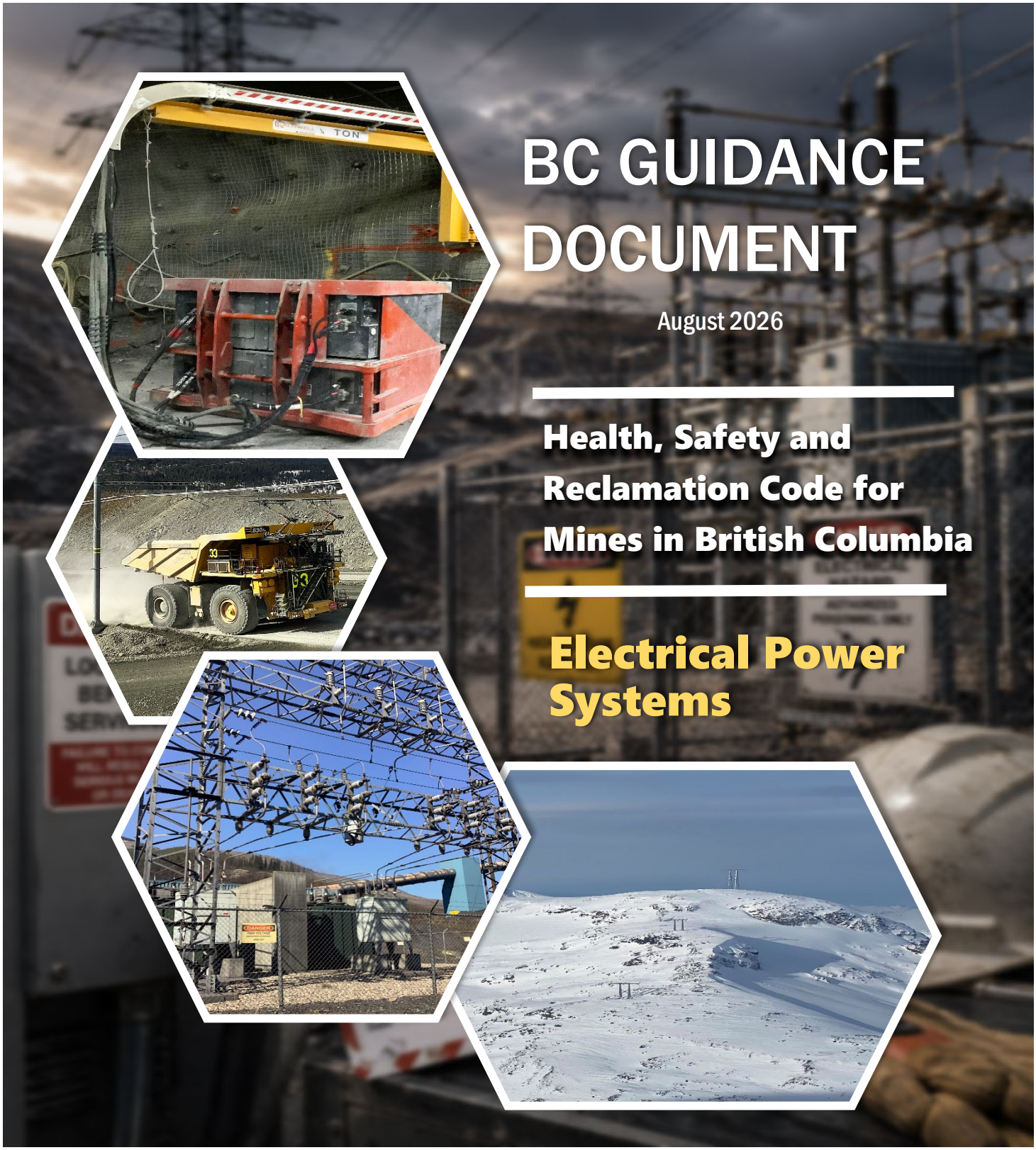

BC GUIDANCE DOCUMENT

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Health, Safety and Reclamation Code for Mines in British Columbia

Electrical Power Systems

BRITISH COLUMBIA
Ministry of Mining and Critical Minerals

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Purpose

This document provides guidance regarding the updates and new additions to Part 5 of the Health, Safety and Reclamation Code for Mines in British Columbia (the Code) which relates to electrical safety on mine sites. The intent of this document is to provide guidance on the Ministry of Mining and Critical Minerals (MCM) expectations for the application of the Code and is meant to assist operations in understanding and complying with the Code.

This guidance document is intended to be general and not prescriptive in nature and provide context to clarify the Code requirements. The provisions of the *Mines Act* (the "Act") and the Code prevail in cases where differences may occur in interpretations of the guidance. Every site presents its own unique set of needs and challenges, and more conservative approaches than those outlined herein may be required in some cases.

The responsibility and authority for interpretation of this guidance document rests with the Chief Inspector of Mines.

Definitions

Electrical Room

"Electrical room" means a dedicated space for housing electrical equipment for the purpose of electrical distribution or motor control, such as switchgear, transformers and panelboards.

Guidance: The term 'electrical room' is commonly used in industry; however, it is not formally defined in most electrical or building codes, including the *Canadian Electrical Code*, National Electrical Code (NEC), NFPA, or International Electrotechnical Commission (IEC) standards. This definition is provided to clarify its meaning and intended application within this Code.

A room may be considered an electrical room when the type, size, or voltage of the installed electrical equipment presents a level of hazard that requires controlled access and dedicated space for safe operation and maintenance.

Photographs below are provided to demonstrate examples of what would be considered designated electrical rooms:

FIGURE 1. ELECTRICAL AREAS DEFINED AS ELECTRICAL ROOMS.

In practical terms, this occurs when codes or standards require:

- Working space clearances around electrical equipment, and/or
- Dedicated space to prevent interference from other building uses, and/or
- Restriction of access to qualified personnel.

As the hazard associated with the electrical equipment increases, the need for separation from other activities also increases. At that point, the space effectively functions as an electrical room, even if it was originally intended as a general service room.

Large rooms or areas, such as shops, warehouses, or process areas, that contain electrical equipment are not considered electrical rooms unless the space is specifically dedicated to electrical equipment.

Below are examples of electrical areas that would not be defined as a designated electrical room:

FIGURE 2 . ELECTRICAL AREAS NOT DEFINED AS A DESIGNATED ELECTRICAL ROOM.

Where electrical equipment is installed within a larger multi-use area:

- The area around the equipment should be kept clear and accessible for safe operation and maintenance,

- Flammable or combustible materials should not be stored nearby, and
- Environmental conditions should be suitable for the equipment.

For example:

- Electrical equipment that is not rated for wet conditions should not be installed in areas subject to washdown, excessive moisture, or contamination.
- Dust, corrosion, or chemical exposure should not compromise the equipment's design or operation.

Small or incidental installations do not constitute an electrical room. For example, a lighting panel located in a janitorial closet or storage room is not considered an electrical room.

Electrical panels in a common area would not be considered an electrical room. However, please note that the area is kept accessible and free of storage.

Fixed-substation

"Fixed-substation" means a permanent facility that is used to generate, transform, transmit or distribute electricity.

Guidance: The definition of fixed substation does not include movable or short-term installations used in the day-to-day operations of a mine site.

Below are two examples of designated fixed substations:

FIGURE 3. FIXED SUB-STATIONS.

Below are two examples of movable substations, and therefore do not meet the definition of a "fixed" substation.

FIGURE 4. MOVABLE SUB-STATIONS.

General

Electrical – General

5.1.1 The manager must ensure that, unless modified by this code, all electrical equipment is installed, maintained and operated in accordance with CSA Standard M421 Use of Electricity in Mines, in conjunction with the *Canadian Electrical Code*, as amended from time to time.

Guidance: The language has been updated to add clarity to the language. No changes to the intent have been made to 5.1.1 which references CSA M421 Use of Electricity in Mines and the *Canadian Electrical Code* (also referred to as CSA 22.1) "as amended from time to time." This wording ensures that any future updates to these standards are automatically accepted by this Code and applicable to all mines in British Columbia.

Electrical Work

5.1.2 (1) The manager must ensure that design, installation, alteration and maintenance work performed under section 5.1.1 is only performed by, or under the supervision of, a certified person.

(2) The chief inspector may, for the purposes of subsection (1), require the certified person to be a professional engineer.

Guidance: Subsection (1) ensures that electrical work is carried out by individuals with the training, skills, and experience necessary to manage electrical hazards safely.

A *certified person*, as defined in the Code, is an individual certified by an agency or board acceptable to the Chief Inspector. In British Columbia, under the *Skilled Trades BC Act*, the following are designated compulsory trades:

- Construction Electrician,
- Industrial Electrician, or
- Power Line Technician.

