, Film, Live Performance and Event Electrical Guidelines
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This guideline deals with the installation of electrical equipment utilizing any source of power, including generator sets. This includes events of a temporary nature held indoors, outdoors, in tents, such as film, television, live performance and other events.

Much on the subject of electrical installations can be found in the Ontario Electrical Safety Code 2002 (OESC). In most cases, where the specific aspect of the installation is not clear within the OESC, the installation should use alternate methods to achieve the equivalent level of safety required. Following the guidelines described herein should allow the production to achieve the desired result without ever compromising safety.

This Guideline is intended to serve a very specific need and is in no way intended to be used as a substitute for the Ontario Electrical Safety Code. Omission of any requirements presently in the OESC does not in any way affect the OESC, nor should these omitted requirements be considered unimportant. They are essential to the OESC and its intended application, that is, its use by those who design, install, and inspect electrical installations. This guideline, on the other hand, is intended for use by employers, employees, ESA and OHSA.

This guideline is a living document and should be reviewed and rewritten on a three year cycle as appropriate to reflect new or changed industry practices, technologies, equipment, ESA bulletins as well as changes to the OESC.
Electrical Safety Authority

Who We Are

The Electrical Safety Authority (ESA) is a stand-alone, financially self-sustaining not-for-profit corporation accountable to a Board of Directors and operating as an administrative authority under the Electricity Act 1998 and an administrative agreement with the Ministry of Government and Consumer Services. ESA is responsible for public electrical safety in Ontario as designated by Ontario Regulation 89/99.

ESA is accountable to the public through the Ministry of Government Services for meeting its legislative and contractual obligations in the delivery of its delegated regulatory mandate. At the same time, it is accountable to its regulated sectors for results, sound management, and efficiency.

ESA’s Authority

On April 1, 1999, Ontario Hydro’s Electrical Inspection Division became the Electrical Safety Authority (ESA), assuming the responsibilities previously held by Ontario Hydro’s Electrical Inspection Division. ESA was established as a not-for-profit corporation following the Ministry of Government Services’ delegated administrative authority model that transfers the delivery of services previously provided by the Ministry to the private sector.

The Safety and Consumer Statutes Administration Act and an Administrative Agreement with the Ministry establish the legal framework for ESA’s operation as an Administrative Authority. In addition, ESA is designated the Ontario authority responsible for electrical safety by Ontario Regulation 89/99 as the responsible authority for purposes of section 113 of the Electricity Act, 1998 and associated Ontario Regulation 10/02 (The Ontario Electrical Safety Code).

The Electrical Safety Authority was established to:

- Respond to fatalities, injuries and fire losses associated with electricity.
- Promote the safe use of electricity.
- Increase public awareness of the dangers of electricity, and the requirements for ensuring safe electrical applications and use.
- Increase public awareness of the requirement to have all electrical work inspected in accordance with the Ontario Electrical Safety Code.
1 Definitions

Job Title Definitions

1.1 **Gaffer (film):** the head of the lighting department for a film or video production. May design lighting positions; establish choice of luminaires and accessories. Reports to the Director of Photography for film and the Technical Director for video.

1.2 **Lighting Director (television):** the head of the lighting department for a video production. Designs lighting and positions, establishes choice of luminaires and accessories. Reports to the technical director for video production.

1.3 **Lighting Designer:** see Appendix B.

1.4 **Production Electrician (Theatre/Live show):** see Appendix B.

1.5 **Head Electrician:** (a term used in the Theatre industry, but not necessarily holding a Certificate of Qualification (“CofQ”)) the head of the lighting department for theatre. The supervising electrician on a production, trained in the lighting skills and techniques necessary for the implementation of the lighting design. The person responsible for all luminaires and related equipment.

1.6 **Best Boy (film & TV):** 2nd or assistant to Gaffer in the lighting department. Generally responsible for designing and supervising the set-up and take-down of a single-pin based power distribution system for film or television production. Supervises crews on larger productions.

1.7 **Electrician (Theatre), Electric (Film and Television), Lighting Technician (Event, Television):** terms referring to workers in the entertainment industry involved in the implementation of a lighting design, including set up and take down of power distribution systems, hang and focus of luminaires, operation of equipment, wiring of practicals, etc. member of a lighting crew, not necessarily holding a certificate of qualification.

1.8 **Electrician (Trade):** a trades person, with a valid certificate of qualification (CofQ), under the Trades Qualifications and Apprenticeship Act, regulation 1051. (Refer to the following)

1.8.1 **Construction and Maintenance Electrician:** a person holding a valid “CofQ” in the Electrical trade that lays out, maintains, connects and repairs a wide range of electrical equipment, from lighting to security systems.

1.8.2 **Domestic and Rural Electrician:** a person holding a valid “CofQ” in the Electrical trade that lays out, maintains, connects and repairs a wide range of electrical equipment, from lighting to security systems in residential buildings and structures used for farming.
1.8.3 **Industrial Electrician**: a person holding a valid “CofQ” in the Electrical trade that prepares, installs, maintains, tests, troubleshoots and repairs industrial equipment and associated electrical and electronic controls.

1.8.4 **CofQ**: a term describing the Certificate of Qualification as issued by the Ministry of Training, Colleges and Universities (MTCU) for a specific pertinent ‘trade’.

1.9 **Entertainment Industry Power Technician**: a person holding a valid C of Q in Ontario as Trade 269E. Certified to perform temporary installation and maintenance of feeders, branch circuits and equipment used for the production of entertainment events, including but not limited to corporate events, live performance, trade shows, movie (film), video and television production studios and locations. Maximum of 400 amps, 750 volts, 3 phase power in any individual circuit. (refer to Ontario Ministry of Training, Colleges and Universities (MTCU) Apprenticeship Training Standards Trade Code 269E).

1.10 **Registered trainee**: (Apprentice) recognized indentured worker training to become an Entertainment Industry Power Technician. Able to perform assigned tasks under direct supervision of appropriate responsible certificate holder.

1.11 **Grip (Film & Television)**: see Appendix B.

1.12 **Generator Operator**: Entertainment Industry Power Technician (C of Q holder) in charge of setting up, starting, monitoring, balancing the load, and shutting down an electrical generator set. On film locations, the Generator Operator is also generally responsible for the layout and connection of single pin & sub-distribution networks for support equipment (i.e. vehicle camp, or “circus”).

**General Definitions**

1.16 **Adaptor**: a device or cordset used to make a connection between non-mating connectors. (Refer to 4.11 of this document)

1.17 **Ampacity**: is the current carrying capacity of electrical conductors expressed in amperes.

1.18 **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.

1.19 **Big Three**: set of crowfoot moulded single pin locking devices, arranged in vertical set of 5, in a freestanding metallic framework. Bond connection device is bonded to the metallic frame. Rated at 400 amps. (Refer to 1.48 of this document.)

1.20 **Bonding**: means a low impedance path obtained by permanently joining all non-current-carrying metal parts to assure electrical continuity and having the capacity to safely conduct any current likely to be imposed on it.
1.21 **CSA:** the Canadian Standards Association sets standards for safe construction of electrical equipment. It also inspects and identifies equipment that meets the standards.

1.22 **CAM-LOK**(TM): a trade name, which has become generic. A brand of single pin locking connectors, generally with moulded rubber or Santoprene**(TM)** insulators, commonly used for mains portable power distribution on stage, studio and location projects. (Refer to 1.58 of this document)

1.23 **Certification Organization:** an organization accredited in accordance with the Standards Council of Canada Act to certify electrical equipment.

