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THE SELECTION, INSTALLATION, AND USE OF SINGLE-CONDUCTOR PORTABLE POWER FEEDER CABLE SYSTEMS FOR USE AT 600 VOLTS NOMINAL OR LESS FOR THE DISTRIBUTION OF ELECTRICAL ENERGY IN THE TELEVISION, FILM, LIVE PERFORMANCE AND EVENT INDUSTRIES IN CANADA

Approved by the ANSI Board of Standards Review on _____

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ESTA's Technical Standards Program

The ESTA Technical Standards Program was created to serve the ESTA membership and the entertainment industry in technical standards related matters. The goal of the program is to take a leading role regarding technology and safety within the entertainment industry by creating recommended practices and standards, monitoring standards issues around the world on benefit of our members, and improving communications and safety within the industry. ESTA works closely with the technical standards efforts of other organizations within our industry including ESA, CITT, USITT and VPLT as well as representing the interests of ESTA members to ANSI, UL, ASCE, ICC, and the NFPA. ESTA is an ANSI Accredited Standards Developer.

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The Electrical Power Working Group, which authored this standard, consists of a cross section of entertainment industry professionals representing a diversity of interests. ESTA is committed to developing consensus-based standards and recommended practices in an open setting. Future Electrical Power Working Group projects will include updating this publication as changes in technology and experience warrant, as well as developing new standards and recommended practices for the benefit of the entertainment industry.

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Voting members:

Observer members:

Interest category codes:

CP custom-market producer	DE designer
DR dealer or rental company	MP mass-market producer
G general interest	U user

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1 Scope

This standard covers the selection, installation, and safe use of single-conductor portable power feeder cable for events of a temporary nature in Canada. This includes but is not restricted to

(a) amusement parks;

(b) midways;

(c) carnivals;

(d) fairs;

(e) film, television, and radio productions;

(f) remote broadcasting and recording locations;

(g) live performance and entertainment events;

(h) touring shows and productions;

(i) concerts;

(j) sporting events; and

(k) trade shows.

For the purposes of this Standard, “single-conductor portable power feeder cable system” covers any use of these cable types and single-pole separable connectors, both in-line and panel mounted, between the load terminals of the main overcurrent protection device used to energize the system and the line terminals of the feeder inlet of the last disconnecting means or utilization equipment.

2 Definitions

2.1 Accredited certification organization: an organization that has been accredited by the Standards Council of Canada, in accordance with specific criteria, procedures, and requirements, to operate, on a continuing basis, a certification program for electrical equipment.

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

2.3 Ampere (A): unit of measure for the rate of current flow.

2.4 Authority Having Jurisdiction (AHJ): The office or individual responsible for approving installations and/ or equipment and materials.

2.5 Authorized person: a qualified person who, in his or her duties or occupation, is obliged to approach or handle electrical equipment; or a person who, having been warned of the hazards involved, has been instructed or authorized to do so by someone having authority to give the instruction or authorization.

2.6 Bond (Bonded): connect (connected) by bonding.

2.7 Bonding: a low impedance path obtained by permanently joining all normally non-current-carrying metal parts to assure electrical continuity and having the capacity to safely conduct any current likely to be imposed on it.

2.8 Bonding conductor: a conductor that connects the non-current-carrying parts of electrical equipment, raceways, or enclosures to the service equipment or the system grounding conductor.

2.9 CEC (Canadian Electrical Code): CSA C22.1-21 - Canadian electrical code, part I (25th edition), safety standard for electrical installations

2.10 Certified person: a holder of a valid certificate of qualification.

2.11 Conductor: a wire or cable, or other form of metal, installed for the purpose of conveying electric current from one piece of electrical equipment to another or to ground.

2.12 Connector:
Box connector: a device for securing a cable, via its sheath or armour, where it enters an enclosure such as an outlet box.

Wire connector: a device that connects two or more conductors together or one or more conductors to a terminal point for the purpose of connecting electrical circuits.