This means that individuals performing work in these trades are a certified journeyperson, or a registered apprentice working under supervision.

The Red Seal endorsement is a national certification that demonstrates a tradesperson meets the Canadian standard for their trade. While not always required, it is widely recognized in the mining industry as a benchmark of competency for electrical and powerline work.

Electrical work covered by this section is performed by a certified person, or under the direct supervision of a certified person.

Supervision means the certified person is responsible for the work being performed, will provide direction and oversight, and ensures the work meets applicable safety and technical standards.

Subsection (2) allows the Chief Inspector to require that a Professional Engineer (P.Eng.) be responsible for certain work, typically related to design or complex system modifications.

This requirement is applicable where electrical installations:

- Are high voltage or high energy systems,
- Involve complex design or system integration, or
- Require detailed engineering analysis to manage risk.

Examples of work that may require a P.Eng. include:

- New installations or upgrades to substations or high-voltage systems,
- Installation or modification of neutral grounding resistors,
- Electrical systems in hazardous locations,
- Arc flash studies and incident energy analysis, and
- Protection and coordination studies.

The intent is to ensure that complex or higher-risk systems are properly designed and reviewed, consistent with applicable codes and engineering practices, and safe for workers and the operation. The requirement for a P.Eng. is applied on a case-by-case basis, depending on the nature and risk of the work.

Electrical Safety Plan

5.1.3 (1) The manager must ensure that an electrical safety plan for the mine is developed, implemented and updated whenever relevant conditions or regulations change.

(2) The electrical safety plan must include training for workers who may be exposed to an electrical hazard while doing any of the following:

(a) performing maintenance on specialized equipment in the workplace including

(i) electrolytic cells,

(ii) batteries, battery rooms or battery enclosures,

(iii) lasers,

(iv) power electronics equipment, or

(v) mobile electrical equipment.

(b) operating induced polarization geophysical systems as referred to in section 9.3.5 of this code.

(3) The manager must ensure that the electrical safety plan is kept at the mine and made available to an inspector on request.

Guidance: The purpose of an electrical safety plan is to identify and control electrical hazards specific to the mine, and to protect workers from injury.
The electrical safety plan is:

- Documented and available at the site,
- Implemented in practice, not just written, and
- Reviewed and updated whenever there are changes to equipment, processes, or regulatory requirements.

The level of detail and complexity of the plan will reflect the type and complexity of the electrical systems at the mine. Simpler operations may require a basic plan, while larger or more complex operations will require a more comprehensive approach.

At a minimum, the electrical safety plan addresses:

- Identification of electrical hazards,
- Safe work practices and procedures,
- Training requirements for workers, and
- Roles and responsibilities (including supervisors and qualified persons).

The electrical safety plan is best developed with input from qualified or certified electrical personnel to ensure technical accuracy. CSA Z462 – Workplace Electrical Safety is a recognized standard and can be used as a reference when developing or reviewing an electrical safety plan.

Subsection (2) maintains that electrical hazards are not limited to standard distribution equipment. Many types of specialized equipment used in mining can present unique or elevated electrical risks. The examples listed in subsection (2), are not exhaustive, but highlight areas where additional hazards may exist.

The electrical safety plan will identify any specialized equipment at the mine that may expose workers to electrical hazards to ensure that workers who operate, maintain, or work near this equipment receive appropriate training and instruction. The electrical safety plan will also address hazards specific to the equipment, such as:

- Stored energy (e.g., batteries, capacitors),
- High voltage or current,
- Unintended energization, or

- Environmental conditions affecting equipment safety.

The level of training on the electrical safety plan relates to the worker's level of exposure. This may include general awareness training for workers working near the equipment, or task-specific training for those operating or maintaining equipment.

Integrating the Electrical Safety Plan

Please note that this guidance document includes examples of how other requirements may be integrated into an electrical safety plan; these examples are provided as best practices and are not intended to prescribe specific approaches.

Subsection (3) states the electrical safety plan is kept at the mine and is readily available for review by an inspector upon request. In practice, this means the plan should be easy to locate, is kept current, and is well known to supervisors and relevant personnel

Worker's Awareness

5.1.4 The manager must ensure that any person working near high voltage electrical equipment or conductors, whether exposed or potentially exposed during their work, is properly trained and familiar with.

(a) the existence, location and voltage of the electrical equipment or conductors, and

(b) the work arrangements and procedures to be followed in accordance with the electrical safety plan referred to in section 5.1.3.

Guidance: Workers who perform tasks near high-voltage electrical equipment or conductors need to have more than general awareness of electrical hazards. The intent of this section is to ensure that workers are informed, prepared, and able to work safely when exposed to high-voltage risks.

To prevent incidents, subsection (a) recognizes electrical hazards must be clearly identified and communicated to workers before work begins. Workers exposed to high-voltage hazards must be trained to:

- Know the location of electrical equipment or conductors, including overhead and underground systems,
- Understand the voltage levels and associated risks,
- Are aware of minimum approach distances or safe limits where applicable, and
- Recognize situations where their work may bring them into potential contact with energized systems.

Unintentional contact with overhead power lines and buried electrical cables is a common cause of incidents in mining operations. These hazards are often not obvious, especially where equipment operates near energized lines, ground disturbance activities (e.g., excavation, drilling) occur, or electrical infrastructure is not clearly identified.

Subsection (b) states workers need to be familiar with the safe work arrangements and procedures that apply to their tasks, including:

- Site-specific procedures for working near electrical systems,
- Requirements for clearances, barriers, or isolation,
- Communication and coordination with electrical personnel,
- Emergency response actions in the event of contact or near-miss,

These procedures need to be clearly defined and communicated before work begins.

Training needs to go beyond simple awareness and be appropriate to the worker's level of exposure and task.

Training includes both awareness training for workers who may be in proximity to electrical hazards and task-specific instruction for workers operating equipment, excavating, or working in areas where contact is possible.

Integration with the Electrical Safety Plan

Requirements for identifying hazards, training workers, and implementing safe work procedures is included in the electrical safety plan (Section 5.1.3).
This ensures:

- *Hazards are consistently identified across the site,*
- *Training and procedures are standardized, and*
- *Workers and supervisors understand expectations.*

The goal is to ensure workers not only know that hazards exist but also understand how to work safely around them.

The photo below shows incorrectly buried electrical cables, which were then dug up by workers who were unaware of the hazard present. This is an example of what can happen when electrical hazards are not identified properly for all workers.

FIGURE 5. UNIDENTIFIED ELECTRICAL HAZARD.

Notices and Information

5.1.5 (1) For any permanent electrical installation at a new mine, the manager must ensure that
- (a) an electrical plan, approved by an electrical engineer registered within British Columbia, is developed for the use of electrical energy at the mine, and
- (b) the electrical plan is forwarded to the chief inspector prior to the introduction of electricity at the mine.

(2) For any existing mine, the manager must ensure that
- (a) a notification is sent to the chief inspector prior to the construction, expansion, alteration or replacement of fixed substations at the mine, and
- (b) electrical plans respecting the actions referred to in paragraph (a) are kept at the mine and made available to an inspector on request.

Guidance: Subsection (1) requires that, for any new mine, the electrical system be designed and reviewed by a Professional Engineer (P.Eng.) before electricity is introduced.

The electrical plan typically includes:

- Single-line diagrams,
- Major equipment ratings (e.g., substations, transformers),
- Grounding and protection systems, and
- Distribution layout.

The intent of subsection (1)(b) is to ensure that the overall electrical system design is safe, complete, and appropriate for the mine, hazards are identified and addressed before energization, and that the Chief Inspector has an opportunity to review the design at an early stage.

The requirement to submit the plan prior to energization ensures that major design issues can be identified before the system is put into service.

Following construction, it is a best practice to ensure the installation is consistent with the approved design. This may include as-built drawings, showing the final installed configuration, and assurance or record letters from the design engineer, confirming that the installation substantially complies with the design intent.

Subsection (2)(a) applies to changes at existing mines and focuses on fixed substations, which are critical components of the mine's electrical system.

The manager notifies the Chief Inspector before:

- Constructing a new fixed substation,
- Expanding an existing substation,
- Altering a substation (modifying its design, protection, or capacity), and
- Replacing a substation (e.g., upgrading or changing major components).

The intent is to ensure that significant changes to the electrical system are brought to the attention of the regulator before they are carried out.

Subsection (2)(a) is not intended to apply to minor maintenance or like-for-like replacement, where equipment is replaced with equivalent rating and function and the overall system design and operation are not significantly changed

This requirement applies to major changes, such as:

- Installing a new permanent substation (including on-pole or pad-mounted substations serving facilities like pump houses or process plants).
- Increasing the capacity, voltage, or configuration of an existing substation.
- Replacing transformers, switchgear, or protection systems with different ratings or designs, and
- Modifying protection, grounding, or control systems that affect system performance or safety.