1.24 **Competent:** one qualified by knowledge, training and experience to perform assigned work and has knowledge of any potential or actual danger to health and safety in the workplace.

1.25 **Company Panel/Switch:** a dedicated electrical supply, up to 400 Amps, provided in theatres and other event venues, for the connection of portable dimming or distribution equipment.

1.26 **Cordset:** an assembly of a suitable length of flexible cord or power supply cable provided with an attachment plug (cord cap) at one end and a cord connector at the other end.

1.27 **Crowfoot (Crowfoot Tower):** a moulded single pin locking connection device with one supply and three load connections, arranged in a nominal 120° pattern on the load side. Rated at 400 amps.

1.28 **Crowfoot Tower:** set of crowfoot moulded single pin locking connection devices, arranged in vertical sets of 5, in a freestanding metallic framework. Bond connection device is bonded to the metallic framework. Rated at 400 amps. (Refer to 1.48 of this document)

1.29 **Dimmer:** a device used to regulate the intensity of a luminaire. When multiple units are encased together the result is referred to as a dimmer pack or dimmer rack.

1.30 **Electrical Safety Authority (ESA):** Authority having jurisdiction over electrical installations in the Province of Ontario which are within the scope of Section 113 of the Electricity Act of Ontario. In this regard, ESA may issue disconnection orders relating to any works or matters it considers necessary or advisable for the safety of persons or the protection of property.

1.31 **Electrical Cables:** often referring to main and/or sub-main conductors.

1.32 **Electrical Distribution Box (Distro):** a device that permits the branching of power to two or more downstream devices; either loads or additional distribution boxes. It usually consists of either a single pin, Joy*, or pin and sleeve line connectors, with circuit breaker(s) (or fuse[s]) overcurrent protection feeding female load connectors. (Refer to tables 1 & 1A of this document) Other versions, bearing appropriate approval markings, are also available.
1.33 **Electrical Inspection:** all electrical installations covered by the scope of the Ontario Electrical Safety Code in the province of Ontario require an electrical inspection notification (permit) issued by ESA and must be inspected by ESA, whether of a temporary nature or not.

1.34 **Equipment Certification/Approval:** equipment bearing a valid and appropriate certification or field approval label indicating that it meets applicable standards (See ESA Bulletin #2-7-23 for the most current list of acceptable marks)

1.35 **Event:** a gathering, presentation, production, performance or activity for entertainment, business, education, sporting competitions, etc., utilizing production equipment and practices as a part of the event; such as equipment assembled, operated and disassembled by entertainment technical personnel.

1.36 **Feeder:** any portion of an electrical circuit between the service box or other source of supply and the branch circuit overcurrent devices. Often single conductor cables with single pin connectors used to provide power to dimmer racks or other distribution equipment.

1.37 **Ground:** a connection to earth obtained by a grounding electrode.

1.38 **Grounding Conductor:** the conductor used to connect the service equipment or system or generator set to the grounding electrode.

1.39 **Grounding Electrode:** a metal plate, rod, water pipe or other conductor buried or driven into the earth providing an uninterrupted electrical path to earth. (Refer to OESC Section 10)

1.40 **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.

1.41 **Head (Cap):** the portion of a luminaire or luminaire assembly that contains the light source.

1.42 **High Five:** vertical single pin connection splitter point, consisting of one set of supply connections, and five sets of load connections, arranged around a metallic hexagon, for a 5 wire system rated at 400 amps. (Refer to 1.48 of this document)

1.43 **Joy *(TM):** a trade name that has become generic. A brand of electrical connector employing low profile rubber moulded insulation and cylindrical pins, commonly used in the entertainment industry. The connector construction permits hard duty usage. Designed to be water resistant.

1.44 **Jumper (Stinger):** an electrical cable used from a distribution point to connect a load.
1.45 **Jumper set:** a set of single pin jumpers used from a distribution point to connect downstream devices.

1.46 **Live Performance:** generic nomenclature used to describe the industry of the performing arts involving theatre, dance, opera and music.

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

1.48 **Multiple Connection Device:** a single pin splitting device with one line and 3 or more load connections per conductor, containing connections for a complete set of grounded and ungrounded conductors of a system.

1.49 **Ontario Electrical Safety Code (OESC):** the standard for temporary or permanent electrical installations in Ontario, the OESC (comprising CSA Standard C22.1 Canadian Electrical Code, Part 1 and Ontario amendments to the Canadian Electrical Code, Part 1, (C22.1.and bulletins). Check with ESA for the version of the OESC that is in effect.

1.50 **PPE (Personal Protection Equipment):** any equipment worn or used by a worker in order to provide protection from local hazards of the job (e.g. gloves, safety and/or flash glasses, work boots, etc).

1.51 **Polarized:** a device or connection arranged such that it allows attachment or connection in one manner or orientation only.

1.52 **Polarized receptacle/plug:** ensures correct connection by differentiation of pin (blade) sizes and/or arrangement.

1.53 **Polarized socket:** ensures correct alignment/orientation of a lamp by means of differently sized/arranged pins or locator.

1.54 **Power Source:** anything that has the potential to provide voltage and electrical current, i.e., electrical power.

1.55 **Practical:** a working "On - Set" luminaire may be standard or custom, and receives its power from the portable distribution system. Unless it is an approved two wire fixture, it must be bonded to the ground. If installed on a set piece, it must be attached and connected with OESC section 12, wiring methods.

1.56 **Receptacle:** one or more female contact devices, on the same yoke, installed at an outlet for the connection of one or more attachment plugs.

1.56.1 **Single Receptacle:** one female contact device, with no other contact device on the same yoke, installed at an outlet for the connection of one attachment plug.
1.56.2 **Duplex Receptacle**: two female contact devices, on the same yoke, installed at an outlet for the connection of two attachment plugs.

1.56.3 **Split Receptacle**: a duplex receptacle having terminals adapted for connection to a grounded, 3-wire supply with the identified conductor common, e.g., 120/240 V or 120/208 V.

1.56.4 **Dual-Fed Receptacle**: a duplex receptacle or two receptacles in the same box, fed from two separate sources. The identified conductor is NOT common, and there MUST be an accepted warning label installed under the cover plate, clearly identifying that more than one source supplies this device(s). Utilized on sets for supplying line voltage and controlled (dimmed) voltage to the same device(s).

Note: This represents a deviation from the OESC.

1.57 **Safety**: short form for safety cable. a non-meltable, non-combustible wire rope or chain with a connector and a loop used as a secondary means of retention to prevent suspended equipment from falling in the event of failure or damage to the primary attachment apparatus.

1.58 **Single pin**: (connector or connection) a single-conductor plug-in locking-type connector.
   a) A locking one pin, approved for outdoor use connector rated up to 400 amps. Generally colour coded to designate phasing. (Refer to 1.22 of this document, & OESC Section 66); or,
   b) Broadly refers to an entire method and system of distribution.

1.59 **Tee** (electrical, aka T-off. See also “Crowfoot”, “Tee Tower”): Single pin device consisting of a total of three connections, arranged in the form of a “T” for the purpose of connecting either:
   a) Tapping Tee: one supply (line) connection to two load connections: or,
   b) Paralleling Tee: one load connection to two supply (line) connections.

1.60 **Tee (mechanical)**: see Appendix B.

