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ELECTRICAL SUPPLY AND EQUIPMENT

HYER STANDARD

PROCEDURE

CONTENTS +

PURPOSE AND SCOPE

It is the purpose of this procedure to ensure that electrical work and use of electrical equipment is undertaken safely without risk of injury to workers. This procedure applies to all HY projects.

RESPONSIBILITIES

HY PROJECT TEAM

- Ensure inspections and verifications of electrical equipment and installations are performed and reports are obtained

- Ensure applicable Work Permits are implemented prior to commencing work
- Ensure only trained and competent persons perform work on site
- Ensure worker competencies and qualifications are verified prior to commencing work
- Ensure that SWMS are provided for any work that is carried out on or near energised electrical installations or services

HAZARD IDENTIFICATION RISK ASSESSMENT AND CONTROL (HIRAC)

All risks associated with electrical work and use of electrical equipment are to be included in the project risk register. This includes risks associated with:

- Electric shock, received by direct or indirect contact, tracking through or across a medium, or by arcing
- Fire (such as fire resulting from an electrical fault), arcing or explosion causing burns
- Electric shock from 'step-and-touch' potentials
- Other risks associated with electric shocks such as falls from ladders, scaffolds or other elevated work platforms

TRAINING AND COMPETENCY

Electrical work, whether energised or de-energised, must only be carried out by appropriately licensed or registered electrical workers. All electrical installations must be conducted by qualified electrician as per AS/NZS 3000. Qualifications must be verified as per the Site Induction procedure.

Apprentice electricians must be supervised at all times. Supervisory levels and ratios must be in accordance with the state advisory bodies' requirements.

Safety Observers supporting electrical works must be trained in low voltage rescue and Cardiopulmonary Resuscitation (CPR) as a minimum. They must be trained in the subcontractor's rescue procedures, inducted into the relevant SWMS, and be able to use the subcontractor's electrical rescue kit.

TEMPORARY ELECTRICAL SUPPLY

All electrical supplies used for the purpose of construction and demolition work (including temporary installations) must have RCD protection installed and utilised.

SWITCHBOARDS

All switchboards (main and distribution boards) must be installed in accordance with AS/NZS 3012. They must be readily accessible and protected from damage during the course of construction and/or demolition work. Switchboards must be securely attached to a pole, post, wall, floor or other structure of a stable, freestanding design that takes into account any external forces that may be exerted on the switchboard (e.g. by flexible cord).

Requirements for switchboard construction include, but are not limited to, the following:

- Robust construction and materials to withstand mechanical damage from environment and other external influences that may be expected at the location
- The enclosure must have a degree of protection appropriate for the environment in which it is installed
- Where provided with a door or lid to maintain a degree of protection, the door or lid must:
- Require the use of a tool for removal
- Be fitted with a facility for locking
- Be fitted with a means of retention in the open position
- Not damage leads and allow for the safe entry of leads if the switchboard is provided with socket-outlets
- Display a clearly visible and legible sign fixed on the external surface e.g. words to the effect of ‘KEEP CLOSED – RUN ALL LEADS THROUGH BOTTOM’
- Be kept closed except when access is required

Where there is more than one switchboard on site, markings must be provided by means of numbers, letters, or both, to distinguish one switchboard from another.

TEMPORARY DISTRIBUTION BOARDS

All temporary Distribution Boards must be registered in HammerTech as an item of Electrical Equipment and the Distribution Board Checklist completed by the installing electrician for each distribution board, post-installation. The electrician is to supply a Certificate of Compliance (COC) for each distribution board once installed. This is to be added to the Board's registered Equipment Profile.

Distribution Boards must be of robust construction, weatherproof and secured against unauthorised relocation or damage by environmental factors. As per AS3012, RCDs must also have a lockable cover and must remain locked to prevent unauthorised access.

CONSTRUCTION WIRING

Cables and fittings used in construction wiring must comply with the requirements of AS/NZS 3000.

Prior to the installation of construction wiring (or whenever change occurs) the risk of the cables being exposed to mechanical damage must be assessed. Where there is a risk of damage the cables should be installed in an alternative location. Where this is not possible, cables must be protected by a suitable enclosure or barrier.

