

Revision Summary

Version	Author	Reasons for Change	Approver	Date Approved
1.0	M Imamura	New document	M Guantero	29 Aug 2018
1.1		Remove use of shock and flash hazard form	M Guantero	1 Oct 2019



1: Purpose and scope

This document sets the requirements for performing electrical work for and on behalf of Z Energy Limited (Z).

Definition of Electrical Work

For purposes of this document, "live electrical work" is defined as any task that involves

- **working "on" an electrical system or equipment** that is operating at a voltage of 50 volts or more and that has "**exposed live parts**"

The inherently safer and preferred practice is to place electrical equipment or systems (conductors and/or exposed parts) of 50 volts or more into an **electrically safe** work condition first before work is begun.

Electrically safe

This means, in relation to works, installations, fittings, appliances, and associated equipment, that there is no significant risk that a person or property will be injured or damaged by dangers arising, directly or indirectly, from the use of, or passage of electricity through, the works, installations, fittings, appliances, or associated equipment.

Exposed Live Parts

Energized, conductive components capable of being inadvertently touched or approached within an unsafe distance by a person. This term is applied to parts that are not suitably guarded, isolated or insulated.

Extra Low Voltage (ELV)

Voltage not exceeding 50V AC or 120 V ripple-free DC

High Voltage

Voltage exceeding 1000V AC or 1500V ripple-free DC.

Live Line Work

Means any high voltage work performed under approved procedures inside the minimum approach distance (MAD), on or near components of a line capable of being energised to high voltage without implementing the full protective practice of isolating, proving de-energised and earthing.

Low Voltage

Exceeding extra-low voltage (50V AC or 120V DC), but not exceeding 1000V AC or 1500V ripple-free DC.

Working near energised electrical equipment

Performing any type of activity within the Limited Approach Boundary of energized exposed live parts or equipment. Refer to 5.1.3.2.

Working on energised electrical equipment

Performing activities that require contact with exposed live parts on electrical equipment, circuits or components either through the use of tools or by hand, regardless of whether or not personal protective equipment is being employed.

Applicability

This document applies to all persons working for and on behalf of Z or its subsidiaries, i.e. employees, contractors, sub-contractors, franchisees, and retail site staff, as well as visitors and other third parties on premises operated by Z or its subsidiaries.

Compliance shall be the responsibility of all employee, contractor, retailer and retail site staff or 3rd party working for or on a Z area of business. This is a Z procedure and adherence to the procedure is not required in any area controlled exclusively by another third party.

The requirements of this document, shall apply in addition to any applicable laws and regulatory requirements, including the latest electrical code of practice as issued by WorkSafe. This document takes precedence only where its requirements exceed those of applicable laws and regulatory requirements.

All applicable laws and regulations shall be complied with when performing any work, either within or beyond the scope of this policy.



2: Hazards



Electrical

Applicable LifeSavers



3: References

External References

- Health and Safety at Work Act 2015
- Electricity (Safety) Regulations 2010 (<http://www.legislation.govt.nz/regulation/public/2010/0036/latest/whole.html>)
- New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECP 34:2001) <https://worksafe.govt.nz/dmsdocument/1565-new-zealand-electrical-code-of-practice-for-electrical-safe-distances-nzecz-34-2001>
- OSHA's Train-the-Trainers Guide to Electrical Safety For General Industry (https://www.osha.gov/dte/grant_materials/fy07/sh-16615-07/train-the-trainer_manual2.pdf)

ZORM Documents

- Z's Approach to managing operational risks
- Z's Approach to managing operational integrity
- Z's Permit to Work Manual
- Z's Drug and Alcohol Policy
- Managing fatigue at Z - QRG
- PPE Matrix - QRG
- PPE Specifications – QRG
- Energised Electrical Work Certificate