1.61 **Tee Tower**: 5 wire splitter box with one set of supply and generally 5 sets of load connections of single pin connectors, arranged for linear continuation of single conductor cable runs. Usually allows some runs to change physical direction by 180° to the supply run. May also allow changeover between 1018 and 1016 connector styles. Rated at 400 amps. (Refer to 1.48 (Multiple Connection Device) in this document)

1.62 **Temporary**: refers to anything that is not fixed to a facility and is portable in nature. It usually refers to equipment that is rented or installed for a specific production that has a limited run and will be removed when such a production is over or moved.

1.63 **Tie-in**: a hardwire connection to a utility supplied switch, splitter, panel or switchboard.
1.64 **Twist Lock**: a generic term for a type of connector with locking blades with 2 or more poles. (often referred to as TLG or TL)

1.65 **VA (Volt-amperes)**: a mathematical product of voltage times current (volts times amperes) in an electrical circuit.

1.66 **KVA (kilovolt-amperes)**: one thousand Volt-amperes.

1.67 **Watt**: an international unit of power. The amount of energy expended per second by an unvarying current of one ampere across a potential difference of one volt.

1.68 **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.
2 General Practices

2.1 Permits (Application for Electrical Inspection Notification)

The Ontario Electrical Safety Code (Rules 2-004 – Inspection & 44-100 – Travelling Shows), requires a wiring notification (permit) be obtained when any temporary wiring distribution system is to be set up.

All productions and events shall file an application for inspection with the ESA 48 hours prior to commencement of any electrical activity. See Appendix (g) for a blank Application for Inspection.

Permits may be obtained by contacting the ESA Customer Service Centre at 1-877-ESA SAFE or 1-(877) 372-7233. The applicant must have all information such as location details, call sheets, contact personnel etc. available at the time of the call. Upon receipt of the notification, (permit) the production must display the notification (permit) in an area accessible to production staff and or the Electrical Inspector in the vicinity of the central power distribution point. The notification (permit) shall be reasonably protected from environmental destruction.

2.2 Reporting of Serious Electrical Incidents

Any serious electrical incident must be reported to ESA within 48 hours of the occurrence. Refer to OESC 2-007 – Reporting of Serious Electrical Incidents. This section is very specific as to procedure.

2.3 Personnel

All electrical personnel shall have a thorough understanding of electrical theory and power distribution.

Only a certified Entertainment Industry Power Technician or a holder of a valid Electrician Certificate of Qualification shall be the person responsible for designing & implementing single pin distribution systems.

In theatre, event, and related industry sectors, that responsible person shall be the member of the lighting, audio or video department, certified as described above. In film and television, that responsible person shall be a member of the lighting department.

Supervised registered apprentices of these designated trades may handle and connect single pin distribution.

Designing & implementing shall refer to any activity regarding or affecting the process of determining the nature or configuration of the relevant distribution system or network. The act of assisting the qualified person in charge by carrying and depositing, and wrapping cable as specifically directed may be excluded.
2.4 Equipment & Operations

2.4.1 All electrical equipment (including cordsets) must by law, be approved by and bear an approval or certification mark of;

- a) one of the accredited certification organizations; or,
- b) special inspection (field approvals) under SPE1000; or,
- c) special acceptance under ESA SPEC-001, with such labels affixed to the electrical equipment. These confirm to the user that the equipment is in compliance with Ontario regulations. (Refer to the OESC Rule 2-024, ESA-SPEC-001 and ESA-SPEC-003 Appendices D, E & F.)

2.4.2 The use of all distribution and utilization equipment shall conform to either: Section 44, Section 66, Section 14, and other applicable sections of the OESC for theatrical shows; or Section 66 and, Section 14, and other applicable sections of the OESC, for events and productions not specifically covered under section 44 of the OESC.

2.4.3 A log of all electrical maintenance shall be kept.

2.4.4 Any equipment, cable, or box that has been maintained in the field shall be identified and carefully tested for safety and appropriate function before being re-used.

2.4.5 Equipment that has been repaired in the field shall have the details of the repair noted on the equipment so that the source supplier can verify that the repair has been properly completed.

2.4.6 During set-up or reconfiguration, the power supply to electrical installations, equipment or conductors shall be de-energized where practicable. (Refer to OESC 2-304 & 2-306)

2.4.7 When not in use or unsupervised, temporary power distribution equipment shall be de-energized, locked out and tagged. Refer to Section 4.1of this document.

2.4.8 Utilization equipment shall only be installed in locations for which it is approved, unless suitable precautions are taken to protect it from inclement weather. (OESC 66-402 (5) & Sections 4.27 & 4.28 of this document)

2.4.9 Where practicable, GFCIs shall be used in wet or damp locations. Additionally, all electrical equipment within 3 metres of water must be GFCI protected. The GFCI shall be rated for personnel protection (Class A). The GFCI shall not be located within 3 metres of the water.

2.4.10 All metallic electrical equipment shall be bonded to ground as per the OESC.

Care should be taken not to walk on or drive over electrical cables. All cables subject to vehicular or extensive personnel traffic shall be protected in an appropriate manner. (Refer to OESC 66-450 (c))
2.4.11 Electrical personnel shall wear appropriate Personal Protective Equipment (PPE) such as rated electro-resistive footwear meeting CSA Standard Z195-M92, displaying the Ohm symbol. Gloves and safety (flash) glasses should be used at all times. Refer to the OHSA (Occupational Health and Safety Act).

2.4.12 Lamps shall be allowed to cool sufficiently before luminaires are moved. Appropriate PPE shall be worn when carrying, handling, or moving hot luminaires.

2.4.13 All personnel shall be made aware of high voltages used by gas discharge lamps such as neons, HMIs, CSIs and fluorescents. Anyone using these sources shall be familiar with the ballasts used and ensure that any safety devices are in proper working order.

2.4.14 Prior to "striking" an HMI, xenon or similar discharge lighting source, the operator shall make sure that no one is in contact with the unit, any support, or the ballast.

2.4.15 In damp or rainy conditions, ensure all personnel are clear of any HMI, xenon or similar discharge lamp head. As humid conditions increase the conductivity of the air, and thus the likelihood of arcing.

2.4.16 All personnel in potential proximity shall be advised that various HMI, xenon or similar discharge lighting sources emit much larger amounts of ultra-violet (UV) light than tungsten lamps. Follow appropriate practices and manufacturer’s recommendations. Never view an ignited discharge lamp directly.

2.4.17 Before a luminaire is re-lamped or otherwise worked on, the luminaire shall be switched off, allowed to cool and isolated from the power source. If appropriate, implement lock-out/tag-out procedures.

2.4.18 When replacing lamps, utilize appropriate PPE and follow the manufacturer’s recommendations.

Any open-faced luminaire shall have protection in accordance with CSA specifications covering such equipment, or to SPE 1000. (Consult CSA Standard C22.2 NO.166-M1983 Stage and Studio Luminaires, CSA TIL B-42A and UL standard 1573 for Stage and Studio Lighting Units)

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

Emergency lighting and exit signs shall be installed where none is present or functioning, and to augment the installation, as required by the Ontario Building Code and the Ontario Fire Code. (Refer to Ontario Building Code section 3.2.7 for Lighting and Emergency Power Systems section 3.4.5 for Exit Signs and Ontario Fire Code section 2.7 Safety to Life and consult appropriate inspectors)
2.4.20 All flying or mounting of luminaires, projectors, loudspeaker enclosures, structural supports and other equipment shall be performed using hardware, equipment and safety factors consistent with appropriate practices and manufacturer’s specifications.