Movable substations are generally not included in this requirement. These systems are designed for temporary or relocatable use and are typically addressed under separate requirements (e.g., mobile equipment and temporary installations)

For any work described in (2)(a), to meet requirements for (2)(b) the manager will ensure that electrical plans are kept at the mine, and that these plans are available to an inspector upon request

These plans should reflect the current configuration (preferably as-built) and be sufficiently detailed to allow understanding of the system and include major equipment and protection systems.

Keeping accurate, up-to-date plans is critical for troubleshooting and maintenance, safe work planning, and incident response.

Warning Notices

5.1.6 The manager must ensure that all vaults, rooms, enclosures or areas containing electrical equipment have a permanent, legible warning notice affixed in a conspicuous position at all points of entry or access which identifies the danger and indicates the highest voltage in use.

Guidance: Section 36 of the *Canadian Electrical Code* was used as the basis for this signage requirement. It was determined that including a more accessible and easy-to-interpret requirement directly in this Code would be beneficial for industry.

FIGURE 6. EXAMPLES OF SIGNAGE.

System Testing

5.1.7 (1) The manager must ensure that supply systems for mobile electrical equipment are tested before being put into service, and at least once a year thereafter, to prove the effectiveness of the ground fault tripping and the ground conductor monitoring circuits.

(2) The manager must ensure that a record of the tests required under subsection (1) are kept at the mine and made available to an inspector on request.

Guidance: The intent of 5.1.7(1) is to ensure that electrical protection systems associated with mobile electrical equipment are functioning correctly before use and on an ongoing basis. This requirement applies specifically to ground fault protection (tripping systems) and ground conductor monitoring circuits. These protection systems are critical for detecting ground faults, loss of grounding continuity, and hazardous conditions that could result in electric shock or equipment damage. The required testing confirms that these systems will detect faults as designed, and trip or respond within the required time and sensitivity.

Testing is completed before the system is put into service, and at least once every 12 months thereafter. Additional testing should be considered after repairs or modifications, if a fault or abnormal condition has occurred, and anytime protection settings are changed.

Testing verifies that the protection systems operate correctly under simulated fault conditions, detect a loss of ground continuity, and initiate a trip or alarm as designed. This may include injection testing of protective relays, functional testing of trip circuits, and verification of ground monitoring continuity. Testing is performed by qualified personnel who understand the protection system.

This requirement also applies to the protection systems associated with mobile electrical equipment or mobile substations, including:

- Ground fault relay systems,
- Ground monitoring relays, and
- Pilot wire or ground check systems.

This requirement is not intended to apply to the upstream supply system (e.g., fixed substations or distribution feeders supplying the mobile equipment).

Records, as stated in 5.1.7(2), provide documented evidence that required system testing has been completed and maintained. They support compliance verification by enabling inspectors to confirm that testing is conducted as required. They also contribute to electrical safety by demonstrating that protective systems remain effective over time.

Electrical Test Equipment

5.1.8 The manager must ensure that electrical test equipment is
(a) inspected before each use, and
(b) maintained for safe operation and calibrated to ensure accuracy.

Guidance: Subsection (a) maintains that electrical test equipment is inspected before first use to confirm that equipment is in good condition and suitable for use, that there are no visible defects that could affect safety or accuracy, and that the user can rely on the equipment to provide correct readings.

Pre-use inspection includes checks for:

- Physical damage (e.g., cracked cases, damaged leads, exposed conductors),
- Proper operation (e.g., display functioning, controls responsive),
- Condition of test leads, probes, and insulation.

Defective or questionable equipment is then removed from service and not used until it has been repaired or replaced.

A process to ensure inspections are carried out consistently may include:

- Worker training on inspection requirements,

- Procedures for removing and reporting defective equipment, and
- Recordkeeping practices, where appropriate, to demonstrate compliance.

Subsection (b) requires electrical test equipment to be maintained in safe operating condition and calibrated to ensure accuracy. Proper maintenance ensures that equipment continues to function safely under normal use and does not introduce additional risk during testing. Calibration ensures that measurements are accurate and reliable and that decisions based on test results are valid.

Calibration and maintenance best practice is to follow manufacturers (OEM) recommendations and is performed at appropriate intervals based on manufacturer requirements, frequency of use, and environmental conditions.

Integration with the Electrical Safety Plan

The electrical safety plan (Section 5.1.3) addresses:

- *Inspection procedures*
- *Maintenance and calibration schedules*
- *Training requirements for workers using test equipment*

This ensures consistent practices across the site, reliable test results, and reduced risk of incidents caused by inaccurate or faulty equipment

Equipment that is out of calibration or not functioning correctly is removed from service until corrected.

The following is a list of common examples of electrical test equipment:

- Multimeters
- Clamp meters
- Insulation resistance testers
- Power quality analyzers
- Voltage or proximity testers
- Ground resistance testers
- Micro-ohmmeters

These devices are often used to verify absence or presence of voltage, diagnose faults, and confirm system performance. Because workers rely on these instruments for critical safety decisions, their condition and accuracy are essential.

Electrically Insulated Elevating Work Platform

5.1.9 (1) The manager must ensure that any insulated elevating work platform that workers use to perform electrical related tasks is dielectrically tested in accordance with section 5.3.4 of Standard CAN/CSA-C225:20 “Vehicle Mounted Aerial Devices” at least once every 12 months.

(2) The manager must ensure that the insulating capability of the electrically insulated elevating work platform is certified by a CSA recognized testing agency.

(3) If the electrically insulated elevating work platform fails dielectric testing as set out in subsection (1), or if it is to be used only as a non-electrically insulated elevating work platform, the failure or use must be clearly identified on the platform, and on all of its related labeling, and in its records and logbook.

Guidance: Electrically insulated elevating work platforms (e.g., aerial buckets) are often used for work near energized electrical equipment. This section addresses that when these platforms are relied upon for electrical protection, their insulating capability is verified, maintained, and clearly understood.

Electrically insulated elevating work platforms are dielectrically tested annually in accordance with CSA standards as set out in 5.1.9 (1). The intent of subsection (1) is to confirm that the insulation components (e.g., boom, bucket) can provide the required level of electrical protection and that the equipment has not been compromised by wear and tear, contamination (e.g., dirt, moisture, hydraulic fluid) or mechanical damage. Dielectric testing verifies that the unit is safe to use for work where electrical insulation is required.

In subsection (2), the insulating capability of the platform is to be tested and certified by a CSA-recognized testing agency. This ensures that testing is performed using standardized and accepted methods, results are reliable and traceable, and that the equipment meets recognized safety standards certification provides assurance that the platform is suitable for use near energized electrical hazards.

Subsection (3) maintains if a platform fails dielectric testing or is not intended to provide electrical insulation it must be clearly identified as such.

When an electrically insulated elevating work platform has failed dielectric testing and is now intended to be used only as a non-electrically insulated elevating work platform, it is important that the identification of the testing failure and usage is:

- Clearly visible on the equipment,
- Reflected in labeling and markings, and
- Documented in maintenance records and logbooks

to prevent any misunderstanding about the equipment's capability. A platform that is not certified as insulated must be treated as non-insulated equipment and not relied upon as a protective measure against electrical hazards.

This section is critical because workers may assume that all aerial devices provide electrical insulation which is not the case. Improper assumptions can result in workers being exposed to energized conductors overreliance on equipment that is not providing protection. To prevent this, only platforms with valid dielectric certification should be used where insulation is required and failed or uncertified units must be clearly marked and restricted in use.

Integration with the Electrical Safety Plan

The electrical safety plan (Section 5.1.3) addresses:

- *Inspection and testing requirements for insulated platforms,*
- *Verification of certification before use, and*
- *Worker training on the limitations of insulated equipment.*

This ensures that workers understand when insulation can and cannot be relied upon, and the equipment is used consistently and safely across the site.

The photo below shows isolated working platforms being used for non-electrical related work such as painting. It is rare to use certified isolated platforms for non-electrical work as the other work could compromise the unit integrity.

FIGURE 7. ISOLATED WORKING PLATFORMS BEING USED FOR NON-ELECTRICAL RELATED WORK.

Submersible Pumps

5.1.10 The manager must ensure that a submersible pump that is supplied by a portable trailing cable is provided with ground fault protection to
(a) limit ground fault current to a maximum of 25 amps, and
(b) automatically isolate the supply in the event of a ground fault.

Guidance: Submersible pumps are commonly used in mining operations and present increased electrical hazards due to their use in wet or conductive environments. This

section addresses that pumps supplied by portable trailing cables are properly protected to reduce the risk of electrical shock and equipment damage.