4: Roles and responsibilities

General Manager-BU	<ul style="list-style-type: none"> • Ensure business unit compliance to this procedure
HSSE Operations Manager	<ul style="list-style-type: none"> • Responsible for maintaining and confirming the implementation of this procedure
Senior Permit Issuer	<ul style="list-style-type: none"> • Ensure any tasks that involves working at heights is managed under the Z Permit to Work System (PTW)
Permit Issuer	<ul style="list-style-type: none"> • Confirm that the hazards associated with the electrical work have been identified and assessed and that the identified controls are adequate to perform the work in a safe and environmentally-sound manner prior to authorising and issuing the Permit to Work • Ensure that the contractor complies with the requirements stipulated in this document • Ensure only a competent person performs electrical work and/or electrical isolations
Permit Holder	<ul style="list-style-type: none"> • Completes a Safe Work Method Statement (SWMS)/Hazard Identification and Task Risk Assessment (HITRA)/Job Safety Analysis (JSA) that reflects the Hierarchy of Control before Work at Height commences • Ensure all equipment used comply with relevant code of practice or regulation, be fit for purpose, well maintained and certified where required
Service provider/Contractor performing live line work	<ul style="list-style-type: none"> • Meet as a minimum standard all the requirements of New Zealand Electrical Code of Practice for High Voltage Live Line Work (NZECP 46.2003) • Have in place an effective process to regularly monitor and review all aspects of live line work;



	<ul style="list-style-type: none"> • Have in place an effective process to inspect the field performance of live line work • Have in place an effective process to regularly review the health of live line workers • Have in place an effective risk management process • Have documented and approved work techniques for live line work to ensure that they can be carried out reliably and safely. • Keep for each live line worker adequate records of the training undertaken and live work history of each live line worker
Authorised Electrical Person	<ul style="list-style-type: none"> • Competent in isolation of hazardous energy and is capable of recognizing electrical hazards • Accesses the appropriate reference materials if needed • Conducts tests to verify the equipment is in an electrically safe work condition • Installs and removes isolation devices and safely returns equipment to operational condition • Can carry out electrical isolations or tripping of circuits operated at extra low voltages (any voltage normally not exceeding 50 volts A.C. or 120 volts D.C.).
Qualified Electrical Person	<ul style="list-style-type: none"> • Has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved • Identifies and communicates any needed changes in work scope or changes in conditions to their supervisor immediately • Reviews and participates in hazards assessment and in identifying controls to be implemented • Verifies equipment is properly de-energized, isolated, and locked and tagged before applying personal locks • Tests equipment before touching it to ensure it has been properly de-energized • Carry out electrical isolations or tripping of circuits operated at low voltage circuits (any voltage exceeding 50 volts A.C. or 120 volts D.C. but not exceeding 1000 volts A.C. or 1500 volts D.C.) or high voltage circuits (exceeding 1000 volts A.C. or 1500 volts D.C.). • Testing step of isolation on systems/equipment above 50 volts with exposed parts (potentially energized)
Standby person (live electrical work)	<ul style="list-style-type: none"> • Alert the work team to any potentially unsafe actions or lack of compliance with an approved work procedure or technique. • Be certified and competent to carry out the particular work being observed; • Be positioned at a suitable location to observe the work being performed; • Have the authority to temporarily suspend the work at any time; • Maintain effective and immediate communication with the work team at all times; • Not perform any other task whilst live electrical work is in progress; and • Suspend all work in the event of having to leave the site or significantly change position until he/she has returned/reached a new location or has been replaced. • Monitors use of overhead equipment to prevent equipment or personnel from entering the limited approach distance or coming into contact with live exposed electrical parts • Helps establish the limited approach zone and maintains the barricades • If filling a dual role as a rescue person ensures that CPR and AED equipment (if available) is immediately available outside the space for rescue and knows how to use it <p>The Standby Person's role may be rotated among members of the work team, for example to reduce fatigue. When this occurs it shall be formally handled such that all members of the work party are aware at all times who is performing the role of the Standby Person.</p>



5: Requirements

All electrical works shall be managed under the **Z Permit to Work System** (PTW).

Work permit is required for all live electrical works, including working on or near an energised electrical equipment.

An **Energised Electrical Work Certificate** must be used in conjunction with the permit to provide a higher level of detail on the controls to be put in place to manage the activity. This certificate is valid for up to 8 hours but can be extended once up to a maximum of 16 total hours, providing all conditions remain the same and it is safe to work.

Where electrical isolation is required, refer to the **LOTO procedure**.