2.4.21 All raised electrical equipment (e.g. luminaires or loudspeakers) shall be adequately supported and weighted to prevent tipping.

2.4.22 Scaffolds and other metallic structures used to support electrical equipment or power distribution shall be effectively bonded to ground. A non-meltalbe, non-combustible safety wire or chain shall be used for all suspended luminaires. This shall be in addition to the primary means of attachment or support.

2.4.23 Panel or chassis mount single pin connectors shall be installed;

a) from the inside of enclosures, with attaching fasteners adequately clear of any possible contact with terminals or busses; and,

b) if installed on a mobile generator or other vehicle, be installed in an enclosure, or provided with covering equivalent to CSA type 4, such that when not in use, or while traveling, the connectors cannot be exposed to rain, snow, slush, road salt or contaminants; and,

c) have any connection that is not in use, sealed or capped to prevent accidental electrical contact. (Refer to 4.22 of this document) (Refer also to OESC Section 66-456-2)

2.4.24 Connections for vehicle supply, where on portable cord, shall be situated in readily accessible boxes or compartments, preferably on the curbside of the vehicle, and configured;

a) with a bushed, non-conductive opening, either independent of the access door; or,

b) through the access door, with adequate provision to ensure that no metallic or sharp edges can contact the conductor(s); and,

c) sufficient conductor length to allow the supply cord(s) to exit; and, with the resultant connection(s) to be adequately clear of the box or compartment, and not under the vehicle, and in any case, not less than 2 metres in length; and,

d) with provision for industry standard methods of attachment for strain relieving.

2.4.28 Consult the most current OESC and Ontario Electrical Safety Code Bulletins for technical support.
3 Power Sources

3.1 General

3.1.1 Types of Sources:
- Diesel/Gasoline/Gaseous Fuel Engine Driven Generator Sets
- Utility
- Storage batteries

3.1.2 Voltages and power distribution that may be encountered in Canada:
- 120 single phase 2 wire
- 120/240 single phase 3 wire
- 120/208 three phase 4 wire “Y” (Wye or Star)
- 208 3 phase 3 wire “D” (Delta)
- 277/480 phase to neutral/phase to phase on 480 volt 3 phase system **
- 347/600 phase to neutral/phase to phase on 600 volt 3 phase system
- 600 3 phase 3 wire “D” (Delta) – ungrounded system with ground fault indicating lights

** Often found on US manufactured equipment.

3.1.3 Definitions

a) **Single Phase Two Wire**: One supply or phase conductor, and one neutral (identified) conductor, plus a bond (ground) conductor.

b) **Single Phase Three Wire**: Two supply or phase conductors, typically 180° apart electrically, and one common neutral (identified) conductor, plus a bond (ground) conductor. (Also referred to as Centre Tapped)

c) **Three Phase Four Wire**: Three supply or phase conductors, 120° apart electrically, and one common neutral (identified) conductor, plus a bond (ground) conductor.

** In the above trade standard terminology, PLUS GROUND (BOND), is always assumed.

In portable power distribution, where the bond wire is a specific conductor either in multi conductor portable cord, or a specific conductor run with any single pin distribution system, the bond conductor is counted; therefore in:

a) **Single Phase Two Wire** requires three-conductor portable cord.

b) **Single Phase Three Wire** requires four-conductor portable cord, or four wire single pin.

c) **Three Phase Four Wire** requires five-conductor portable cord, or five wire single pin.
3.2 **Generator Sources**

3.2.1 Generator sets shall be clearly and prominently labeled, with such label on the control panel or other readily visible location, with the rating showing their respective prime power rating in kW and Amps/phase. This rating shall be based on the relationship of the alternator to the SAE net continuous mechanical kW (or bhp) of the prime mover. See Appendix C for an example.

3.2.2 Generator sets if installed inside a vehicle, shall provide single pin or other appropriate mains connections at an externally accessible panel.

3.2.3 Where it is not practicable to provide an externally accessible connection panel due to the installation being of short duration; and the equipment is not intended to stay in the said vehicle, appropriate steps shall be taken to ensure that cables can exit over smoothly rounded, non-conducting material, with readily available securement points for strain relieving the cables.

3.2.4 Generator sets shall have an emergency stop system or an accessible main circuit breaker shunt trip or other emergency isolation means. (Refer to OESC 28-900) The emergency stop system must include means to simultaneously de-energize the ungrounded conductors by opening the overcurrent protective device, or opening the main field of the alternator.

3.2.5 Mobile generator sets with single pin load connections shall have:

   a) a minimum of one dedicated single pin ground connector; and,

   b) a minimum of one single pin bonding connector for the distribution system bond, and/or to facilitate bonding to adjacent mobile generators or buildings into which the distribution network may run.

3.2.6 Generator sets shall be grounded. Grounding shall be proved using an approved ground-proving device, using the appropriate practice. All Generator Installations involving distribution equipment shall be installed in accordance with the OESC, this specification and inspected by ESA prior to use.

3.2.7 A generator set ground shall be run directly by the shortest practicable route, utilising the minimum number of connections, from the ground electrode to the generator set. This ground shall utilise a dedicated grounding conductor as per table 3 of this specification, and be independent of any bonding conductor. (Refer to OESC 66-420(2) and 10-806(1))

3.2.8 Ground Fault Indicators both visible and audible, shall be readily available to the operator of generator sets supplied for entertainment prime power, where the intent is to supply single conductor distribution networks. Such equipment shall be adjusted to the lowest practicable settings of time and current consistent with general portable power distribution systems.
3.2.9 Where more than one generator set is used to supply any set or support equipment, or where more than one generator is used such that its distribution network or supplied load(s) is, or could come into contact with that of any other, such generators shall have their grounds or bonds bonded together. (Refer also to 3.2.5 & 3.3.7 of this document)

3.2.10 Ground connection to a building or structure supplied by two or more sources: when temporary leads enter a building, the bonding conductor of the generator set(s) shall be bonded to the effectively grounded structural metal members (OESC 10-511), of the building structure, or effectively grounded conduit system or effectively grounded metal water pipe of the building. The minimum conductor size for the bonding jumper shall be # 2 AWG copper.

3.2.11 On film, television, and other event locations, where it is necessary to place a generator set such that its connection panel or resulting cable entries or ports are on the traveled side of a roadway that is not closed to vehicular traffic, mains cables shall be directly routed away from such exposure, to a safe position on the non-traveled side of the generator set. Any subsequent downstream protective devices, and/or multiple connection device splits, must be situated on the side of the generating equipment that is not exposed to vehicular traffic.

3.2.12 Generator sets shall only be started under a no load condition, and unless under an emergency condition, stopped under a no load condition.

3.2.13 All generator sets shall be operated and maintained by a competent operator.

3.2.14 In conjunction with the Ministry of Labour, Safety Guidelines for the Film and Television Industry in Ontario; the operator or competent assistant shall supervise the generator set at all times while it is running, and shall be available to operate the emergency stop or isolation system.

3.2.15 Notwithstanding the above, if more than one generator set is located adjacent to the principal unit or is reasonably within line of sight or adequate oversight and can be satisfactorily monitored by the operator, then, one operator may control more than one generator set.