2.13 Cord set: an assembly of a suitable length of power supply cable provided with an attachment plug (cord cap) at one end and a cord connector at the other end.

2.14 Dimmer: a device used to regulate the intensity of a luminaire.

2.15 Disconnect: a device, or group of devices, whereby the conductors of a circuit can be disconnected from their source of supply.

2.16 Emergency lighting: lighting required by the provisions of the National Building Code of Canada for the purpose of facilitating safe exit and access to exit in the event of fire or other emergency.

2.17 Feeder: any portion of an electrical circuit between the service box or other source of supply and the branch circuit overcurrent devices.

2.18 Ground: a connection to earth obtained by a grounding conductor and a grounding electrode.

2.19 Ground fault: an unintentional electrical path between a part operating normally at some potential to ground, and ground.

2.20 Grounded: connected effectively with the general mass of the earth through a grounding path of sufficiently low impedance and having an ampacity sufficient at all times, under the most severe conditions liable to arise in practice, to prevent any current in the grounding conductor from causing a harmful voltage to exist

a) between the grounding conductors and neighbouring exposed conducting surfaces that are in good contact with the earth; or

b) between the grounding conductors and neighbouring surfaces of the earth itself.

2.21 Grounded (neutral, or **identified) conductor:** One current carrying conductor of a service entrance, transformer or generator service is intentionally bonded to the ground conductor at the power source to maintain a nominal voltage of 0 V to ground.

2.22 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.

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

2.24 Grounding electrode: a buried metal water-piping system or metal object or device buried in, or driven into, the ground to which a grounding conductor is electrically and mechanically connected.

2.25 Grounding system: all conductors, clamps, ground plates or rods, and grounding electrodes used to ground the electrical installation.

2.26 Multiple Connection Device (special terminology): single-conductor splitting device with one line and three or more load connections per conductor, containing connections for a complete (5-wire, 3 phase - four wire plus bond) set of grounded and ungrounded conductors of a system.

2.27 Overcurrent device: any device capable of automatically opening an electric circuit, under both predetermined overload and short-circuit conditions, either by fusing of metal or by electromechanical means.

2.28 Overcurrent Protection: Overcurrent device(s) used to protect electrical components, equipment, premises, and persons from hazardous current flow.

2.29 Qualified person: one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and who is trained to recognize and to avoid the hazards involved.

2.30 Single pin: (connector or connection) a single-conductor plug-in locking- type connector.
a) a locking, one pin connector, colour coded to designate use (phasing, ground, or Neutral). (Refer to CEC Section 66). ; or,

b) Broadly refers to an entire method and system of distribution.

2.31 Splice: inline permanent mechanical (repair) terminations.

2.32 Switch: a device for making, breaking, or changing connection in a circuit.
General-use switch: a switch intended for use in general distribution and branch circuits and that is rated in amperes and is capable of interrupting its rated current at rated voltage.

Isolating switch: a switch intended for isolating either a circuit or some equipment from its source of supply and that is not intended either for establishing or interrupting the flow of current in any circuit.

2.33 Tails:
Supply tails (Dropdowns): single-conductor cables installed for the supply of power into an apparatus.

Load tails: single-conductor cables installed temporarily for the supply of power from a power source

2.34 Tap point: a connection point in an electrical system that does not interrupt current flow to other parts of the system.

2.35 Utility Sources: the permanently installed electrical distribution systems of a building or structure that receive power directly from the Local Distribution Company (LDC).

2.36 Volt (V): unit of electromotive force, the difference of potential that would drive one ampere of current against one ohm resistance.

2.37 Voltage: the potential difference between two points expressed in volts. May be a nominal or an actual measured value. Measured effectively as the maximum root-mean-square (RMS) value. Also the potential difference required at the point of use for a system and/or equipment to operate as designed.

2.38 Voltage Rating: the highest voltage at which a component, a piece of equipment, and/or a system can safely prevent unwanted current flow.

