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	Risk Assessment & Safe Work Procedure For Major Electrical Equipment Installation	Revision No.: 0	Document Ref: PD-S-PRO-020	

Purpose:	This document establishes a structured methodology for the execution of major electrical equipment installation activities that are carried out safely and systematically. It aims to identify hazards, control risks to a level that is as low as reasonably practicable, prevent damage to critical equipment and ensure compliance with project specifications, statutory requirements and consultant expectations.
Scope:	Applies to all activities associated with the installation, cabling, testing and commissioning of switchgears, transformers, gensets, UPS systems, load banks, busduct systems and main switchboards. It covers heavy lifting operations, movement of equipment using cranes and mechanical handling devices, installation within electrical rooms and plant areas, interfacing with energized systems and associated testing activities.
Duties & Responsibilities:	(1) <u>Project Manager (PM)</u>: Responsible for overall planning, approval of risk assessments and method statements, allocation of resources, coordination with the consultant and main contractor. (2) <u>Construction Manager (CNM)</u>: Responsible for coordinating installation activities, ensure work sequencing is properly planned, verify that lifting plans and permits are approved and ensure safe execution of works on site. (3) <u>Safety & Health Officer (SHO) / Site Safety Supervisor (SSS)</u>: Responsible to monitor compliance with the approved risk assessment and safe work procedures, conduct inspections, verify implementation of control measures and ensure all personnel comply with site safety requirements. (4) <u>Competent Electrician (CE)</u>: Responsible for carrying out installation, alignment, termination and testing works in accordance with approved procedures, particularly ensuring strict adherence to LOTO and electrical safety practices. (5) <u>QAQC Engineer (QE)</u>: Responsible to verify compliance with approved shop drawings, installation tolerances, inspection requirements and testing criteria prior to consultant inspection and handover.
ISO Reference:	MS ISO 45001:2018 Clause No. 6.1, 8.1.2, 8.2, 9.1

Revision History			
Revision No.	Revision Date	Originator	Description of Changes

Definitions	
LOTO	Lockout-Tagout
PTW	Permit-to-Work
Electrical Equipment	Switchgears, transformers, gensets, UPS systems, load banks, busduct systems and main switchboards.
SWL	Safe Working Load - the maximum load that lifting equipment is certified to safely handle.

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Hazard Identification	Major hazards associated with installation of electrical equipment include heavy lifting operations, crane movement, equipment collapse or tipping, pinch points during positioning, electrical hazards, work at height, manual handling injuries, equipment damage during shifting, fire hazards during energization and interaction with other ongoing construction activities.
Risk Evaluation	Risk assessment shall be conducted using a likelihood and severity matrix. High-risk activities such as heavy lifting, crane operations and electrical interfacing shall require strict supervision, permit approval and implementation of engineered control measures.
Risk Control Measures	Control measures shall follow the hierarchy of controls. Heavy lifting activities shall be controlled through approved lifting plans, use of certified cranes and lifting gear, competent riggers and establishment of exclusion zones. Electrical hazards shall be controlled through strict LOTO procedures, verification of isolation and use of insulated tools. Equipment damage risks shall be minimized through proper handling techniques, use of manufacturer-approved lifting points and environmental protection measures during storage and installation.

Step	Activity	Responsibility	Reference
1	<u>Risk Assessment Methodology</u> (1) Likelihood (L): 1–5 (2) Severity (S): 1–5 (3) Risk Rating (R = L × S) (4) Risk Levels: (a) 1–5: Low (b) 6–10: Medium (c) 11–25: High	PM / CNM / SHO / SSS	
2	<u>Risk Assessment Table</u>	PM / CNM / SHO / SSS	