3.2.16 All generator installations involving distribution equipment shall be installed in accordance with the OESC, this specification and inspected by ESA prior to use.
3.3 Utility Sources

3.3.1 Where utility supplies are utilized, care must be taken to ensure that available fault currents do not exceed 10,000 amps (10kA). Where available fault current could exceed this level, appropriate steps must be taken to limit the fault current on single conductor cables to this level. (Refer to OESC, 66-452)

3.3.2 Tying-in to utility sources shall only be performed by appropriately qualified personnel as determined by OHSA requirements.

3.3.3 Where the above situation occurs, the responsible person as described above shall notify other users of power from the same panel that their loads may be disconnected if the main breaker feeding the panel is tripped under overload conditions; i.e.- for such permanent loads as interior building lights, exit lights, emergency lighting, computers, phone systems and elevators. The aforementioned responsible person shall determine which loads will potentially create a safety hazard if shut down and shall take suitable precautionary actions.

3.3.4 Temporary leads exiting a distribution panel shall be secured such that the weight of any cable does not put a strain on any electrical connector. (OESC 12-120) Any such system or sub-system shall be protected in accordance with Section 14 of the OESC.

3.3.5 Where temporary connections are made, and the panel covers cannot be replaced, the panel shall be left in a dead front condition. The name of the person responsible for the installation shall be clearly marked on any such temporary cover, and the hazard identified. If the panel is in an electrical room, all doors opening directly into the room shall be posted with the above warning. (Refer to OESC 2-200 & 2-202)

3.3.6 Where two or more distribution panels are used to feed temporary distribution systems, the systems shall have their bonds bonded together. Under no conditions shall two or more distribution panels be used to feed a single temporary distribution system: i.e. one with a single main trunk. (Refer to OESC 10-206 (1)(B) & 14-112)

3.3.7 When utilizing a portable/temporary transformer, it must be ensured that the Xo (secondary neutral) is bonded to ground, and that a grounding conductor, correctly sized to meet the requirement of Table 17 OESC, is connected to an appropriate ground electrode. (Refer to OESC sections 10 and 66)
4 Temporary Power Distribution

4.1.1 Single pin distribution systems, and stage and studio lighting and/or power distribution systems shall only be energized when the responsible certificate holder as determined by the OHSA, or designee of equivalent certification is present.

Single pin distribution, where used to supply a panelboard or grouped set of panelboards, for the purpose of power distribution to shop tools and the like, and without additional down stream single conductor cables, and not connected to any supply that simultaneously energizes stage and studio lighting and/or machinery, shall be exempt from this requirement.

4.1.2 Where practicable, all connections should be made:
- with the system de-energized
- not in rainy or wet conditions
- with adequate illumination to allow this work to take place safely

4.1.3 If it is not practical to de-energize the system in order to connect electrical equipment or conductors to it, i.e. to an energized tap or splitting point, procedures shall be in use for building a temporary electrical distribution system, which includes the following sequence:
- load switched off
- connect the bond
- connect the neutral
- connect the lines
- energize the load

4.1.4 When dismantling a temporary electrical distribution system the reverse sequence of above procedures shall be in use.

4.1.5 When work is being performed on any live electrical system, a competent person who is able to recognize the hazards in the work being performed shall be present. (Refer to OHSA for compliance information and the Ministry of Labour, Safety Guidelines for the Film and Television Industry in Ontario, for information on the physiological effects of electrical current)

4.1.6 Continuous bonding shall be provided throughout any electrical distribution system. No local bonding to ground shall be permitted. No downstream bonding of the neutral shall be used. (OESC 66-458)

4.1.7 Connectors and cabling of single pin distribution systems shall be provided with standard colour coding:
- Red, Blue, Black Line
- White Neutral (identified conductor)
- Green Ground or Bond
4.1.8 Where single conductor cables are used, i.e. not bundled, the above colour codes shall be applied with coloured tape at both ends of each cable before the cables are connected. Length colour coding shall not use the above colour coding.

4.1.9 Any power distribution system, utilizing single pin connectors, operating at any voltage above 150 volts to ground, shall:

(a) have all inline connectors made inaccessible by wrapping or enclosing the joint or connector(s) in a secured, non-conductive box or material; and,
(b) with prominent identification as to the supply voltage of the circuit, outside and, if practicable, inside the secured enclosure(s) or joint(s).

4.1.10 All electrical personnel shall be aware of the ampacity of each type of cable, adaptor, or distribution box.
(Refer to OESC 4-038 & 4-040 and OESC tables 12 & 12A, regarding portable power cable) (Refer also to recommended practise, Table 5 of this document for overcurrent protection on Portable Power Cable (PPC))

4.1.11 Consistent with item 2.4.2, adaptors shall only be used where it is necessary to convert configurations between connectors of the same rating, or where for the purposes of temporary convenience, a plug of lesser rating is supplied from an appropriately protected circuit to supply a differing configuration of a higher rating.

Example: a 60amp female connector such as a 3 pin “JOY” may be connected to a 15 amp supply.

4.1.12 Single conductor cables that are bundled or installed in close proximity to one another shall be rated for ampacity as multi conductor cables (OESC Section 4 & 66-454 (1)), except that bundled single conductor cables of any one circuit shall be permitted to be free air rated, without correction factors, if different circuits are kept a minimum of a bundle diameter apart. (OESC 66-454 (2))

4.1.13 Single conductor cables shall have overcurrent protection not exceeding the ratings set out in the recommended practice for Portable Power Cable Usage in Ontario in this document. No allowance or other easement shall be given, due to the ability to bundle, and the consideration of free air ratings. (Refer to Table 5 of this document)

4.1.14 Multi-pin (Socapex) multi conductor cables utilizing 12AWG/14C (12AWG/19C), when connected to non-dimmed panelboards, shall have overcurrent protection not exceeding 15 amps. (Refer to OESC section 4.014)

4.1.15 Multi-pin (Socapex) multi conductor cables utilizing 16AWG/19C shall only be used:

(a) with circuits not exceeding 10 amps; and,
(b) in conjunction with dimming apparatus or from hoist motor distribution panels; and,
(c) not used for any system supplying power directly from a panelboard or other distribution equipment. (Refer to OESC section 4.014)
4.1.16 All cables shall be protected from mechanical damage. In high traffic areas cable shall be laid in troughs, covered or suspended. Care must be taken to ensure that all cables are appropriately protected or located to ensure that they are not a trip hazard for personnel.

4.1.17 Where it is necessary to run temporary cables through doorways, positive protection shall be provided in the form of a substitute doorframe or portion of doorframe that allows door closing, with appropriate bushed non-conductive passage for the conductors. (Refer to 2.4.11 and 4.16 of this document)

4.1.18 All connections to elevated panel mounted connectors on sets, company panels, gensets, trucks, trailers and the like, shall be adequately strain relieved, using industry appropriate methods.

4.1.19 Any connection not supported by truss, pipe, scaffold, set-piece, elevating plate or similar support shall be adequately strain relieved using industry appropriate methods.

4.1.20 Vertical cable runs to pipes, trusses, scaffolds or other structures shall be adequately strain relieved using industry appropriate methods. Cable pickups shall be made in such a way to avoid lateral movement of the pipe or truss.

4.1.21 All Electrical Distribution Boxes as shown in Tables 1 & 1A of this guideline shall be labeled as to the rated voltage, current, and the CSA type, as per table 65 of the OESC.

4.1.22 Any single-pin load connection that is not being used shall be sealed or capped to prevent accidental electrical contact.