3 Administrative

Productions, shows and events shall follow all permitting instructions of the local AHJ.

The permit shall be prominently displayed in an area accessible to the AHJ in the vicinity of the central power distribution point. The permit shall be reasonably protected from environmental destruction.

Electrical equipment for the entertainment industry shall only be installed, connected, energized, operated, and uninstalled by Qualified Personnel.

4 Equipment Approval

4.1 Electrical equipment used in all installations shall be approved and shall be of a kind or type and rating approved for the specific purpose for which it is to be employed. (Canadian Electrical Code 2-024)

4.2 All electrical equipment shall be approved, and bear an approval or certification mark from:
(a) one of the accredited certification organizations; or

(b) special inspection (field approvals) agency under SPE1000; and
(c) such labels shall be affixed to the electrical equipment.

4.3 Single Pin connectors shall only be used on approved single-conductor cables as per Table 11 and section 66 of the Canadian Electrical Code.

5 Component Selection for Feeder Cable Systems

5.1 Selection of Conductors

5.1.1 Size of Conductors

Minimum cable size shall be Number 4 AWG copper (Canadian Electrical Code 66-450).

5.1.2 Cable Temperature Rating

Cables shall have a minimum high temperature rating of 90°C.

Cables shall have a minimum low temperature rating of -40°C.

When attaching conductors to equipment, (terminal connector, lug, etc.), the ampacity of conductors shall be selected from the temperature column in Table 1 that corresponds to the lowest temperature rating marked on the electrical equipment or any wire connector. (Canadian Electrical Code 4-006)

5.1.3 Cable Types

Feeder cables shall be certified Hard Usage or equivalent. (Canadian Electrical Code Table 11)

5.1.4 Voltage

Cable shall have a minimum rating of 600 V.

5.1.5 Cable Markings

Cable shall be permanently indent marked with the following:

Gauge (AWG)
Temperature Rating
Type
Maximum Voltage Rating
Manufacturer’s Identification
Listing Mark
Flame test rated FT5

5.2 Selection of Connectors

5.2.1 Certified

Single-pole separable connectors shall be certified by a Standards Council of Canada Accredited Testing Laboratory. The certification mark of the testing laboratory shall appear on the connector assembly.

5.2.2 Locking

Single-pole separable connectors shall be of the locking type.

5.2.3 Connector Ratings

Single-pole separable connectors shall be rated by ampacity.

Where the cable ampacity is smaller than the ampacity of the single-pole separable connector installed on it, it shall be permissible to use that same connector at a reduced ampacity provided that cable has appropriate overcurrent protection.

5.2.4 Voltage rating

The voltage rating shall be a minimum of 600 V.

5.2.5 Temperature rating
Connectors shall have a minimum temperature rating of 90°C.

5.2.6 Termination of Conductors to Connectors
Single-pole connectors should be terminated only to single-conductor cable via crimp or double setscrew, as per manufacturer's instructions. Although allowed by some other standards, single setscrew connectors do not create as secure a connection, and should not be used, if at all possible.

For information on series 15, 16, and 18 connectors, see C22.2 No.1691.

6 Conditions of Use

6.1 Where water, snow, or icy conditions are present, appropriate methods shall be used to prevent submersion of electrical equipment.

6.2 Panel or chassis mount single pin connectors shall be installed per the manufacturer's instructions. Verify that attaching fasteners are adequately clear of any possible contact with terminals or buses

6.3 If installed on the exterior of a generator or other vehicle, panel or chassis mount single pin connectors shall be installed within an enclosure rated type 3R or 4, such that when not in use or while traveling, the connectors shall not be exposed to rain, snow, slush, road salt or contaminants. (Canadian Electrical Code 2-400 (c)(d))

6.4 Plug-in connectors for single-conductor cables shall have all connections that are not in use covered with a seal or cap that is acceptable.

6.5 As feeder cables shall not penetrate walls; floors; windows; ceilings; or doors; contact the local AHJ to see what method of mechanical protection would be acceptable for that location/situation.