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						rigger, exclusion zone	
Crane lifting operation	Crane overturning	Fatality, major damage	2	5	10 (High)	Ground assessment, crane load chart verification, outriggers, lifting supervisor	Low
Forklift movement	Collision with personnel	Serious injury	3	4	12 (High)	Trained operator, spotter, barricaded movement path, speed control	Medium
Equipment shifting using rollers/skates	Pinch points/ crushing	Hand or foot injury	3	4	12 (High)	Proper shifting tools, trained personnel, hand positioning control, gloves	Low
Manual handling of accessories /components	Musculo- skeletal strain	Back injury	3	3	9 (Medium)	Team lifting, mechanical aids, lifting technique training	Low
Installation of busduct at height	Fall from height	Fatality	3	5	15 (High)	Certified scaffold, full body harness, PTW, supervision	Medium
Installation inside electrical room	Restricted access and poor ergonomics	Minor injury, fatigue	3	3	9 (Medium)	Adequate lighting, ventilation, work rotation, housekeeping	Low
Positioning and alignment of equipment	Equipment tipping/ collapse	Crush injury, equipment damage	2	5	10 (High)	Stable supports, proper jacking method, competent supervision	Low

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Busduct joint installation	Improper torque tightening	Overheating/fire risk	2	5	10 (High)	Calibrated torque tools, QA/QC inspection, manufacturer guideline compliance	Low
Electrical cable termination	Electrical shock	Fatality	2	5	10 (High)	LOTO, insulated tools, test-before-touch, competent electrician	Low
Energized testing/pre-commissioning	Arc flash	Severe burns/fatality	2	5	10 (High)	Arc-rated PPE, barricade, restricted access, permit authorization	Low
Temporary power connection	Short circuit	Fire/equipment damage	2	4	8 (Medium)	Proper cable sizing, inspection, competent electrician	Low
UPS battery installation	Battery acid exposure	Chemical burns	2	4	8 (Medium)	Chemical-resistant gloves, goggles, spill kit, ventilation	Low
Genset fuel system interface	Fuel leakage	Fire/explosion	2	5	10 (High)	Leak inspection, fire extinguisher, no smoking policy	Low
Work near live systems	Accidental energization	Fatality/system outage	2	5	10 (High)	Strict PTW and LOTO control, coordination with client	Low
Use of power tools	Cuts/noise/vibration	Injury	3	3	9 (Medium)	Tool inspection, PPE, trained users	Low
Poor housekeeping during installation	Trip hazard	Injury	4	2	8 (Medium)	Daily housekeeping, cable management, waste removal	Low

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Simultaneous activities by multiple contractors	Interface conflict	Injury/property damage	3	4	12 (High)	Coordination meetings, work sequencing, permit coordination	Medium
Fire during testing or energization	Electrical fire	Injury/property damage	2	5	10 (High)	Fire extinguishers, emergency shutdown plan, standby personnel	Low
Failure of lifting accessories	Dropped load	Fatality	2	5	10 (High)	Certified lifting gear inspection, SWL verification	Low
Inadequate grounding/ earthing	Electrical fault	Shock/equipment damage	2	5	10 (High)	Earthing continuity test, QA/QC verification	Low
Exposure to diesel fumes during genset testing	Respiratory irritation	Health effects	3	3	9 (Medium)	Ventilation, limited exposure duration, monitoring	Low
Noise during genset testing	Hearing damage	Occupational hearing loss	3	3	9 (Medium)	Hearing protection, restricted exposure	Low
Final energization of switchboards	Electrical explosion	Fatality/fire	2	5	10 (High)	Energization checklist, consultant approval, controlled energization procedure	Low

Step	Activity	Responsibility	Reference
3	<u>Safe Work Procedure</u> 3.1 <u>Pre-Installation Planning and Approval:</u> 3.1.1 Before any physical work begins, the project manager ensures that the risk assessment, method statement and any specific lifting plans have been submitted to and approved by the consultant.	PM / CNM / SHO / SS	

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	3.1.2 A site-specific Permit-to-Work (PTW) is obtained for each work zone. 3.1.3 On the day of installation, a mandatory toolbox talk is conducted with all personnel involved. The talk covers the tasks scheduled, the identified hazards, the control measures in place and emergency procedures. Attendance is signed and recorded. 3.1.4 The site is then prepared: the concrete foundation is checked for final strength, anchor bolt locations and levelness using a precision level. The room is verified to be clean, dry and free of debris. Door openings and access routes are measured to ensure adequate clearance for the electrical equipment. 3.1.5 A joint inspection of the electrical equipment itself is carried out, confirming that no damage has occurred during transit and that all components are present. 3.2 <u>Transportation, Offloading and Lifting:</u> 3.2.1 All heavy lifting and offloading operations are supervised by a competent lifting supervisor. The crane, forklift and all rigging gear are certified and have valid third-party inspection certificates. 3.2.2 An exclusion zone is established around the lifting area using hard barricades and warning signs; only essential personnel are allowed inside. The crane operator, rigger and signalman hold current certification. 3.2.3 The lifting plan specifies the weight of the equipment, the centre of gravity and the radius of the lift. Tag lines are attached to the load to control swinging.	PM / CNM / SHO / SS	