4.1.23 No tapping tee, paralleling tee, or rigid turnaround shall be used for direct attachment to any panel mounted single pin connector or single pin multiple connection device; and (a) shall not be attached within 2 m. of the panel mount or multiple connection device; and,

(b) shall not impose any mechanical strain on the connection.

4.1.24 Consistent with 4.23, no more than one tapping or parallel tee per conductor shall be used at any one point in a power distribution system. Any distribution breakout/takeoff/splitting requiring more than 2 load connections per conductor shall use a single approved multiple connection device at that point.

4.1.25 “Tap” points used in an Entertainment Industry single conductor power distribution system, which go from a higher ampacity conductor set to a lower ampacity conductor set and extend beyond 3 meters in total length (distance being calculated from the tap point to the downstream device bus), shall have an appropriately sized overcurrent protection at the tap point.
Single conductor jumper sets, of no less than #2 AWG – PPC, may be utilized to facilitate the connection of distribution devices to the tap point, without the addition of overcurrent protection, providing that their length, combined with any supply tail or lead on the downstream device does not exceed the 3 meter total, as described above. This shall not be interpreted to include any type of adaptor, but shall be limited solely to single pin connectors.

4.1.26 When connecting to a power source, suitable overcurrent protection and a means of isolation, either internal or external to the source panel, shall be used between the power source and the "on-set" distribution. (OESC Section 14)

4.1.27 All cable connections shall be kept clear of water or wet surfaces by use of appropriate elevation.

4.1.28 Distribution boxes shall be used in accordance with the requirements of their respective rating types. When used outdoors, or subjected to water, usage shall be as follows:
(a) no distribution box shall be placed in standing water.
(b) type 1 boxes shall be elevated and covered to prevent intrusion of water, snow, sleet or slush.
(c) type 3R boxes shall be installed with their orientation such that they will repel water as designed, and with any covers securely closed.
(d) type 4 or 4X boxes require no additional covering, but shall have any covers securely closed.

(Refer to OESC Table 65)
Appendix A

OESC References

Sections:

2-200 - Protection of Persons and Property, General
2-202 - Guarding of Bare Live Parts
2-304 - Disconnection
2-306 - Maintenance of Live Equipment

4-038 - Uses of Portable Power Cables
4-040 - Ampacity of Portable Power Cable

10-106 - Alternating-Current Systems
10-204 - Grounding Connections for Alternating-Current Systems
10-206 - Grounding Connections for Isolated Systems
10-210 - Conductor to be Grounded
10-511 - Equipment on Structural Metal
10-702 - Artificial Grounding Electrodes

12-120 - Supporting of Conductors

14 - Protection and Control
14-100 - Overcurrent Devices Required
14-112 - Overcurrent Devices in Parallel

28-900 - Disconnecting Means Required for Generators

46 - Emergency Systems, Unit Equipment, and Exit Signs

66 - Amusement Parks, Midways, Carnivals, Film and TV Sets, TV Remote Broadcasting Locations, and Traveling Shows
66-402 - Equipment
66-450 - Single Conductor Cables
66-454 - Free Air Ampacity
66-456 - Single-Conductor Cable Connections
66-458 - Bonding

Tables:

12 – Allowable Ampacity of Flexible Cord and Equipment Wire
12A – Allowable Ampacity of Flexible Cord and Equipment Wire (Amperes per Conductor)
17 – Minimum Size of Grounding Conductor for AC Systems or Common Grounding Conductor
65 – Enclosure Selection Table for Nonhazardous Locations
Appendix B

Glossary of Other Job Titles – (not specifically in the document)

**Audio Technician/Tech:** person involved in set-up and/or strike of audio equipment and power distribution for audio equipment.

**Video Technician/Tech:** person involved in set-up and/or strike of video equipment and power distribution for video equipment.

**Crew Chief:** person in charge of a number of other people involved in the set-up or tear down of equipment.

**Grip (Film & Television):** A technician who places and adjusts accessories that alter the quality and quantity of light. The Grip also assembles dolly track, scaffold, legs, etc., and handles the camera dolly during shoots. The Supervisor or Department Head of a number of grips is referred to as the “Key Grip”.

**LX:** see Lighting Tech or Electrician.

**Labourer:** Non-certified entertainment industry worker.

**Lighting Designer (theatre):** responsible for the creation of the visual look of a production through designing, plotting and focusing the lighting. Not normally responsible for operating the lighting, although may in amateur theatre.

**Lighting Tech:** a technician involved in the set-up and/or strike of lighting equipment and power distribution.

**Responsible Person in charge:** generally the head of the department or his/her designate.

**Production Electrician:** designs and packages/assembles the electrical and lighting components of a production.

**Spot Op:** follow spot operator.

**Stagehand:** person involved in general set-up or strike. Could handle lighting, audio, staging, props, scenery, etc.
**Glossary of Industry Related Terms - (not specifically in the document)**

**AMX (AMX192):** protocol for analogue multiplexed control to dimming systems.

**AV:** Audio Visual

**AWG:** American Wire Gauge

**Balcony Rail:** a position in the Front of House at the front of a Balcony used for hanging fixtures.

**Boom:** a piece of pipe used to support luminaires usually on the sides of the stage attached to the floor by a Flange or a Bell base and generally attached to the grid or another position above the pipe.

**Box Boom:** a position in the Front of house of a theatre usually on the sides of the house close to the stage.

**Break-in:** a soca connector with male connectors.

**Breakout:** a soca connector with female connectors to supply power to instruments or other electrical devices.

**Bridge:** a hanging position either on stage or in the FOH that resembles a bridge.

**C Wrench:** an adjustable wrench.

**CITT:** Canadian Institute of Theatre Technology

**Colour:** a generic term for Gel.

**Cove:** a position in the FOH in the ceiling at the back of the theatre.

**DMX (DMX512):** USITT protocol for digital multiplexed control of dimming systems and related equipment.

**Dimmer Beach:** an area at an event where lighting dimmers and/or power distribution are located.
Dry Ice: frozen Carbon Dioxide.

FOH: Front of House.

Fresnel: a luminaire using a fresnel lens.

Ladder: a device used to hang luminaires from above without ground support.

Leko: generic name for ellipsoidal luminaire.

Moving Light/Intelligent Light: generic name for luminaire that can be remotely controlled: intensity, beam direction, beam angle, colour, and other effects.

Multi-pin Circular Pin Connectors: nineteen pin connectors (Socapex™) used in lighting circuit distribution in all areas. Refer to USITT recommended practice for Multi-pin Circular Pin Connectors PR-1.

Multi-pin Circular Pin Connectors Wire: multi-conductor wire available in 16, 14 or 12 gauges in 14 or 19 conductors for Multi-pin Circular Pin Connectors. (Socapex™)

PAR: generic name for PAR (parabolic aluminized reflector) type luminaire.

Patch Panel: a permanently installed circuit board to patch dimmers to circuits to various locations in a theatre.

Pani: a trade name for a projector but generically used for all projectors.

Pin + Sleeve Connectors: a pin and sleeve connector available in various amperage sizes use for equipment power distribution. Manufactured to IEC 309 standards and CSA approved.

Pyro: Pyrotechnics

Scroller: an automated device for changing colours on a luminaire.

Side Arm: a piece of pipe attached to a boom from which a fixture may be attached. See T (Tee).