6.6 The feeder cable shall be protected from physical damage

7 Feeder Cable Systems

7.1 Feeder cable assemblies
Feeder cable assemblies shall consist of lengths of cable with a male connector on one end and a female connector on the other end, and configured as

(a) a single conductor
(b) a two-conductor bundle for two wire DC (black, white) or (red, black)
(c) a three-conductor bundle (green, white, black) or (green, red, black);
(d) a four-conductor bundle (green, white, red, black); or
(e) a five-conductor bundle (green, white, red, black, blue).
Refer to 4.2, of this standard

7.2 Feeder Cable Connectors

1) Plug-in connectors for single-conductor cables shall
   a) be of a locking type; and
   b) incorporate a mechanical interlock to prevent wrong connections or be colour-coded as follows:
      I) bonding connectors shall be identified with green colouring.
      ii) neutral connectors shall be identified with white colouring;
      iii) phase connectors shall be identified with
         a) red, black, blue colouring
         b) orange, brown, yellow colouring which shall be permitted only on systems greater than 150 volts to ground;
      iv) Circuits shall be identified with
         a) any phase colour for 2 wire phase to neutral circuits;
         b) any two phase colours for single phase circuits on single or 3 phase systems; and
         c) any two phase colours for phase to phase individual loads;
      v) Colour coding shall be accomplished by
         a) manufactured coloured connectors; or
         b) connectors that are tape coloured for their entire length except for 30mm from the mating end. **

Refer to CE Code rule 66-456 (3) & (4)

2) For single-conductor cables, the grounded conductor and the bonding conductor shall be permitted to have the female half connected to the supply end of the cord. (Canadian Electrical Code 66-400(4)).

7.3 Ampacity

The cable system shall be limited to the ampacity of the cable in use, and have an overcurrent device in place that will protect the cable, and connectors, from reaching an ampacity, exceeding the rating of the cable system.

7.3.1 Conductor Ampacity

(1) Overcurrent protection values for feeder cable sizes are applicable (per Canadian Electrical Code Table 12A) when

(a) installed in a, conduit, nipple, or (each) enclosure for not more than 1 meter; and

(b) cable bundles of any one circuit are separated by at least one cable bundle diameter.(Canadian Electrical Code 66-454 (2)); and

(c) cables are used in an ambient temperature of 30[5] C or less.

(2) Ampacities for feeder cable bundles when layered, stacked or in physical contact shall be rated inaccordance with Canadian Electrical Code Table 5b as follows:

Correction factors for Tables 1 and 3 (where from two to four single conductors are present and spaced less than 25% of the largest cable diameter)	
Number of conductors	Correction factors
2	0.90
3	0.85
4	0.80

7.3.2 Ambient Temperatures Above 30°C

When the ambient temperature is above 30°C the ampacity correction factors from table 5A (Canadian Electrical Code) shall apply and the maximum overcurrent protection shall be changed to protect the corrected values.

7.4 Voltage

Voltage drop shall not exceed 3% by

(a) Limiting the length of the cable

Distance to centre of distribution for 3% drop @120 V – in metres *(feet)*

Current	**Copper conductor size, AWG**				
	#4	#2	1/0	2/0	4/0
50	37.5 *(123)*	59.4 *(195)*	94.5 *(310)*	119.4 *(392)*	189.6 *(622)*
100	18.6 *(61)*	29.7 *(97)*	47.4 *(156)*	59.7 *(196)*	94.8 *(311)*
125	15 *(49)*	23.7 *(78)*	37.8 *(124)*	47.7 *(156)*	75.9 *(249)*
150		20.1 *(66)*	32 *(105)*	39.6 *(130)*	64 *(210)*
175		17 *(56)*	27.4 *(90)*	34 *(112)*	54.8 *(180)*
200			23.7 *(78)*	29.7 *(97)*	47.4 *(156)*
250				24 *(79)*	37.8 *(124)*
300					32 *(105)*
350					27.4 *(90)*
400					23.7 *(78)*

(a) Increasing the conductor size, or if using 4/0, paralleling the cables; or,
(b) Increasing the supplied voltage if practicable

7.5 Load Tails

4.5.1 Load tails may be installed temporarily for the supply of power from a utility source.

4.5.2 Load tails shall be removed at the conclusion of any production, show, or event.

7.5.3 Load tails shall be installed and removed by qualified, authorized, and where required, appropriately certified personnel.