The following are typical examples of situations where cables require mechanical protection:

- Construction wiring installed
- on any surface within 2.5 m of the floor or ground level
- on any surface and within 150 mm of scaffolding
- within 150mm of unearthed metal structures being installed as part of the construction process (e.g. sheet metal ducts and hydraulic piping)
- across the top of transportable structures, storage containers, shipping containers or the like
- across or over metallic roofs or edges

- in adverse conditions (e.g. extreme temperature, harsh environment – heat, chemical exposure, mechanical damage)
- Construction wiring affixed to a concrete ceiling slab more than 150 mm away from the juncture of the ceiling slab and a wall or beam that would otherwise provide protection

Construction wiring must be easily identifiable from permanent wiring by using cable sheaths of a different colour or by attaching iridescent yellow tape spaced at intervals not >5 m and marked with the words 'CONSTRUCTION WIRING'.

Overhead wiring must be positioned to avoid crossing roadways or access ways where cranes, high loads or heavy vehicles may travel. Where this is not practicable, an effective means to minimise the risk of contact by mobile plant must be provided. This may include flagged catenary wires or cables of suitable material across the access way at:

- 6 m on either side of the overhead wiring; and
- 6 m below the lowest point of the overhead electrical cables or lower.

A record must be maintained in the form of "as builts", drawings or a site layout indicating all in ground and in slab service locations.

RESIDUAL CURRENT DEVICES (RCD)

All portable generators must be RCD protected and where required by the manufacturer be earthed (self earthing or stake) prior to use. RCDs must also be used for equipment connected to a permanent onsite supply (e.g. general purpose outlet).

On Construction or Demolition Sites:

- Portable RCDs and RCDs used on portable equipment (including generators) must be verified (push button test) after connection to a socket, before connection to equipment, and at least once per day when in use. Operating time tests for portable RCDs are to be conducted once every 3 months.
- Fixed RCDs are to be push button tested once per month and operating time tests are to be conducted once every 12 months.

Records of trip time values for RCD tests are to be provided to HY.

The date of monthly push button testing for fixed RCDs is to be recorded and displayed on or next to the RCD for easy identification. This may be using a register, sticker, or other appropriate means that indicates the date of the test and who it was performed by.

Only authorised personnel are permitted to re set an RCD. The fault must be investigated by a qualified electrician and root cause concluded. Although faults can be intermittent, NEVER switch onto a fault.

LIGHTING

Minimum lighting should be 40 lx for walkways and 160 lx for general areas. Lamps must be protected against mechanical damage.

Lift shaft lighting should be:

- at a minimum lighting level equivalent to that provided by a 36 W fluorescent and guarded against mechanical damage;
- connected to supply via a plug and socket arrangement; and
- installed at intervals not exceeding 6 m with the uppermost fixture installed within 1 m of the top of the lift shaft.

Emergency lighting must be provided:

- in designated access and egress paths; and
- directly above and in front of switchboards, on all demolition and construction sites where the general lighting requirements cannot be met using natural lighting.

Distribution Boards are to have lighting with emergency battery backup fitted.

Emergency lighting must provide an average of 20 lx at 900 mm above floor level long the centre line of the corridor. The emergency lighting level must be provided for a minimum of 1 hour following loss of normal lighting in the area.

PLANT SAFETY VERIFICATION

Generators must be approved for use at site as per the Plant and Equipment procedure.

INSPECTION AND TESTING

All electrical equipment must be visually inspected for obvious damage and wear prior to use.

All construction wiring, including switchboards, fixed RCDs, and transportable structures are to be inspected and tested by a qualified electrician to verify they are in accordance with AS/NZS 3000 and AS/NZS 3012 following initial installation.

These records are to be maintained in the Registers module within HammerTech.

CERTIFICATE OF COMPLIANCE

A Certificate of Compliance (COC) must be obtained for all new or altered electrical installations prior to them being made available for energisation. The COC must be issued as per the relevant state's regulatory requirements. The COC must be issued per the relevant state's regulatory requirements and include the recording of values for continuity of earthing system and insulation resistance values where required.

Records are to be input and maintained against the equipment profile in the Equipment module within HammerTech.