This section applies specifically to submersible pumps supplied by portable trailing cables, typically used in mine dewatering operations and temporary or movable pumping installations. These systems often operate at voltages exceeding 150 V to ground, where the risk of electrical hazards is greater.

With this requirement, ground fault currents are limited, and power is automatically disconnected if a fault occurs.

For applicable pumps, ground fault protection limit ground fault current to a maximum of 25 amps under subsection (a). The system must automatically isolate the supply when a ground fault is detected under subsection (b).

The intent is to reduce the severity of electrical shock hazards and quickly remove fault conditions before they escalate which protects both workers and equipment. In practice, these protections are typically implemented through ground fault relays and ground monitoring (ground check) systems associated with trailing cables.

These requirements align with CSA M421 provisions, including:

- Ground fault protection (Rule 4.5.6)
- Ground conductor monitoring (Rule 4.5.8)
- Submersible pumps (Table 4)

*Note that submersible pumps, in mine sumps, submersible dewatering or slime/tailings applications, that are >150 Volts to ground fall in this section. All other submersible pumps must be <150 Volts to ground and installed to the *Canadian Electrical Code*: Section 26-950 to 26-956.

Other Submersible Pump Installations

Not all submersible pumps fall under this requirement. Submersible pumps installed in wash plants, shops, water treatment facilities are generally fixed installations and comply with the Canadian Electrical Code (CSA C22.1), particularly sections 26-950 to 26-956,

These systems typically use fixed wiring methods and may not require ground conductor monitoring, just ground fault monitoring. They rely on standard grounding and protection approaches.

Submersible pumps installed in lakes, creeks, ponds, flooded structures have additional requirements under *Canadian Electrical Code* section 26-956, including restrictions on operating voltage specific cable types and installation methods' ground fault protection requirements suited to these environments. These installations present increased risk of electrical shock due to direct contact with water and should be designed and controlled.

Deep well pumps have specific requirements under *Canadian Electrical Code* section 26-954. They are typically considered fixed installations and do not require ground conductor monitoring. When designing, use appropriate installation and protection methods.

Critical factors in determining weather the installation is a portable system versus a fixed system are outlined below:

Portable systems:

- Portable (trailing cable supply) → Ground fault protection and monitoring required,
- Are subject to movement, damage, and changing conditions, and
- Require enhanced protection (including monitoring).

Fixed systems:

- Are permanently installed and rely on engineered protection systems, and fixed installation → Governed by *Canadian Electrical Code* requirements.

Low Voltage Disconnection and Lockout

5.1.11 (1) The manager must ensure that low voltage electrical equipment is completely disconnected and locked out before starting work on it.

(2) Despite subsection (1), if adjustments, tests, calibrations, repairs or alterations with respect to electrical conductors or circuit parts cannot be performed in a de-energized state because of equipment design or operational limitations, or de-energizing will introduce new hazards or increase existing hazards,

(a) energized work may be performed, and

(b) all necessary precautions consistent with the nature and extent of the hazards must be taken to ensure that the work can be performed safely.

Guidance: Work on low voltage electrical equipment is performed in a de-energized state whenever practicable. This means the equipment is completely disconnected from all sources of energy and properly locked out and verified before work begins.

The intent of 5.1.11(1) is to help prevent electrical hazards such as:

- Electric shock,
- Arc flash or arc blast, or
- Unexpected energization.

Subsection (2) maintains that energized work is an exception, not the normal method of work. It is only considered where the work cannot be performed de-energized due to equipment design or operational limitations, or de-energizing the equipment would introduce a greater hazard, such as creating unsafe conditions elsewhere in the operation. In these situations, the decision to perform energized work is based on a careful risk assessment, considering all feasible options for de-energization, the risks introduced by shutting down the equipment, and the risks of performing the work energized.

Examples of Acceptable Energized Work

Limited energized work may include electrical troubleshooting or diagnostics that require the system to be operating (e.g., intermittent control issues); Verification of voltage or current where required for testing; or work on line voltage or power circuits while energized should be rare and only performed where clearly justified and properly planned.

Controls and Precautions for Energized Work

Where energized work is permitted, implement additional safety measures, including:

- Work performed by certified and authorized personnel only,
- Use of appropriate personal protective equipment (PPE),
- Clearly defined safe work procedures,
- Establishment of shock and arc flash boundaries,
- Use of insulated tools and equipment where required, and
- Adequate supervision and planning.

Integration with the Electrical Safety Plan

Requirements for lockout, energized work, and associated controls are to be clearly defined in the site's Electrical Safety Plan (Section 5.1.3) and consistently applied across the site. This ensures that workers and supervisors understand expectations, energized work is properly controlled and justified, and that compliance can be demonstrated during inspections.

All precautions are to reflect the level of hazard. Low voltage refers to voltages exceeding 30 V but not exceeding 750 V (CSA M421:23).

Electrical Rooms

5.1.12 (1) The manager must ensure that electrical rooms are located and constructed to have the best practical protection against fire propagation, water and dust ingression and corrosive atmospheres.

(2) The manager must ensure that access to electrical rooms is restricted to authorized personnel only.
(3) The manager must ensure that electrical rooms are sufficiently ventilated to maintain the electrical equipment inside at safe temperatures.
(4) The manager must ensure that clear access to electrical equipment is maintained at all times.
(5) The manager must ensure that electrical rooms
  (a) are not used for general storage,
  (b) store only equipment and materials directly related to the electrical system,
  (c) do not store flammable materials, including combustible liquids and gases, and
  (d) are not used as a workstation for work not related to the electrical equipment in the room.
(6) The manager must ensure that items stored in an electrical room do not obstruct egress routes or interfere with ventilation systems, fire protection systems or any other safety-critical infrastructure within the electrical room.
(7) The manager must ensure that items such as spare fuses, arc flash personal protective equipment, high-voltage tools and draw-out-type breakers are stored in appropriate storage areas.
(8) The manager must ensure that each electrical room has a single-line diagram posted showing, for that electrical room,
  (a) the relative locations of all fixed electrical distribution equipment,
  (b) the ratings of all fixed electrical distribution equipment, and
  (c) the routes, properly noted and referenced, of all fixed power distribution feeders.
(9) The manager must ensure that the single-line diagrams referred to in subsection (8) are reviewed and updated at least annually and after any significant changes to the electrical system.

Guidance: Section 5.1.12(1) ensures that electrical rooms are designed and maintained to protect the electrical equipment from conditions that could cause damage or increase risk, including:

- Fire and fire spread,
- Water or moisture ingress,
- Dust accumulation, or
- Corrosive or contaminated atmospheres.

This requirement reinforces applicable provisions from CSA M421, *the Canadian Electrical Code*, and the BC Building Code, but does not replace them. Electrical rooms are not to be used as general-purpose spaces. Using these rooms for storage, workshops, or other activities can introduce hazards and compromise the design and protection of the electrical systems.

According to 5.1.12(2), access to electrical rooms is restricted to authorized personnel. This means only workers who are trained and permitted to enter have access and that doors are secured or controlled where appropriate. Restricting access reduces the risk of unqualified persons being exposed to electrical hazards and interference with critical electrical equipment.

In accordance to subsection (3), ventilation of electrical rooms ensures that equipment operates within safe temperature limits. The purpose of ventilation is to prevent overheating of electrical equipment and maintain equipment reliability and safe operation. Ventilation is intended for equipment protection, not for worker comfort.

Clear working space around electrical equipment, according to subsection (4), is required to be maintained at all times. This ensures safe operation of equipment, adequate space for maintenance and inspection, and quick and safe response in emergency situations. Storage or obstructions cannot impede required working clearances.

The intent of subsection (5) ensures that electrical rooms are only used for electrical purposes and contain only equipment and materials directly related to the electrical system

Electrical rooms:

- Are not to be used for general storage,
- Are not to be used as workspaces for unrelated work (e.g., mechanical work, lunch areas), and
- Do not contain flammable or combustible materials, including liquids and gases.

Limiting use of the room helps maintain fire safety, equipment protection, and safe access and clearances.

In accordance with subsection (6), any items stored in an electrical room cannot block egress routes, interfere with ventilation systems, obstruct fire protection systems, or impact any safety-critical infrastructure. Even approved storage needs to be controlled so that the original safety design of the room is not compromised.

Subsection (7) states that items such as spare fuses, arc flash personal protective equipment, high-voltage tools and draw-out-type breakers are to be stored in designated, appropriate storage areas. This will prevent damage or contamination, avoid introducing hazards into the electrical room, and maintain clear access and proper room function. Electrical rooms are not intended to serve as general storage for spare parts or tools.