8 Connection Panels

8.1 Main Disconnect

a) Connectors utilized shall be of the panel-mount type.
b) For temporary lug connection tie-ins, dropdowns/tails installed by certified personnel shall be permittedwhere acceptable to the AHJ..

8.2 Panel Assemblies

Multiple connectors per pole shall be permitted.

Where multiple connectors per pole are provided, the second and additional sets of input (supply or line) and all output (load) connectors shall have:

(a) an automatic closing cover that shall prevent accidental contact with energized elements; or
(b) a cap manufactured for the purpose.

8.3 Panel Markings

Each piece of electrical equipment shall bear those of the following markings necessary to identify the equipment and ensure that it is suitable for the particular installation:

(a) the maker's name, trademark, or other recognized symbol of identification;
(b) catalogue number or type;
(c) voltage;
(d) rated load amperes;
(e) watts, volt amperes, or horsepower;
(f) whether for AC, DC, or both;
(g) number of phases;
(h) frequency in hertz;
(i) rated load speed in revolutions per minute;
(j) designation of terminals;
(k) whether for continuous or intermittent duty;
(l) evidence of approval; or
(m) other markings necessary to ensure safe and proper operation.

8.4 Equipment overcurrent protection

Equipment shall be protected by an overcurrent protection device in accordance with section 7.

9 Designing the system

9.1 Cable routing

Cable routing shall be determined prior to commencement of any installation. *Prior to installation the cable route shall be evaluated so as not to interfere with means of egress or fire protection systems and for hazards to cable and personnel such as sharp edges, doors, and pedestrian and vehicle paths. See clause 10.1.3 and its subclauses.*

9.2 Tap Points

9.2.1 More than one tapping or parallel tee per conductor may be used at any one point in a power distribution system, providing that each connection is:

a) fully engaged;
b) strain relieved such that there is no mechanical strain on the electrical connection. Refer to CE Code 66-456 (6) (c); and
c) Where possible, any distribution splitting or combining devices requiring more than two load connections per conductor should use a single approved multiple connection device at that point.

9.2.2 Tap points used in a single-conductor power distribution system, not over 3 m long, which go from a higher ampacity conductor set to a lower ampacity conductor set, shall be permitted to be reduced in size where the following conditions are met:
(1) The ampacity of the supply conductors shall be at least one-third of the current rating of the supply overcurrent protective device.

(2) The supply conductors shall terminate in a single overcurrent protective device that will limit the load to the ampacity of the supply conductors. This single overcurrent device shall be permitted to supply additional overcurrent devices on its load side.

(3) The conductors shall be supervised by qualified staff personnel while energized.

(4) The conductors shall be protected from vehicular and pedestrian traffic by their location or a physical barrier.

9.3 Source
The source shall be of the voltage, frequency, phasing and cable type required by the load. The source shall be capable of providing the calculated current required by the connected load. Where more than one source of power is utilized on a site, the supply source shall be indicated on each piece of distribution equipment.

9.4 Multiple systems on one site

9.4.1 Voltages over 150 V to ground:
In-line single-conductor cable connections forming part of a circuit of more than 150 volts-to-ground shall

a. be coloured per 4.1 (c) (ii); and
b. be clearly identified with a label that is;
   i) securely attached to each connection point; and
   ii) resistant to damage from the environment in which it is placed; and
c. be mechanically protected by enclosing the connector(s) in a lockable, non-conductive box or similar enclosure.