PERIODIC TESTING

Appliances and portable equipment used on construction/demolition sites is to be tested and tagged by a qualified electrician every 3 months.

Transportable structures, fixed and transportable equipment, and construction wiring is to be tested and tagged by a qualified electrician every 6 months.

Hire equipment requiring electrical inspection is to be tested and tagged prior to use on site. If hire equipment is on site long term it is subject to the above applicable inspection periods. 6 monthly for transportable/fixed equipment and 3 monthly for appliances and portable equipment.

Testing and tagging of appliances, corded equipment, and extension leads is to be undertaken by a:

1. licensed electrician, or
2. licensed electrical inspector, or
3. person who has successfully completed a

structured training course and been deemed competent in the use of a pass-fail type portable appliance tester and the visual inspection of electrical equipment.

Appliances, portable electrical equipment and flexible extension cords that pass testing must be tagged as tested and safe to use and test results recorded and kept on site or made available as required.

UNSAFE ELECTRICAL EQUIPMENT

Unsafe electrical equipment must be disconnected and isolated from its electricity supply. It must be tagged out "Warning Out of Service – DO NOT USE" until it is repaired and/or tested by a competent person and found to be safe or is replaced or permanently removed from use.

FLEXIBLE CORDS AND EXTENSION LEADS

Extension leads must be heavy-duty and sheathed. Extension leads must not be run between floors other than for formwork, stairwells & external staging.

Flexible cords and extension leads must not be subject to mechanical damage, damage by liquids or damage by high temperature. Where they are >4 m in length or are not in the view of the personnel using the electrical equipment, they must be:

- Provided with suitable protection against, or located where they are not subject to, mechanical damage, damage by liquids or high temperature; or
- Suspended off the floor or ground on stands or hangers covered with material that is non-conducting and will prevent mechanical damage to the cable.

Double adapters and 3-pin plug adaptors (piggyback) must not be used.

WORKING DE-ENERGISED

Electrical work must not be carried out on electrical equipment while the equipment is energised, subject to the following prescribed exceptions:

- It is necessary in the interests of health and safety that the electrical work is carried out while the equipment is energised (e.g. it may be necessary for life-saving equipment to remain energised and operating while electrical work is carried out on the equipment)
- It is necessary that the electrical equipment to be worked on is energised in order for the work to be carried out properly
- It is necessary for the purposes of testing to ensure the equipment is de-energised
- There is no reasonable alternative means of carrying out the work

These requirements in relation to energised electrical work do not apply to work carried out by or on behalf of electricity supply authorities on the electrical equipment.

Note – all electrical equipment and cables must be treated as energised until isolated and determined not to be energised. Prior to electrical work, equipment and cables must be:

- Isolated and de-energised, including ensuring that it cannot be inadvertently be re-energised
- Tested by a competent person to determine whether it is energised or not
- 'Tested for dead' before touched

Refer to the Lock Out Tag Out process in the Isolations procedure.

WORKING NEAR ENERGISED ELECTRICAL INSTALLATIONS OR SERVICES

A SWMS must be prepared for construction work that is to be carried out on or near energised electrical installations or services.

Permanent wiring located where construction or demolition work is to be carried out must be regarded to be energised until proven otherwise by inspection and testing. All energised permanent wiring must be identified and

assessed for the risk of electric shock or mechanical damage from construction or demolition activities. Where the risk of electric shock or damage exists, wiring must be:

- Appropriately labelled to highlight the danger of energised parts
- Protected as per requirements for construction wiring

Live permanent wiring that is located where construction activity is occurring, must be marked (or its location) with the words 'LIVE WIRING' at intervals not >5 m. Signage may also be required at the entry to and in areas highlighting live services in the area.

Refer to Underground and Overhead Services procedure.

TOOLS AND EQUIPMENT FOR ELECTRICAL WORK

All insulated tools and equipment must be suitable for the electrical work, be rated for the voltage being worked on and be maintained in good working order, including regular maintenance, inspection and testing.