5.1 Hierarchy of controls

At all times, when working on electrical equipment make a risk assessment and apply the "Hierarchy of Controls", in descending order. Apply additional risk controls so far as reasonably practicable.

5.1.1 Eliminate the risk

5.1.1.1 Electrical isolation

Avoid working on energised electrical equipment where possible. The inherently safer and preferred practice is to place electrical equipment or systems (conductors and/or exposed parts) of 50 volts or more into an electrically safe work condition first before work is begun.

Electrical Isolation can only be carried out by a competent and qualified electrician, except for the following two exceptions which may be carried out by appropriately trained personnel:

- Electrical isolation on circuits operated at extra low voltages (extra low voltage: any voltage normally not exceeding 50 volts A.C. or 120 volts D.C.).
- Tripping of circuit breakers on extra low or low voltage circuits (low voltage: any voltage exceeding 50 volts A.C. or 120 volts D.C. but not exceeding 1000 volts A.C. or 1500 volts D.C.).

Note: Authorized Electrical Persons can conduct isolation under these exceptions. However, the testing step of isolation on systems/equipment above 50 volts with exposed parts (potentially energized) needs be conducted by a Qualified Electrical Person.

Refer to the LOTO procedure for the steps on electrical isolation.

5.1.1.2 Electrically unsafe equipment

We DO NOT allow the use of any installations, fittings, or appliances that are **electrically unsafe**.

Electrically unsafe means that there is a significant risk that a person may suffer serious harm, or that property may suffer significant damage, as a result of dangers arising, directly or indirectly, from the use of, or passage of electricity through, the works, installations, fittings, appliances, or associated equipment.

5.1.2 Isolate the hazard

When electrical isolation is not possible, the person who does work on any works, installations, fittings, or appliances must, while doing the work, must ensure, so far as is reasonably practicable, that people and property are protected from dangers arising from the work.

5.1.2.1 Grounding/Earthing

This means providing an intentional connection to earth through a ground connection of sufficiently low impedance and with sufficient current carrying capacity as to prevent voltage build-up that might result in undue hazard to persons or to connected equipment. This also is referred to as "earthing." Equipment to be grounded to prevent feedback include:

- All switchgear buses;
- All feeders from sub-stations;
- All open wire lines, and
- All motor circuits over 600 volts, nominal.

Grounding Previously Energized Parts

Grounding of previously energized parts shall include the following steps in sequence:

1. Connect one end of the grounding device to an effective ground;
2. Test the previously energized part for voltage;
3. If part(s) are free from voltage, complete the grounding by securely attaching the grounding device to the part using live line tools, and

If the voltage test indicates the part(s) are not free from voltage, do not attach the ground to the part. Determine the source of the voltage to ensure the presence of this voltage does not prohibit safe



completion of grounding.

Removing Grounds

Grounds may be temporarily removed by a qualified electrical person for testing. During the testing, consider the previously grounded lines and equipment to be energized. The following steps shall be followed in sequence for removing grounds:

1. Remove the grounding devices from the de-energized parts using live line tools, and
2. Remove the connection to the ground.

5.1.2.2 Barricades and signage

Access to the work site shall be controlled at all times when work is in progress. Barricades must be erected and signs posted to prevent unauthorised access.

5.1.3 Minimise the hazard

A person who has control of electrical works, must minimise, so far as is reasonably practicable, the risk of injury to persons or damage to property from dangers arising from direct or indirect contact between any live exposed conductive parts of the works and any person.

5.1.3.1 Minimum approach distance (MAD) limits working near exposed lived parts

Minimum safe distances from exposed live parts shall be maintained at all times. Where necessary, insulating barriers shall be used to maintain minimum safe approach distances.

For non-competent persons

For non-competent persons working near exposed live parts, where written consent from the owner of the live parts has not been obtained, the minimum safe approach distances limits are:

- (a) For circuit voltages 110 kV and below - 4 m
- (b) For circuit voltages above 110 kV - 6 m

For competent persons

Competent persons are those who can demonstrate that they have the necessary knowledge, skills and experience to carry out electrical work in the vicinity of overhead electric lines, or exposed live metal, safely and to the standards used by the employer.