The lockable enclosure shall

(a) be labeled on the outside, in a conspicuous, legible, and permanent manner, identifying the supply voltage of the circuit; and

(b) be acceptable.

Refer to CE Code rules 66-456 (4), (7) & (8)

9.4.2 Frequency

9.4.2.1 AC
When current is distributed at different supply frequencies in a portable power distribution system, all branches of the system that are not 60 Hz shall have their frequency identified.

9.4.2.2 DC

9.4.2.2.1 DC (direct current) It shall be permissible to use red and black for a 120 VDC system.

9.4.2.2.2 All DC portable power distribution systems shall be grounded. (Canadian Electrical Code 10- 102, 10-104, 10-114, 10-118, 10-200, 10-202)

9.4.2.2.3 All DC connections in a portable power distribution system shall be clearly labeled DC.

9.4.3 Load
The total load used on a portable power system shall not exceed 80% of the rating of the overcurrent device unless the device is specifically marked as a 100% rated device.

9.4.4 Parallel Conductors
Parallel Conductors shall only be used for reducing voltage drop. (Canadian Electrical Code 66-456 (5)

10 Installation

10.1 Cabling

10.1.1 Cable Inspection

Single-conductor feeder cable shall be inspected for abrasions, cuts, insulation damage, signs of overheating, chemical damage, and/or other defects that would affect the safe use of the cable, and rejected if such defects are found.

10.1.2 Cable Spacing and Ampacities

10.1.2.1 Each individual single-conductor cable of any one phase shall be spaced a minimum of one cable diameter apart from any cables of the same phase. If cables are run in such a manner that the individual cables of any one phase are spaced less than one cable diameter apart, they shall be rated for ampacity in accordance with Tables 12A and Table 5B (Canadian Electrical Code).

10.1.2.2 Bundled single-conductor cables of any one circuit shall be permitted to be free air rated, without correction factors, if different circuits are separated by at least one cable bundle diameter. (Canadian Electrical Code 66-454 (2))

10.1.2.3 Bundled Cables closer than one diameter or in contact with other cables shall be derated per section 4.3.1 (2).

10.1.3 Cable Protection

Where subject to damage cables shall be suitably protected. (Canadian Electrical Code 2-200)

10.1.3.1 Crossing walkways and paths
It shall be permissible to cross walkways or paths where there is no vehicular traffic and the cable(s) shall be protected by devices for the purpose and arranged so as not to present a tripping hazard.

10.1.3.2 Vehicular traffic

10.1.3.2.1 Cable shall not be subjected to vehicular traffic. When vehicular traffic must cross over cables, devices of conductive or non-conductive materials manufactured for the purpose of protecting the cable and constructed to accommodate the weight of expected vehicles shall be used to protect the cable.

10.1.3.2.2 Cable protective devices manufactured of conductive materials shall be bonded.

10.1.3.2.3 Signs shall be posted with the maximum permissible vehicle weight.

10.1.3.2.4 Cables elevated over vehicular traffic shall be permissible.
When elevated, the lowest point of the sag of the cable shall be 5.5 metres above grade. Signs shall be posted informing traffic of the maximum safe height.

10.1.3.3 Outdoors
When used outdoors, single-pole separable connectors shall not come in contact with standing or running water.

10.2 Grounding and Bonding

10.2.1 System Ground
All power systems shall have the neutral (identified conductor) bonded to ground and have a dedicated grounding conductor connected to an artificial ground electrode or suitable ground connection point.

10.2.2 Grounding Conductor
The grounding conductor shall be run directly from the grounding electrode(s) or ground connection point by the shortest practicable route, and conform to the following requirements:

a) should have no more than 2 in-line single-pin (single-pole separable connector) connections, excepting those connections at the ground electrode or other ground connection point and the generator or transformer (Canadian Electrical Code 66-200 (2)) and,

b) a dedicated grounding conductor shall conform to section 10 Grounding methods and table 16(Canadian Electrical Code 66-200 (1)).