Soca: multi conductor cable usually 19 conductor utilizing Socapex multipin connectors.
**Stage Pin Connector:** three pin connector available in various amperage sizes prevalent in US Theatres and used in some Canadian Theatres. Refer to USITT S3-1997 Standard for Stage Pin Connectors or Bates Connectors for wiring standards.

**Stiffener:** a piece of pipe attached to a pipe with a C clamp and tied to the steel suspension cables attached to a pipe to stop the pipe from turning.

**Strike:** the tear-down or removal of equipment from an event.

**Tee (mechanical):** a cast metal coupling like device used on a side arm to attach a luminaire to a vertical pipe.

**Testlight:** a single or double low wattage lamp with plug cap for testing circuits.

**Turnaround:** gender similar adaptor, usually only on single pin ground, bond or neutral.

**Two-fers + Three-fers:** are single male y-cords wired with either 5-15 or L5-20 or stage pin connectors to split two or three ways to connect smaller loads to a dimmer or circuit.

**USITT:** United States Institute for Theatre Technology.

**VAC:** Volts Alternating Current.

**Zip cord:** A 2 conductor cable usually used with low amperage devices (practicals). (Lamp cord, 2 conductor cable)
Rating of Generator Sets - Example
An alternator connected for 3 phase power is labeled as follows:

67.5 kVA          Volts: 120/208           Amps: 187           pf: 0.8

**What is its rating in amps based on this information?**

Although the winding rating is given as 187 amps, this is at unity power factor, without allowance for inductive load. Taken at the 0.8 power factor, this is therefore 67.5 x 0.8 (80%), which equals 54 kW.

Using the standard formula for amps when power and voltage are known, then 54 kW results in:

\[
\frac{54 \times 1000}{1.732 \times 208} = 149.89 \text{ (150)} \text{ amps.}
\]

In regard to mechanical power of the prime mover, the power required to spin the alternator to capacity is related to the efficacy (percent efficiency) of the device (alternator).

Therefore, if the alternator is rated at 90% efficient, the MECHANICAL kW required to spin it to full capacity is:

\[
\frac{54}{0.9} = 60 \text{ kW MECHANICAL,}
\]

plus any parasitic loss or other deration.

If expressed in horsepower, the formula is kW x 1.34 divided by the percent efficiency of the alternator. In this case, that is:

\[
\frac{54 \times 1.34}{0.9} = 80.4 \text{ horsepower,}
\]

plus any losses or other deration.

Taking all of the above, if the prime mover has a NET CONTINUOUS MECHANICAL kW of at least 63, (or a NET CONTINUOUS bhp of 84), the GENERATOR SET may be rated at the 54 kW that the alternator can provide.
### Appendix D

**CERTIFICATION MARKS**

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### Appendix E

**FIELD APPROVAL MARKS**

**ACCEPTABLE UNDER THE Ontario Electrical Safety Code**

(Refer to OESC Bulletins for most current list)

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*See Note 1

**NOTE 1- “PANEL ONLY” label identifies that the panel has been evaluated to the SPE-1000. It does not cover equipment that is added or connected to the panel.*

The above marks apply to complete products or systems.
Appendix F

COMPONENT CERTIFICATION MARKS
ACCEPTABLE UNDER THE OESC WHICH ARE SPECIFICALLY USED ON COMPONENT PARTS THAT ARE PART OF A LARGER PRODUCT OR SYSTEM.
(Refer to OESC Bulletins for most current list)

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Note: Electrical components bearing these marks may have restrictions on their performance or may be incomplete in construction, and are intended to be used as part of a larger approved product or system. The Component Recognition marking is found on a wide range of products, including some switches, power supplies, printed wiring boards, some kinds of industrial control equipment and thousands of other products.
Appendix G

ENTERTAINMENT INDUSTRY APPLICATION
FOR INSPECTION

Notice of Legal Requirement

Under the provisions of the Ontario Electrical Safety Code, any electrical equipment installed in Ontario, temporary or otherwise, must have an application for inspection. This includes all Film, Television, Live Performance or Event Productions including but not limited to Live Productions regardless of site or location. Failure to comply could result in unsafe working sites, production downtime and/or fines.

Inspection Process

Step 1: Fill in an Application for Electrical Inspection.

Step 2: Fax or email the Application to the ESA Customer Service Centre a minimum of 48 hours prior to the production set-up.

Optional

Phone in your request for an Electrical Inspection to the ESA Customer Service Centre, a minimum of 48 hours prior to the production set-up.

ESA Customer Service Centre
P.O. Box 24143
Pinebush Postal Outlet
Cambridge, ON, N1R 8E6
Fax: 1-800-667-4278
Phone: (877) 372-7233
email: esa.cambridge@electricalsafety.on.ca

For inspection information please call the ESA Customer Service Centre.
Applicant Information

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<td>Contact (Producer</td>
<td>Phone #</td>
</tr>
<tr>
<td>/Production Manager)</td>
<td>Fax #</td>
</tr>
<tr>
<td></td>
<td>Email</td>
</tr>
</tbody>
</table>

Location Information

<table>
<thead>
<tr>
<th>Production Name/Job Number</th>
<th>Purchase Order #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Location / Studio</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Phone #(s)</td>
</tr>
<tr>
<td>Electrical Contact(s)</td>
<td>Other #(s)</td>
</tr>
<tr>
<td>Expected dates of set-up</td>
<td>Rain dates</td>
</tr>
<tr>
<td>Expected production dates</td>
<td>Hiatus dates</td>
</tr>
<tr>
<td>Best date / time for inspection</td>
<td></td>
</tr>
</tbody>
</table>

- For inspection fees visit the ESA website [www.esasafe.com](http://www.esasafe.com)
- Daily call sheets should be faxed to (905) 712-3013.
- For inspection information please call the ESA Customer Service Centre at (877) 372-7233.

Customer Payment Method

<table>
<thead>
<tr>
<th>ESA Charge Account #:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit Card:</td>
</tr>
<tr>
<td>Visa</td>
</tr>
<tr>
<td>Cardholder Name:</td>
</tr>
<tr>
<td>Card Number:</td>
</tr>
</tbody>
</table>

Cheque Payable to Electrical Safety Authority: Cheque #:_

Please circle type of production: Film | Commercial
Television | Event | Live Performance
<table>
<thead>
<tr>
<th>BOX #</th>
<th>PHASE</th>
<th>SUPPLY</th>
<th>LINE CONNECTOR</th>
<th>LOAD CONNECTOR</th>
<th>BREAKER(S)</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>400 Amp 3 pole</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>Single ****</td>
<td>120/240v</td>
<td>CAM-LOK*</td>
<td>140A 4 pin Joy**</td>
<td>2: 100 A 2 pole</td>
<td>CBC TV Mobile</td>
</tr>
<tr>
<td>3</td>
<td>Single ****</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>140A 4 pin Joy**</td>
<td>1: 100 A 2 pole</td>
<td>CBC TV Mobile</td>
</tr>
<tr>
<td>3A</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>140A 4 pin Joy**</td>
<td>3: 100 A 2 pole</td>
<td>CBC TV mobile</td>
</tr>
<tr>
<td>2A</td>
<td>Single ****</td>
<td>120/240v</td>
<td>140A 4 pin Joy***</td>
<td>60A 4 pin Joy***</td>
<td>1: 60 A 2 pole</td>
<td>CBC Mobile unit adapter box</td>
</tr>
<tr>
<td>9</td>
<td>Single ****</td>
<td>120/240v</td>
<td>CAM-LOK*</td>
<td>60A 4 pin Joy***</td>
<td>1: 60 A 2 pole</td>
<td>CBC Radio Truck</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>250 A 3 pole</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>200 A 3 pole</td>
<td>GFCI</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>175 A 3 pole</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>100 A 3 pole</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>100 A 3 pole</td>
<td>GFCI</td>
</tr>
<tr>
<td>Tee Tower</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>NONE</td>
<td>Various versions. Rated at 400 Amps</td>
</tr>
<tr>
<td>Crow Foot</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>CAM-LOK*</td>
<td>NONE</td>
<td>Rated at 400 amps</td>
</tr>
</tbody>
</table>