In accordance with subsection (8), each electrical room is required to have a posted single-line diagram that clearly shows:

- The location of electrical distribution equipment,
- Equipment ratings, and
- The routing of power distribution feeders.

This information allows workers to quickly understand the system layout, identify sources of power, and then plan work safely.

Under subsection (9), single-line diagrams are reviewed at least annually and updated after any significant system changes. Accurate diagrams are essential for:

- Safe operation and maintenance,
- Troubleshooting and isolation of equipment, and
- Emergency response.

Outdated drawings can lead to incorrect assumptions and increase the risk of incidents.

Isolating Surface Workings

5.1.13 The manager must ensure that the operation of the high-voltage switchgear is conducted by a qualified person.

Guidance: The operation of high-voltage switchgear presents significant hazards and is treated as a controlled and specialized activity. This section ensures that switching operations at surface workings are performed with the same level of safety and oversight as those carried out underground.

Only a qualified person, which is a defined term in the Code, is permitted to operate high-voltage switchgear. A qualified person for the purposes of 5.1.13 is someone who:

- Has the training and experience necessary to safely operate high-voltage equipment,
- Has a demonstrated understanding of the electrical system and switching procedures, and
- Is aware of the hazards associated with switching operations.

Limiting these activities to qualified personnel reduces the risk of incorrect switching sequences, equipment damage, and exposure to arc flash or other electrical hazards.

Qualified persons performing switching operations will:

- Follow established switching procedures or plans,
- Understand the system configuration and consequences of switching actions,
- Be aware of potential impacts during fault conditions or abnormal operation, and
- Communicate with affected personnel before performing switching.

Understanding the consequences of incorrect operation, particularly during fault conditions, is critical for preventing equipment damage, loss of power to critical systems, and unsafe conditions affecting workers.

For the purpose of 5.1.13, *operation of high-voltage switchgear* includes:

- Opening and closing breakers or switches,
- Isolating or energizing circuits, and
- Performing planned switching sequences.

It does not include:

- Maintenance work,
- Repair activities, or
- Resetting or re-energizing equipment following a fault condition.

Integration with the Electrical Safety Plan

The electrical safety plan (Section 5.1.3) should clearly define:

- *Who is authorized and qualified to operate high-voltage switchgear,*
- *The procedures to be followed for normal and planned switching, and*
- *Responsibilities of the individual performing the switching.*

This ensures that switching operations are:

- *Planned and controlled,*
- *Consistently performed across the site, and*
- *Clearly understood by supervisors and workers.*

These activities require additional controls and fall under other requirements of the Code.

Underground Mines

Isolating Underground Workings

5.2.01 (1) The manager must ensure that switchgear is
- (a) installed at a convenient location on surface to provide the means for isolating all underground circuits, and
- (b) operated by a qualified person.

(2) The manager must ensure that switchgear installed underground is
- (a) built of non-combustible materials, and
- (b) fixed in a vertical position on a metal frame or plate.

(3) The manager must ensure that switchboards located underground are
- (a) recessed from hallways, and
- (b) have a floor on which water cannot accumulate.

Guidance: The intent of 5.2.01 is to ensure that all underground electrical circuits can be safely and reliably isolated from the surface.

Subsection (1)(a) is concerned with providing surface-located switchgear:

- Allows power to be quickly disconnected in an emergency (e.g., fire, flooding, incident underground),
- Eliminates the need to enter potentially hazardous underground areas to isolate power, and
- Improves coordination during maintenance and emergency response.

Switchgear must be readily accessible, clearly identified, and suitable for safe operation under all expected conditions.

Subsection 5.2.01(1)(b) maintains that the operation of switchgear is limited to a qualified person, which is defined in the Code, who:

- Understand the electrical system and switching procedures,
- Are aware of the consequences of isolating or energizing circuits, and
- Can perform switching safely and in accordance with established procedures.

Subsection 5.2.01 (2) states that switchgear installed underground is to be suitable for the harsh and potentially hazardous underground environment.

Under 5.2.01 (2)(a), requirements for non-combustible construction and secure mounting are intended to:

- Reduce fire risk in confined underground spaces,
- Prevent movement, tipping, or damage to equipment, and
- Maintain structural integrity under vibration, moisture, and operational conditions.

Under 5.2.01(2)(b), mounting switchgear in a vertical position on a secure metal frame or plate ensures that the equipment remains stable, properly aligned, and accessible for safe operation and maintenance.

Under subsection (3), underground switchboards are installed in a way that minimizes risk to workers and equipment. Switchboards are recessed from travel ways or hallways to avoid obstructing movement of personnel and equipment, reduce the risk of accidental contact or damage, as well as maintain safe egress routes.

Floors around switchboards prevent water from accumulating. This is critical to reduce the risk of electric shock, prevent equipment damage or failure, and maintain safe working conditions.

In practice, this may include proper drainage, raised installations or curbing, and site selection away from known water ingress areas.

Sections 5.2.1 and 5.2.2 are repealed

Sections 5.2.3 and 5.2.4 are renumbered sections 5.6.3 and 5.6.4

Cables

Sections 5.3.1, 5.3.2 and 5.3.3 are renumbered as sections 5.6.5, 5.6.6 and 5.6.7

Handling Trailing Cables

5.3.4 In accordance with 1.8.1 and 1.8.2,

(a) the manager must ensure that appropriate protective equipment is provided to a person handling energized trailing cables at the mine, and

(b) the person must use the equipment, as instructed by a qualified person, and ensure it is in good working order.

Guidance: Trailing cables supplying mobile or movable electrical equipment present a significant electrical and physical hazard, particularly when energized. This section ensures that workers are properly protected when handling these cables.

Under subsection (a), the manager ensures that appropriate protective equipment is provided to any person handling energized trailing cables.

The intent is to protect workers from:

- Electrical shock due to damaged or compromised insulation,
- Contact with energized conductors, or
- Physical hazards such as abrasion, crushing, or strain injuries.

Appropriate protective equipment may include:

- Electrically rated gloves or insulating equipment,
- Protective outer coverings or cable handling devices, or
- Equipment designed to reduce strain and improve control when moving cables.

The type of protection required will depend on:

- Voltage and system characteristics,
- Cable condition and construction,
- Environmental conditions (e.g., wet, abrasive, confined areas), and
- The task being performed.

A risk-based approach should be used to ensure that the protection provided is suitable for the specific hazard.

Subsection (b) maintains that workers handling energized trailing cables use provided protective equipment as instructed, and ensure the equipment is in good working condition before use.

Instruction is provided by a qualified person and includes:

- Proper use and limitations of the protective equipment,
- Recognition of damage or wear, and
- When equipment must be removed from service.

Damaged, worn, or unsuitable equipment may provide a false sense of protection and increase risk.

Integration with the Electrical Safety Plan

Requirements for handling energized trailing cables, including:

- *Selection of protective equipment,*
- *Worker training, and*
- *Safe handling practices.*

Are to be defined in the electrical safety plan (Section 5.1.3).

This ensures:

- *Consistent application across the site,*
- *Workers understand expectations, and*
- *Hazards are properly assessed and controlled.*

Defective Trailing Cables and Associated Connection Accessories

5.3.5 The manager must ensure that defective trailing cables and associated connection accessories are

(a) inspected by a certified person to confirm they are in safe operating condition before they are returned to service, or

(b) if paragraph (a) does not apply, identified and removed from service.

Guidance: Trailing cables and their associated connection accessories are subject to frequent wear, mechanical damage, and environmental exposure, making them a common source of electrical hazards. This section ensures that defective components are properly assessed and controlled before reuse.

The intent of section 5.3.5(a) is to ensure that damage has been properly identified and assessed, repairs, if performed, are adequate and safe, and that the equipment is suitable for continued use under operating conditions. Defective or suspected defective trailing cables and connection accessories are to be inspected by a certified person before being returned to service.

A certified person has the training and experience to:

- Evaluate insulation damage, conductor integrity, and connections,
- Identify hidden or progressive defects, and
- Confirm that the cable or accessory meets safe operating requirements.

Only equipment that can be confirmed to be in safe operating condition may be returned to service.

Under 5.3.5(b), if the equipment has not been inspected by a certified person, or cannot be confirmed as safe for continued use, it needs to be clearly identified and removed from service. This prevents defective equipment from being accidentally reused or returned to service without proper evaluation

Integration with the Electrical Safety Plan

Procedures for the following are included in the electrical safety plan (Section 5.1.3):

- *Identifying defective equipment,*
- *Removing equipment from service, and*
- *Inspection and return-to-service approval.*

This ensures consistent application across the site, clear responsibilities and expectations, and proper documentation and control.

Identification may include tagging or labeling and physical separation from usable equipment. Removal from service ensures the equipment is not accessible for use until repaired and inspected or disposed of if it cannot be safely repaired.