The minimum safe approach distance limits for competent employees carrying out electrical or telecommunications work near exposed live parts shall not be less than those set out in Table 1 (taken from NZECP 34:2001).

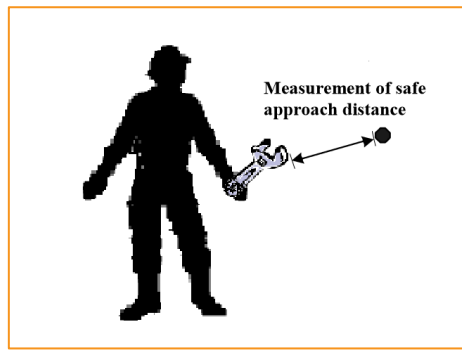
The minimum safe approach distance for competent employees shall be maintained by keeping all parts of the body, clothing and any hand held tools (except those tools designed for contact with live parts) beyond the safe distances set out in Table 1 (see Figure 1).

Table 1. Minimum safe approach distance limits for competent employees from exposed live parts

Nominal Voltage	Distance Limits (m)
Not exceeding 1 kV A.C. or D.C.	0.15
Exceeding 1 kV but not exceeding 6.6 kV A.C. or D.C.	0.25
Exceeding 6.6 kV but not exceeding 11 A.C. or D.C.	0.3
Exceeding 11 kV but not exceeding 22 kV A.C. or D.C..	0.45
Exceeding 22 kV but not exceeding 33 kV A.C. or D.C.	0.6
Exceeding 33 kV but not exceeding 50 kV A.C. or D.C.	0.75
Exceeding 50 kV but not exceeding 66 kV A.C. or D.C.	1
Exceeding 66 kV but not exceeding 110 kV A.C. or D.C.	1.5
Exceeding 110 kV but not exceeding 220 kV A.C. or D.C.	2.2
Exceeding 220 kV D.C. but not exceeding 270 kV D.C.	2.3
Exceeding 270 kV D.C. but not exceeding 350 kV D.C.	2.8
Exceeding 220 kV A.C. or 350 kV D.C.	4

Figure 1. Measurement of minimum safe approach distances (Source: NZECP 34:2001)

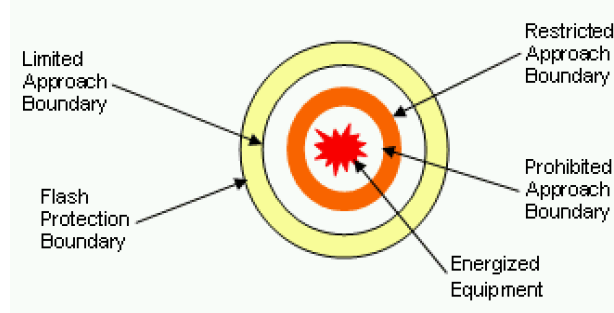




5.1.3.2 Protection Boundaries

Designate specific approach boundaries to protect employees from potential arc flash while working on or near energized equipment. Different equipment will have different approach boundaries, hence calculations must be made on each piece of equipment. These boundaries are shown in Figure 2.

Figure 2. Approach/Flash Boundaries (Source: US National Fire Protection Association)



- **Flash Protection Boundary (outer boundary):** The flash boundary is the farthest established boundary from the energy source. If an arc flash occurred, this boundary is where an employee would be exposed to a curable second degree burn (1.2 calories/cm²)
- **Limited Approach:** An approach limit at a distance from an exposed live part where a shock hazard exists. Personnel other than **Qualified or Authorized Electrical Persons** must maintain a minimum safe distance of **4 metres** from exposed live electrical components or parts.
- **Restricted Approach:** An approach limit at a distance from an exposed live part which there is an increased risk of shock. Only **Qualified Electrical Person** can work at or closer than the restricted approach boundary.
- **Prohibited Approach (inner boundary):** A distance from an exposed part which is considered the same as making contact with the live part. To cross the *prohibited approach boundary* and enter the *prohibited space* is considered the same as making contact with exposed live parts, the **Qualified Electrical Person** must:
 - Have specified training to work on exposed live parts and be approved by authorized management.
 - Use personal protective equipment appropriate for working on exposed live parts and rated for the voltage and energy level involved.