Metallic, wire reinforced or otherwise conductive ladders must not be used:

- for any kind of electrical work
- near equipment where an electrical hazard may result from their use

Test instruments that are to be used or connected to electrical equipment must meet the following conditions:

- be suitable for the work in terms of their function, operating range and accuracy
- be in good condition and working order, clean and have no cracked or broken insulation
- pose no danger of electrocution to workers or damage to the electrical equipment during testing
- have suitably insulated leads and connection probes (double insulted and fused) that enable connection or contact with energised parts to be made with minimal risk to the electrical worker
- provide suitable protection against hazards arising from over-voltages that may arise from or during the testing or measurement process

Testing equipment used for detecting an energised source must be trialled first to prove that it is functioning correctly immediately before and after the test has taken place. The standard test regime is to test a known source of energy, test the de-energised circuit for zero volts, and then test the known source again. A faulty indicator will always read zero so must be proved before and after the test.

All test equipment (including insulated gloves) should be inspected before and after use. It should be noted that some insulated gloves have a shelf life between 6-12 months.

EMERGENCY RESPONSE

Where electrical work is being undertaken at a site, the procedures for the response to an emergency related to electrical work must be included in the Emergency Response Plan. When establishing emergency procedures, the following must be considered:

- Electrical contact/shock
- Arc flash (burn)
- Major electrical fault
- Explosion
- Rescue of persons working near live parts
- Trained and Competent Safety Observers
- Making area safe/setting up exclusion zones where overhead or underground electrical wires have been contacted and/or damaged
- Location of isolation points

ELECTRICAL RESCUE

When working on or in close proximity to live power including energising electrical services, an electrical safety observer must be present and trained in low voltage rescue and CPR as a minimum. Training records for both LV rescue and CPR are to be uploaded to the worker's profile in HammerTech. The electrical subcontractor is to have an electrical rescue kit compliant to AS/NZS 4836 readily accessible appropriate for the task being performed. Electrical rescue is to be outlined in the Electrical subcontractor's SWMS.

DEFINITIONS AND ABBREVIATIONS

Electrical work means:

- Connecting electricity supply wiring to electrical equipment or disconnecting electricity supply wiring from electrical equipment
- Installing, removing, adding, testing, replacing, repairing, altering or maintaining electrical equipment or an electrical installation

Construction wiring – a system of wiring that is installed to provide electrical supply for construction

Permanent wiring – wiring that forms part of the permanent electrical installation of the building or site

COC – Certificate of Compliance

Portable – Able to be carried or moved by hand

RCD – Residual Current Device

Transportable – Able to be moved from one place to another

REFERENCES

- Electricity (General) Regulations 2012 (SA)
- Electrical Safety Regulation 2013 (QLD)
- Electrical Safety (General) Regulations 2019 (VIC)
- Work Health & Safety Regulation 2012 (TAS) and 2017 (NSW) – Part 4.7
- AS/NZS 3000: Electrical installations
- AS/NZS 3012: Electrical installations – Construction and demolition sites
- AS/NZS 4836: Safe working on or near low-voltage and extra-low voltage electrical installations and equipment
- Managing Electrical Risks in the Workplace (Model Code of Practice)
- Federal Safety Commission (FSC) Audit Criteria – H12: Electrical
- State Electrical Apprentice Supervisory Requirements:
    - South Australia (https://www.safework.sa.gov.au/workers/types-of-workers/apprentices-and-trainees)

- Victoria (https://esv.vic.gov.au/technical-information/electrical-installations-and-infrastructure/electrical-technical-guidelines-and-determinations/requirements-for-the-effective-supervision-of-apprentice-electricians/)
- New South Wales (https://www.safework.nsw.gov.au/hazards-a-z/electrical-and-power)
- Tasmania (https://cbos.tas.gov.au/topics/technical-regulation/electrical-standard-safety/standards/supervision)
- Queensland (https://www.worksafe.qld.gov.au/licensing-and-registrations/electrical-training/apprentices-and-trainees)

ASSOCIATED DOCUMENTS

- HYer Standard – Electrical Supply and Equipment
- Isolation and Energisation procedure (https://www.hyworkzone.com.au/isolation-and-energisation-procedure/)
- Plant and Equipment procedure (https://www.hyworkzone.com.au/plant-and-equipment-procedure/)
- Underground and Overhead Services procedure (https://www.hyworkzone.com.au/underground-and-overhead-services-procedure/)

Last Modified: December 22, 2023

ANIMATION

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