Practical Application

This requirement applies to trailing cables supplying mobile or movable equipment and cable couplers, plugs, receptacles, and similar connection devices.

Common defects may include:

- Cuts, abrasions, or exposed conductors,
- Damaged insulation or jackets,
- Loose, worn, or overheated connections, or
- Evidence of moisture ingress or contamination.

Workers need to be trained to recognize and report defects, but only a certified person may approve the equipment for return to service.

Damaged Trailing Cables and Associated Connection Accessories

5.3.6 (1) The manager must ensure that damaged trailing cables and associated connection accessories are, before being returned to service,
(a) repaired by a certified person or by a qualified person under the supervision of a certified person, and
(b) tested by a certified person.
(2) The manager must ensure that a record of the tests required under subsection (1) (b) are kept at the mine and made available to an inspector on request.

Guidance: Trailing cables and their associated connection accessories are subject to frequent mechanical stress, and environmental exposure, and damage that can compromise their electrical integrity. This section ensures that repairs are properly completed and verified before equipment is returned to service.

Section 5.3.6 (1)(a)(b) states that damaged trailing cables and associated connection accessories cannot be returned to service until they have been repaired by a certified person, or by a qualified person, which is defined by the Code, or under the supervision of a certified person and tested by a certified person.

The intent is to ensure that:

- Repairs are completed to an acceptable standard,
- The electrical integrity of the cable or accessory has been restored, and
- The equipment is safe for continued use under operating conditions.

Testing confirms that the repair is effective and that the cable or accessory is fit for service. This may include:

- Insulation integrity testing,
- Continuity of conductors and grounding, and
- Verification of connections and terminations.

Only equipment that has been properly repaired and successfully tested may be returned to service.

Offsite Repairs

Where repairs are carried out offsite, the manager ensures that the repair facility provides documentation confirming that the work and required testing were performed by certified personnel, or the equipment is re-tested on site by a certified person before being returned to service. This ensures that all repaired equipment meets the same standard, regardless of where the work was performed.

Practical Application

This requirement applies to trailing cables supplying mobile or movable equipment and cable couplers, plugs, receptacles, and associated hardware.

Typical damage requiring repair may include:

- Cuts, crushing, or exposed conductors,
- Damaged insulation or outer jacket,
- Loose, worn, or overheated connections, or
- Physical damage to connectors or couplers.

Workers are trained to identify and report damage, but only certified personnel may approve repairs, conduct required testing, and authorize return to service.

In accordance with 5.3.6 (2), a record of all testing needs to be kept at the mine, and made available to an inspector upon request.

Test records include:

- Identification of the cable or accessory
- Date of repair and testing
- Type of testing performed
- Results of the test
- Name of the certified person performing or verifying the test

Integration with the Electrical Safety Plan

To ensure consistent application, clear responsibilities, and proper control of repaired equipment, the electrical safety plan (Section 5.1.3) includes procedures for:

- *Repair of damaged cables,*
- *Testing and verification, and*
- *Documentation and record keeping.*

Maintaining records supports verification of compliance, traceability of repairs and ongoing confidence in equipment condition

Armored Cables

5.3.7 The manager must ensure at the mine site that
- (a) armored cables are not used in place of portable power cables or flexible cords, and
- (b) armored cable connections or terminations are not made using any type of quick connect couplers.

Guidance: Section 5.3.4 (a) ensures that armored cables are not used as substitutes for portable power cables or flexible cords. CSA C22.1 *Canadian Electrical Code* defines distinct differences between these cable types, and installation requirements are specified in CSA M421 and CSA C22.1.

Section 5.3.4 (b) ensures that armored cables are designed for fixed installations, and the use of quick connect couplers or cable ends for terminations is not permitted. This ensures compliance with safety standards and prevents improper connections that could lead to hazards.

Single-conductor cable Connections

5.3.8 (1) The manager must ensure that single-conductor quick connect couplers are not used on three-phase electrical systems at the mine site.

(2) Despite subsection (1), a single-conductor quick connect coupler may be used on a three-phase electrical system at the mine site if the coupler is protected from being disconnected while energized through one of the following means:
- (a) the coupler is mechanically or electrically interlocked with the upstream disconnect switch in a way that ensures the coupler can only be engaged or disengaged while de-energized;
- (b) through the use of a trapped key lock method, or a substantially similar method, the coupler is rendered inaccessible to persons while it is energized.

Guidance: 5.3.8 (1) specifies that single-conductor quick connect couplers should not be used on three-phase electrical systems at the mine site. These couplers, similar to welding cable-style plugs, do not meet the requirements outlined in CSA M421 for safe connections in mining applications.

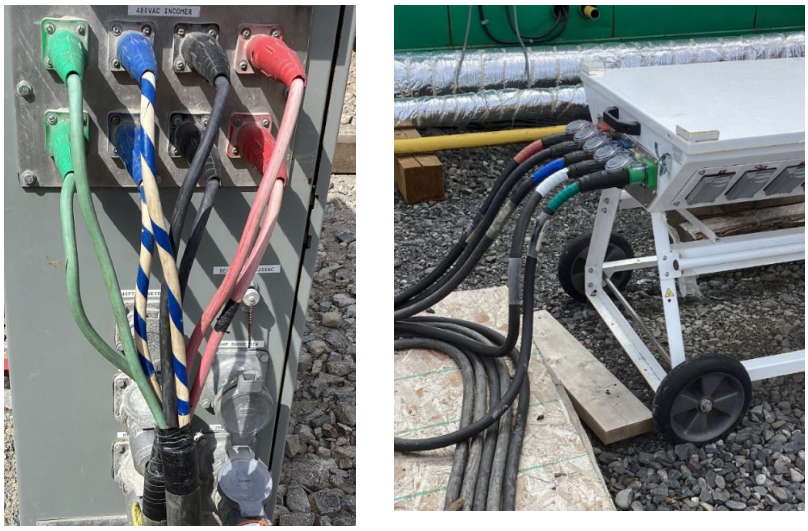


FIGURE 8. CONNECTORS NOT PERMITTED UNDER 5.3.8.

5.3.8 (2) addresses installations that use CSA-approved single-conductor quick-connect couplers. These couplers may only be used if the risk of disconnecting them while energized is reduced to near zero through approved methods, such as interlocking or trapped key systems. This requirement applies to every location where the couplers are installed. Note that the associated single-conductor cable installation should also comply with CSA C22.1, the *Canadian Electrical Code*.

Switching Sequences

Switching Plan

5.4.01 (1) The manager must ensure that a written switching plan is developed, reviewed and implemented prior to the coordinated operation of high-voltage electrical switchgear.

(2) The written switching plan must include an up-to-date and detailed electrical single-line diagram, the sequence of operations and the devices to be operated and their corresponding steps.

Guidance: 5.4.01 (1) specifies a written switching plan is developed, reviewed, and implemented before performing any coordinated operation of high-voltage switchgear.

The intent is to ensure that switching operations involving multiple devices or power sources are:

- Planned and controlled, rather than performed ad hoc,
- Carried out in a safe and correct sequence, and

- Clearly understood by all personnel involved.

High-voltage systems can be complex, and incorrect switching can result in:

- Arc flash or equipment failure,
- Loss of power to critical systems, and
- Unsafe conditions for workers.

A switching plan helps prevent these risks by providing a clear, documented procedure.

When a Switching Plan is Required

A switching plan is required when switching involves:

- Multiple switching steps or devices,
- More than one power source (e.g., utility supply, generator, backup feed),
- Systems with tie breakers, interconnections, or alternate feeds, or
- Any situation where improper sequencing could create a hazard.