5.1.3.3 Light Conditions

Live line work shall only be performed when there is adequate light.

5.1.3.4 Personal Protective Equipment

Personal protective equipment to be used will be determined by the HITRA. In any event, a qualified electrical person taking any part of his body or conductive object to energized circuits at 50v or above closer than the Restricted Approach Boundary, must be protected from electrical contact by one of the following:

- The qualified electrical person is insulated from the energized parts operating at 50v or above, usually by the use of rubber gloves and rubber sleeves. Un-insulated parts of the body must remain out of the Restricted Approach Boundary.
- The energized part operating at 50v or more is insulated from the qualified person and any other conductive object at a different potential.

Personal and protective apparel worn by lineworkers shall include as a minimum:



- Full body coverage, fire resistant clothing. Workers should consider wearing underclothing of fire resistant material, such as cotton, to reduce the severity of injuries in the event of fire.
- Hard hats.
- Protective footwear with non-slip soles, including conductive boots when appropriate.
- Suitable eye protection shall be provided and used at all times. Anti-glare eye protection should be used as appropriate.

Conductive Clothing

Conductive clothing shall be worn where necessary to limit discomfort from induced static discharges.

Wearing of Metallic Objects

Metallic objects such as neck chains, earrings and other body adornments, rings, watches and bracelets should not be worn while carrying out live line work.

Long Hair

Long hair shall be securely fixed and confined close to the head.

Restraint of PPE and Tooling

The free end of body belts, pole straps and ropes shall be restrained from infringing the live line minimum approach distance.

5.2 Competency

Specialised training and competencies are required before an individual is to be assigned to carry out electrical work. Table 2 specifies these training requirements.

Table 2. Training and competency requirements for electrical work responsibilities

Roles	Training	Description
Live line worker	Registration as a Line Mechanic; OR Equivalent Line Mechanic National Certificate in the appropriate lines discipline; OR Equivalent documented proof of qualifications or training as a line worker (as determined by NZQA); AND documented evidence of 2 years' post certification/registration experience in general line work, including current competence in the equivalent earthed line processes to be undertaken live; OR Registration as an Electrician or Electrical Inspector; or be a Qualified Engineer; AND documented evidence of 4 years post registration or qualification experience in general line work, including current competence in the equivalent earthed line processes to be undertaken live	
Standby person for live line work	Demonstrate knowledge on the hazards associated with the electrical work and the minimum approach distance If filling a dual role as a rescue person, trained and competent in First Aid and use of AED equipment (if available)	
Authorised Electrical Person	Trained and competent to carry out: <ul style="list-style-type: none"> - electrical isolations on circuits operated at extra low voltages (extra low voltage: any voltage normally not exceeding 50 volts A.C. or 120 volts D.C.). - tripping of circuit breakers on extra low or low voltage circuits (low voltage: any voltage exceeding 50 volts A.C. or 120 volts D.C. but not exceeding 1000 volts A.C. or 1500 volts D.C.). 	
Qualified Electrical Person	Registered as an Electrician or Electrical Inspector; or be a Qualified Engineer AND Trained and competent to carry out: <ul style="list-style-type: none"> - electrical isolations on circuits operated at high voltages (voltage exceeding 1000 volts A.C. or 1500 volts D.C.). - tripping of circuit breakers on high voltage circuits (exceeding 1000 volts A.C. or 1500 volts D.C.). - testing step of isolation on systems/equipment above 50 volts with exposed parts (potentially energized) 	



5.3 Fitness for work

- A competent person must be physically fit for the task, must have the ability to identify hazardous conditions, and must take action to maintain a safe workplace.
- The contractor providing the live line work must ensure that a medical examination is carried out by a qualified occupational health practitioner to check that the live lineworker can physically meet the requirements to carry out the intended work and has no medical condition that could affect the safety of the lineworker or the work team.
- If workers are exposed to extreme temperatures or physical demands, refer to **Managing Fatigue at Z guidelines** to address the risks of fatigue (HS-HAW-H-GUI-001).
- Workers must comply with **Z's Drug and Alcohol policy**. Z requires the performance of its staff, contractors and others on Z premises or operating equipment on Z's behalf to be unimpaired by alcohol or drugs.