* "CAM-LOK" TM - Trade name which has become generic; moulded water resistant SINGLE PIN connector
** 140A round moulded 4 pin water resistant connector ( TV mobile )
*** "Joy" TM - Trade name which has become generic; moulded water resistant hard usage connectors
**** "Single" single phase, 3 wire plus ground.
## TABLE 1A – Film & Television Load Distribution Boxes

<table>
<thead>
<tr>
<th>BOX#</th>
<th>PHASE</th>
<th>SUPPLY</th>
<th>LINE CONNECTOR</th>
<th>LOAD CONNECTOR</th>
<th>BREAKER(S)</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Single ****</td>
<td>120/240v</td>
<td>CAM-LOK*</td>
<td>60 A 3 pin Joy***</td>
<td>4: 60 A 1 pole</td>
<td>May be 6 circuit</td>
</tr>
<tr>
<td>4A</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>60 A 3 pin Joy***</td>
<td>6: 60 A 1 pole</td>
<td></td>
</tr>
<tr>
<td>4AW</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>60 A 3 pin Joy***</td>
<td>6: 60 A 1 pole</td>
<td>Weatherproof</td>
</tr>
<tr>
<td>5</td>
<td>Single ****</td>
<td>120/240v</td>
<td>CAM-LOK*</td>
<td>60 A 4 pin Joy***</td>
<td>2: 60 A 2 pole</td>
<td></td>
</tr>
<tr>
<td>5A</td>
<td>3</td>
<td>120/208v</td>
<td>CAM-LOK*</td>
<td>60 A 4 pin Joy***</td>
<td>3: 60 A 2 pole</td>
<td></td>
</tr>
<tr>
<td>6A</td>
<td>Single ****</td>
<td>120/240v</td>
<td>4 pin Joy***</td>
<td>15A HOSPITAL GRADE type 5 - 15</td>
<td>6: 20 A 1 pole</td>
<td>Per 66-400 (5)</td>
</tr>
<tr>
<td>“Load Centre”</td>
<td>Single ****</td>
<td>120/240v</td>
<td>CAM-LOK*</td>
<td>15A HOSPITAL GRADE type 5 - 15</td>
<td>8: 20 A 1 pole</td>
<td>Per 66-400(5)</td>
</tr>
<tr>
<td>7</td>
<td>Single ****</td>
<td>120/240v</td>
<td>4 pin Joy***</td>
<td>60 A 3 pin Joy***</td>
<td>2: 60 A 1 pole</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single ****</td>
<td>120/240v</td>
<td>4 pin Joy***</td>
<td>14-50</td>
<td>50 A 2 pole</td>
<td>Stove or equipment with 14-50 connector</td>
</tr>
<tr>
<td>8A</td>
<td>Single 2 w + grd</td>
<td>120v</td>
<td>3 pin Joy***</td>
<td>15 A HOSPITAL GRADE type 5 - 15</td>
<td>3: 20 A 1 pole</td>
<td>Per 66-400 (5)</td>
</tr>
<tr>
<td></td>
<td>Single 2 w + grd</td>
<td>120v</td>
<td>3 pin Joy***</td>
<td>15A HOSPITAL GRADE type 5 - 15</td>
<td>3: 20 A 1 pole GFCI</td>
<td>GFCI</td>
</tr>
<tr>
<td></td>
<td>Single 2 w + grd</td>
<td>120v</td>
<td>3 pin Joy***</td>
<td>60 A 3 pin Joy***</td>
<td>1: 60 A 1pole GFCI</td>
<td>GFCI</td>
</tr>
<tr>
<td></td>
<td>Single ****</td>
<td>120/240v</td>
<td>4 pin Joy***</td>
<td>60 A 3 pin Joy***</td>
<td>2: 60 A 1pole GFCI</td>
<td>GFCI</td>
</tr>
</tbody>
</table>
### TABLE 1A – Film & Television Load Distribution Boxes Cont’d

<table>
<thead>
<tr>
<th>RV</th>
<th>Single 2 w + grd</th>
<th>120v</th>
<th>3 pin Joy***</th>
<th>RV receptacle (Non-NEMA)</th>
<th>30 A 1 pole</th>
<th>For equipment with non-NEMA RV connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV</td>
<td>Single ****</td>
<td>120/240v</td>
<td>4 pin Joy***</td>
<td>14-50 receptacle</td>
<td>50 A 2 pole</td>
<td>CSA/NEMA 14-50 configuration</td>
</tr>
</tbody>
</table>

| 10 | 3               | 120/208v | CAM-LOK*     | CAM-LOK*                      | 3: 100 A 1 pole | 10k incandescent                      |

* "CAM-LOK" TM - Trade name which has become generic; moulded water resistant **SINGLE PIN** connector
** 140A round moulded 4 pin water resistant connector (TV mobile)
*** "Joy" TM - Trade name which has become generic; moulded water resistant hard usage connectors
**** "Single" single phase, 3 wire plus ground.

### TABLE 3

Minimum Size of Grounding Conductor for Mobile Generator

AC Systems Utilizing Single Pin Connectors on the Ground Conductor

<table>
<thead>
<tr>
<th>Ampacity of Overcurrent Protection</th>
<th>Size of Copper Grounding Conductor AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 or less</td>
<td>4</td>
</tr>
<tr>
<td>101 to 200</td>
<td>2</td>
</tr>
<tr>
<td>201 to 300</td>
<td>2/0</td>
</tr>
<tr>
<td>301 and above</td>
<td>4/0</td>
</tr>
</tbody>
</table>

Note: for runs in excess of 30 metres, increase conductor size to next size up in this table.
### TABLE 5

**Recommended Practise for Portable Power Cable Usage in Ontario. ***

<table>
<thead>
<tr>
<th>Conductor Size</th>
<th>Protect at</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>100 Amperes</td>
<td>“Load Centre” (Bundled)</td>
</tr>
<tr>
<td>#2</td>
<td>175 Amperes</td>
<td>“Seaway” (Bundled)</td>
</tr>
<tr>
<td>#1/0</td>
<td>200 Amperes</td>
<td>Singles - Not bundled</td>
</tr>
<tr>
<td>#2/0</td>
<td>250 Amperes</td>
<td>Singles - Not bundled</td>
</tr>
<tr>
<td>#4/0</td>
<td>400 Amperes</td>
<td>Singles - Not bundled</td>
</tr>
</tbody>
</table>

Refer to Table 12A of the Ontario Electrical Safety Code

* 600 volt or 2kv PPC (entertainment cable)
Cover: Photos courtesy of Spring Awakening, Lighting design by Kevin Adams, Photography by Doug Hamilton, William F. White International Inc., and PS Productions Services Ltd.