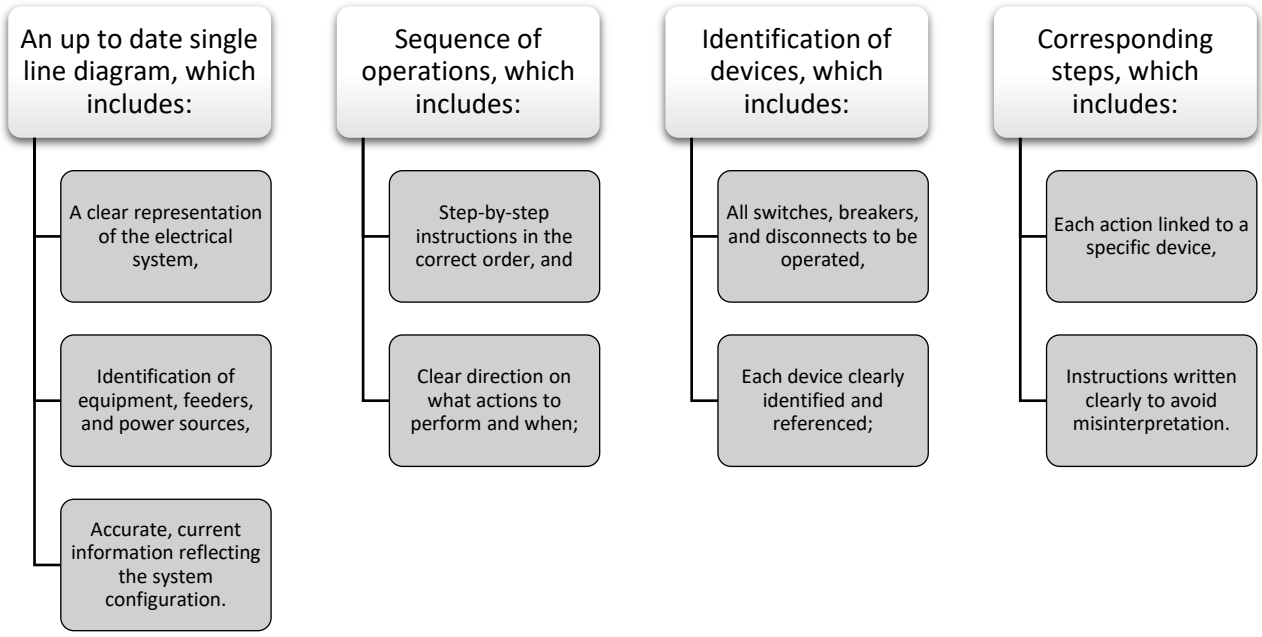
Examples include:

- Isolating part of a main substation supplied by multiple sources,
- Transferring load between primary and secondary supplies, and
- Coordinating shutdown while maintaining power to essential equipment.

When a Switching Plan May Not Be Required

A formal switching plan is generally not required for simple, single-point isolation, where: only one device is operated, or no coordination with other equipment or sources is required. Even in these cases, switching must still be performed safely and by a qualified person (which is defined in the Code), but a detailed written plan may not be necessary.

Under 5.4.01 (2), the switching plan includes:



Review and Implementation

Before starting work the switching plan is reviewed for accuracy and completeness, and all involved personnel fully understand their roles and the sequence of operations. The plan can then be followed exactly as written, unless revised and reapproved. Any deviation from the plan may introduce significant risk and is to be avoided.

Practical Example

A switching plan would be required where:

- A substation has an incoming utility supply and a secondary backup feed,
- A portion of the system must be isolated for maintenance,
- Power must be maintained to critical loads.

In this situation, switching is performed in a specific sequence to:

Integration with the Electrical Safety Plan

The electrical safety plan (Section 5.1.3) includes:

- *Requirements for when switching plans are needed,*
- *Responsibilities for developing and approving plans, and*
- *Training for workers involved in switching operations.*

This ensures:

- *Consistent application across the site,*
- *Clear understanding of expectations, and*
- *Safe and controlled switching practices.*

- Safely isolate the equipment,
- Avoid back-feed or unintended energization, and
- Maintain service to required systems.

Below is an example of a complex system that requires a switching plan:

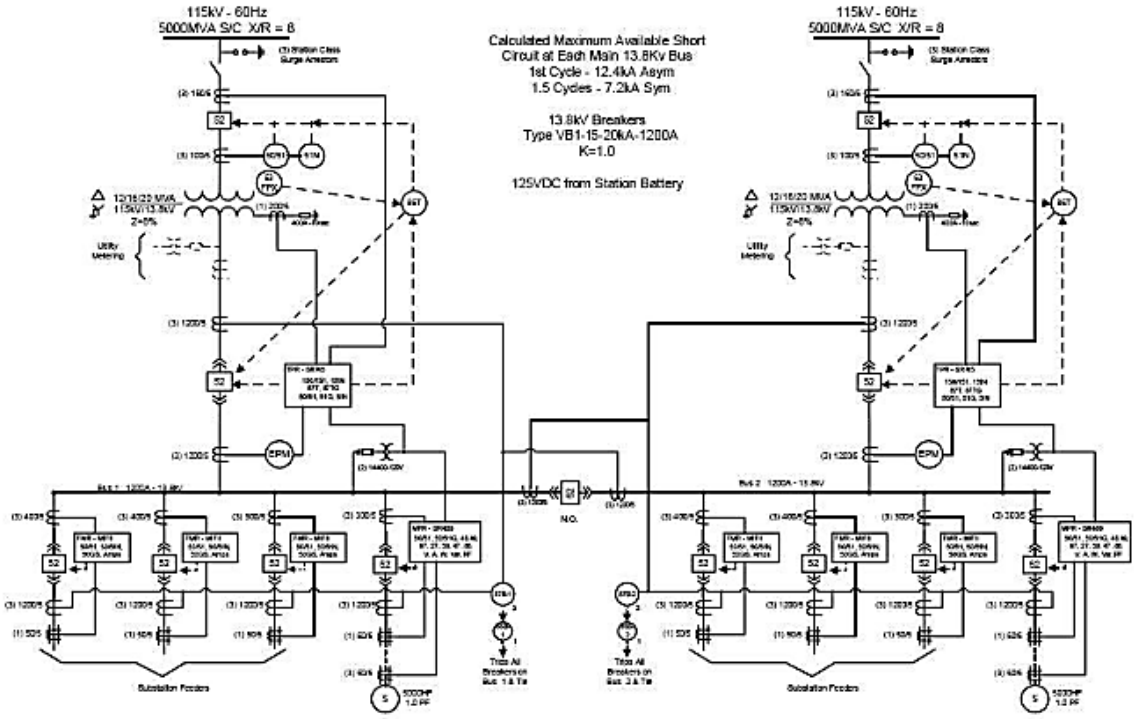


FIGURE 9. COMPLEX ELECTRICAL SYSTEM THAT REQUIRES A SWITCHING PLAN.

Section 5.4.1 is repealed.

Control Systems

General Requirements for Control Systems

5.5.01 The manager must ensure that

(a) the risk to workers posed by electrical equipment with control systems is minimized,

(b) the controlled equipment cannot be inadvertently activated,

(c) emergency stop devices are hardwired, and

(d) after a power interruption or low voltage occurrence, automatic startup is prevented if automatic startup in such circumstances is likely to create a hazard for workers.

Guidance: Control systems are widely used in mining operations and can introduce additional hazards if not properly designed, installed, and maintained. This section ensures that control systems operate in a way that protects workers and prevents unintended or unsafe equipment operation.

Under 5.5.01 (a) control systems are designed and maintained to reduce the risk of injury to workers. This includes ensuring that:

- Equipment operates in a predictable and controlled manner,
- Hazards related to automatic or remote operation are identified and controlled, and
- Failures in the control system do not create unsafe conditions.

Where a hazard to personnel exists, control systems need to be designed to fail to a safe condition (fail-failsafe), meaning equipment will default to a safe state (e.g., stop or de-energize) in the event of a failure.

The intent of 5.5.01 (b) is to ensure that equipment only operates when intended and under controlled conditions. Control systems prevent equipment from being started or activated unintentionally. This includes protection against:

- Accidental contact with controls,
- Unintended signals or faults within the control system, and
- Unexpected activation from automated or remote systems.

In practice, this may include:

- Proper guarding or protection of control devices,
- Use of interlocks, permissives, or start-up sequences, and
- Clear and deliberate operator controls.

Subsection 5.5.01 (c) defines emergency stop (E-stop) devices that are hardwired, operate independently of software or programmable control systems and provide a direct and reliable means of stopping equipment. This ensures that the E-stop will function even if the control system fails and that workers can immediately stop equipment in an emergency

E-stops are to be clearly identified, readily accessible and maintained in proper working condition.

Subsection 5.5.01 (d) specifies after a power interruption or low-voltage condition, equipment cannot automatically restart if doing so could create a hazard.

The intent is to prevent situations where:

- Equipment restarts unexpectedly while workers are exposed
- Workers assume equipment is deenergized or safe
- Restart occurs without proper inspection or control

Control systems require a deliberate, manual restart where hazards may exist and verification that it is safe to return equipment to service

Practical Considerations

These requirements are especially important where:

- Automated or remote-controlled systems are used
- Equipment operates without direct operator presence
- Workers may be exposed during maintenance, clearing blockages, or inspections

Integration with the Electrical Safety Plan

The electrical safety plan (Section 5.1.3) addresses:

- *Safe design and use of control systems*
- *Emergency stop and shutdown procedures*
- *Training for workers interacting with automated or controlled equipment*

This ensures consistent understanding and safe operation across the site.