5.4 Equipment inspection

All equipment to be used in the live line work must comply with requirements stipulated in New Zealand Electrical Code of Practice for High Voltage Live Line Work (NZECP 46.2003), Section 1.3.5.

All insulating equipment shall have an electrical rating suitable for the voltage being worked on.

Leaving of Live Line Insulating Equipment on Energised Lines

Live line insulating equipment should not be left on energised lines for extended periods such as overnight. Where this is necessary, they shall not subsequently be depended upon to protect the live lineworker. Before re-use they shall be removed, cleaned and visually inspected, and, if suspect, submitted for electrical test.

5.5 Live line work

5.5.1 Line hazard identification

The Permit Issuer shall advise the Contractor of any known hazards that have the potential to impact on the safe outcome of the work, e.g. conductor corrosion, defective insulator types, corroded or defective fittings or structures, and known overcrossings of other lines. This should be captured and recorded in the Hazard Identification and Task Assessment (HITRA) form.

The Permit Holder, with the working team, must inspect the work site to identify electrical and non-electrical hazards that could impact upon the safety of the working team or the site staff.

5.5.2 Weather Conditions at Worksite

Work shall not proceed and the work team shall keep clear of the circuit in the event of the following:

- An electrical storm is observed in the vicinity of the worksite.
- Any significant rain (beyond intermittent spotting), mist, fog, snow or sleet unless using techniques and equipment specifically designed and tested as being able to operate whilst wet.
- When using live line rope, any threat of rain, mist, fog, snow or sleet.
- Excessive wind velocities, such that work cannot be continued in safety.

5.5.3 Fault Current Protection

Protective devices shall be operational in the circuit being worked on. These devices shall be capable of detecting and clearing faults at the worksite.

5.5.4 Disabling of Auto-Reclose

All auto-reclose equipment controlling the section of the circuit on which live line work is to be performed shall be blocked for the duration of the work. This reclosing equipment shall be tagged with an appropriate safety tag.

5.5.5 Multiple Live Line Permits on the Same Circuit

Where more than one work team is working on the same circuit but at different locations, the procedure shall ensure that all teams have cancelled their work permits before the reclose features and/or processes (or restart for HV d.c.) are returned to normal.

5.5.6 Work Team Communications

Each work team shall establish a reliable on-site two-way communications link with the Permit Issuer and Permit Holder. Where practicable, and/or required by the Permit Issuer, appropriate calls at specified times should be agreed upon between the work party and the Control Room, or equivalent. The integrity of the communications link should be checked at regular intervals during the course of the work to ensure it is functioning correctly.



5.5.7 Crane Operation

Where work requires crane, prior to the commencement of work, crane operators shall be instructed on the procedure and safe working distances to be used. The crane operator shall be under the direct and immediate supervision of a competent nominated member of the live line team.

5.5.8 Manual Reclose or Other Planned Switching of a Circuit

In the event that a manual reclose or other planned switching of a circuit is required, the work teams shall move clear of the circuit prior to the switching being attempted.

5.6 Work on De-Energised or Earthed Circuits

Live line work methods may be used to work on a circuit that is de-energised or earthed provided that all work is undertaken as though the circuit is energised.

5.7 Other Activity

When live line work is being performed, no other activity that could compromise the safety of the work team shall be carried out.

5.9 Notifying WorkSafe of danger

Electricity (Safety) Regulations 2010 stipulates that if a person carrying out the following works listed below has reasonable grounds to believe that the works, installation, fitting, or appliance presents an immediate danger to life or property, the person must, as soon as practicable, advise Z and WorkSafe of the danger. This applies to the following:

- When carrying out prescribed electrical work, including while acting under an exemption;
- When carrying out a periodic assessment under [regulations 75, 78D, 78G, and 78K](#);
- When examining a connectable installation with a view to issuing a warrant of electrical fitness under [regulation 78](#).

The advice must include:

- details of the nature of the danger; and
- how and why the works, installation, fitting, or appliance presents an immediate danger to life or property; and
- any steps that have been taken, or that the person reasonably believes should be taken, to minimise or eliminate the danger.