10.2.3 System Bonding
Where there is more than one source of supply, all systems shall be bonded to each other.

10.2.4 Bonding Conductor
A bonding conductor shall be run with every single-conductor home run or branch feeder cable. Colloquially referred to as the ground line.

10.2.5 Fault current limiting
Where the available fault current exceeds 10kA (10 000 A), systems employing single-conductor cables shall be supplied by means of current-limiting overcurrent devices to prevent inadvertent movement of the cables. (Canadian Electrical Code 66-452)

10.3 Connection to Utility Power Source

10.3.1 Authorized personnel
Connection and disconnection to/from all power sources shall be performed by authorized, qualified, and where required, appropriately certified personnel.

10.3.2 Determination of shut down hazards
The authorized, qualified, and where required, appropriately certified personnel shall determine which loads will potentially create a safety hazard if shut down and shall take suitable precautionary actions.

10.3.3 Disconnect notification
When connecting to existing distribution panels, the authorized; qualified; and where required, appropriately certified personnel; should inform other users of the distribution panel that their loads may be affected should the main breaker be tripped. Of concern in this situation are interior lighting; exit and emergency lighting; computers; phone systems; and elevators.

10.3.4 Safety to Life
In a temporary location, emergency lighting and exit signs shall be installed where none is present or functioning or to augment the installation, as required by the local Building Code and the Fire Code.

10.3.5 Connection and disconnection to distribution equipment
Connection and disconnection to portable power distribution equipment shall be performed by authorized, qualified, and, where required, appropriately certified personnel.

The last connection(s) shall be to the power source and shall be done in a non-energized condition.

The individual connections shall be made beginning with the bond first, then the neutral (identified conductor), with the phase conductors last.

11 Commissioning the system

11.1 System Inspection

The system shall be inspected by a qualified and authorized person to confirm that all distribution equipment is off, that there are no exposed current-carrying components, that the voltage has been checked, and that all circuits are bonded.

11.2 Energizing the System
Upon completion of the system inspection and prior to energization of main breakers, all branch breakers/ switches should be in the off/open position. The system may then be energized only by authorized, qualified, and where required appropriately certified personnel.

12 Energized Systems
Any portable power distribution system, or connected equipment, shall be energized only while qualified, authorized and, where required, appropriately certified personnel are present.

13 Powering down the system (de-energizing)

13.1 Prior to de-energization
(a) Ensure that sufficient time is allowed for cool-down of any fan-cooled equipment, and that safety and security to personnel and equipment will not be compromised.

(b) In any temporary location, ensure that suitable precautions are taken for the duration of the load out to assure life safety when de-energizing any temporary emergency lighting and exit signs installed.

13.2 De-energizing the system.
Switch off all loads within a branch at the load, if possible, followed by switching off that branch, and repeat for all feeder branches. The main switch shall be turned off to de-energize the system only after all loads and branches are off.

Only qualified, authorized, and, where required, appropriately certified personnel shall de-energize the system.

11 Removal of the installation

11.1 De-energization
Removal of any of the systems components shall commence after systems are de-energized.

11.2 Disconnection
After the system is de-energized, the connections closest to the power source shall be disconnected first.

11.3 Sequence of disconnection
All phase (line) conductors shall be disconnected first, followed by the neutral (identified conductor) and lastly the bond.

11.4 Removing downstream equipment
It shall be acceptable to disconnect and remove any downstream equipment after an isolation switch to that section is de-energized prior to complete system shut down.

11.5 Cable removal
Cable and connectors should be inspected for damage as they are being removed. Any defective cable shall be clearly identified and set aside.

11.6 Storage
Cable shall be stored in a manner to prevent damage to it. Cable shall not be stored outdoors in direct sunlight for long periods of time. Stored cable shall be kept away from solvents and other petroleum products.

12 Live work
If live work must be performed, refer to the requirements of the local Safety Authority and CSA-Z462 for compliance information.

Connection and disconnection of single-conductor cables, to or from any part of an energized system shall be considered as working live