Control system design may consider:

- Interaction between equipment and workers
- Communication between operators and workers in the field
- The potential consequences of system failure or unexpected operation

Sections 5.5.1, 5.5.2 and 5.5.3 are repealed

Section 5.6.1 is repealed

Underground Coal Mines and Hazardous Locations

Underground Coal Mines and Hazardous Locations

5.6.2 Electrical energy used in an underground coal mine or in a hazardous location must conform to the requirements in the *Canadian Electrical Code*.

Guidance: Section 5.2.2 of the 2024 version of the Code was renumbered as section 5.6.2 and the language has not changed. Electrical energy used in underground coal mines and in hazardous locations presents a heightened risk of ignition due to the presence of methane, coal dust, or other flammable atmospheres.

The intent of this requirement is to ensure that:

- Only equipment suitable for the specific hazardous classification (e.g., methane-air mixtures, combustible dusts) is installed and operated.
- Electrical systems are designed and maintained to prevent ignition sources such as arcs, sparks, or excessive heat.
- Protective features, such as explosion-proof enclosures, intrinsically safe circuits, and proper grounding, remain effective throughout the equipment's service life.
- Installation and maintenance practices follow nationally recognized standards that address the unique risks of underground coal mining and hazardous locations.
- No zoning in Underground Coal Mines: As outlined in Sections 5.6.3 and 5.6.4, the Code distinguishes between electrical installations in underground coal mines and those in other hazardous locations. Zoning classifications, as used in general hazardous-location applications, are not applied in underground coal mines in British Columbia. Any application proposing the use of zoning in an underground coal mine will be treated as a variance to the Code and will require evaluation and approval by the Office of the Chief Inspector of Mines before it may be implemented.

Underground Coal Equipment Certification

5.6.3 (1) The manager of a coal mine, when installing electrical equipment underground, shall

(a) if the equipment is new, ensure that it has been certified as suitable for use in an underground coal mine by an accredited laboratory and complies with the relevant standards as produced by one of the following organizations and as accepted by the chief inspector:

(i) Canadian Standards Association (CSA);

(ii) Natural Resources Canada (NRCan);

(iii) United States Mine Safety and Health Administration (MSHA);

(iv) International Electrotechnical Commission (IEC);

(v) International Organization for Standardization (ISO);

(vi) European Committee for Electrotechnical Standardization (CENELEC).

(b) If the equipment is not new and has been obtained from a source outside of the manager's control, ensure that it has been certified by an accredited laboratory and has been assessed and complies with one of the standards listed in paragraph (a) in its current configuration.

Guidance: Section 5.2.3 of the 2024 version of the Code was renumbered as section 5.6.3, and the language has not changed. Electrical equipment used in underground coal mines must be designed and certified to prevent ignition of methane, coal dust, or other explosive atmospheres. This section ensures that only equipment that has been properly evaluated, tested, and certified by an accredited laboratory and shown to comply with recognized international standards is installed underground. These requirements apply both to new equipment and to used equipment obtained from outside the manager's direct control.

The intent of 5.6.3(1)(a) is to ensure that:

- Equipment meets recognized national or international standards for explosion protection.
- Certification is performed by an accredited laboratory with the technical expertise to evaluate equipment for hazardous underground coal environments.
- Only equipment specifically designed and tested for methane- and coal-dust-rich atmospheres is installed underground.

The requirement lists acceptable organizations that may produce standards specifically to underground coal mines electrical installations that address explosion-proof design, intrinsically safe circuits, flameproof enclosures, and other protective features required for safe operation in underground coal mines.

The intent of 5.6.3 (1)(b) is to ensure that:

- Used or refurbished equipment has not been altered, damaged, or modified in a way that compromises its explosion-protection features.
- Certification remains valid for the equipment as it currently exists, not only as originally manufactured.
- Equipment continues to meet the applicable standard for underground coal mine use, even if it has changed hands or undergone repairs.

Only equipment that has been properly certified and confirmed to comply with the relevant standard in its present condition may be installed underground.

Hazardous Locations

5.6.4 The manager shall ensure that all electrical equipment used in a hazardous location, as defined in the *Canadian Electrical Code*, is approved for use in such a location and for the specific gas, vapour, or dust that is or may be present.

Guidance: Section 5.2.4 of the 2024 version of the Code was renumbered as section 5.6.4, and the language has not changed. This section is applicable to any hazardous location other than underground coal mines.

This section ensures that equipment is appropriate for the specific hazardous environment and complies with the requirements of the *Canadian Electrical Code*, which defines hazardous locations and establishes the standards for equipment approval and installation.

The intent of this requirement is to ensure that:

- Equipment is matched to the hazard—different gases, vapours, and dusts have different ignition properties, and equipment must be certified accordingly.
- The hazardous location classification (Class/Zone, Group, and Temperature Code) is correctly identified and applied.
- Equipment approvals are valid and recognized, ensuring that certification is based on testing to accepted standards.

Manager's Responsibility

5.6.5 The manager of a coal mine shall
(1) develop an inspection and maintenance schedule for all electrical equipment in use underground or in any hazardous location, as defined by the *Canadian Electrical Code*, and
(2) designate qualified persons to make the inspections and carry out the maintenance as described in the approved schedule.

Guidance: Section 5.3.1 of the 2024 version of the Code was renumbered as section 5.6.5, but the language has not changed. Effective inspection and maintenance of electrical equipment are essential for preventing electrical failures, fires, and ignition hazards in underground coal mines and other hazardous locations.

The intent of 5.6.5 (1) is to ensure that:

- Inspection and maintenance activities are planned, systematic, and proactive, rather than reactive.

- All electrical equipment is included, regardless of size, function, or frequency of use.
- Inspection intervals reflect the risk level, environmental conditions, and manufacturer recommendations.
- Hazardous location equipment receives specialized attention, ensuring that explosion-protection features remain intact and compliant.

The schedule should be reviewed periodically and updated as equipment, conditions, or regulatory requirements change.

The intent of 5.6.5 (2) is to ensure that:

- Only individuals with the appropriate training, certification, and experience perform work on electrical equipment in underground coal mines or hazardous locations.
- Inspections and maintenance are performed competently, following applicable standards, manufacturer instructions, and mine procedures.
- Personnel understand the specific hazards associated with methane, coal dust, and other explosive atmospheres.

Repair of Power System

5.6.6 At any place in an underground coal mine, or in any hazardous location where flammable gas could accumulate, the repair, adjustment, or replacement of electrical equipment shall only be carried out

(1) after the equipment has been disconnected from the power supply and is electrically dead, and

(2) in a location where the electrician doing the work is satisfied that no dangerous concentration of flammable gas is present.

Guidance: Section 5.3.2 of the 2024 version of the Code was renumbered as section 5.6.6, but the language has not changed. Repairing, adjusting, or replacing electrical equipment in underground coal mines or in hazardous locations requires strict controls to prevent ignition of flammable gases. Methane and other explosive atmospheres may accumulate unexpectedly, and electrical work can introduce sparks, arcs, or heat sources capable of triggering an explosion. This section ensures that electrical work is performed only under conditions that eliminate these risks.

The intent of 5.6.6 (1) is to ensure that:

- No live electrical components are exposed during work, eliminating the risk of electrical shock or arcing.

- Stored energy is safely discharged, and equipment is verified as deenergized using appropriate testing devices.
- Lockout and tagging procedures are followed to prevent accidental re-energization.

The intent of 5.6.6 (2) is to ensure that:

- Atmospheric conditions are verified as safe before electrical work begins.
- A certified person with knowledge in hazardous gas testing assesses the area using appropriate gas monitoring equipment.

Flammable Gas Warning

5.6.7 In any location where flammable gas could accumulate in dangerous amounts, the manager shall ensure that an approved automatic gas detector is available to continually monitor the air at that location. The monitor shall be of a type that will give an audible or visual warning whenever a predetermined percentage of flammable gas is present.

Guidance: Section 5.3.3 of the 2024 version of the Code was renumbered as section 5.6.7, but the language has not changed. In underground coal mines and other hazardous locations, flammable gases such as methane can accumulate unexpectedly and reach dangerous concentrations. Continuous monitoring is essential to detect rising gas levels early and to provide timely warnings that allow workers to evacuate, shut down equipment, or take corrective action.

The intent of this requirement is to ensure that:

- Continuous monitoring is maintained in areas where gas accumulation is possible, including worked-out areas, headings, equipment bays, and locations with restricted ventilation.
- Only approved gas-detection equipment tested and certified for accuracy, reliability, and suitability for underground coal environments is used.
- Early warning is provided before gas concentrations reach hazardous levels, allowing preventive action to be taken.
- Workers are alerted immediately through audible alarms, visual indicators, or both, depending on the detector's type and location.

Sections 5.71 and 5.7.2 are repealed.