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	3.2.4 Offloading takes place directly onto heavy-duty rollers or air skates for horizontal movement. Under no circumstances is lifting performed during high winds, thunderstorms, or poor visibility. 3.3 <u>Positioning and Mechanical Installation:</u> 3.3.1 Once the electrical equipment is offloaded, it is moved to its final position using rollers, pallet jacks, or a forklift fitted with soft pads. The movement is coordinated by a single signal person to avoid pinch points. 3.3.2 For switchgear and main switchboards, the sections are positioned in sequence (outer sections first, then inner). 3.3.3 For transformers and gensets, the equipment is carefully aligned with the anchor bolts and shimmed to achieve the manufacturer's specified level. 3.3.4 After alignment, the equipment is grouted and the anchor bolts are tightened to the torque value stated in the approved drawings. 3.3.5 For UPS units, ESD-safe practices are followed throughout – anti-static mats are laid and personnel wear grounded wrist straps when handling internal components. 3.3.6 For busducts, each section is inspected internally for cleanliness and insulator integrity before joining; joint packs are bolted with a torque wrench and the torque value is recorded on a checklist. 3.3.7 Fire-rated barriers are installed at all floor and wall penetrations.	PM / CNM / SHO / SS	

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	3.4 <u>Electrical Connections and Lockout /Tagout (LOTO):</u> 3.4.1 Electrical work begins only after a verified lockout/tagout has been applied. The Competent Electrician (CE) shall identifies the upstream isolation point (the main incoming breaker or upstream switch). 3.4.2 The breaker is opened and, where possible, withdrawn to the test or disconnect position. A personal padlock and a “DANGER – DO NOT OPERATE” tag are attached. 3.4.3 CE then uses a calibrated, two-pole voltage tester to verify zero voltage on all phases (line-to-line and line-to-ground) – this is the “prove-test-prove” method: first test the tester on a known live source, then test the isolated circuit, then retest the tester on the live source. Only after zero energy is confirmed does the CE proceed. 3.4.4 All cable terminations are carried out by licensed electricians. Before termination, insulation resistance tests (megger) are performed on each cable. Busbar and cable connections are tightened with a torque wrench set to the manufacturer’s specified value; every torque value is recorded on a signed checklist. 3.5 <u>System Completion, Testing and Handover:</u> 3.5.1 After all mechanical and electrical installations are complete, the work area undergoes a thorough housekeeping sweep. 3.5.2 All tools, debris, packing materials and any loose hardware are removed. A HEPA filter vacuum is used to clean dust from the raised floor and equipment interiors.	PM / CNM / SHO / SS / CE	

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	3.5.3 The supervisor then performs a final visual walk-down to ensure that all barriers and covers are in place and that no tools remain inside the equipment. Only then are the LOTO devices removed and only by the same electrician who applied them. 3.5.4 The upstream breaker is closed remotely if possible, or from a safe distance if local operation is unavoidable. 3.5.5 First-time energisation is followed immediately by functional tests: phasing checks, voltage measurements and operational sequences are carried out according to the approved commissioning plan. 3.5.6 For the genset, fuel lines are pressure-tested again after connection and a no-load run is performed to check for leaks, vibration and correct exhaust routing. 3.5.7 For the UPS, battery charging and inverter operation are verified. All test results are recorded and compiled into a test report. 3.5.8 The “as-built” checklists, torque records and test reports are submitted to the consultant. The Permit-to-Work is formally cancelled and handed back to the facility manager.	PM / CNM / SHO / SS	
4	<u>Emergency Procedures and Responsibilities</u> 4.1 In the event of an incident – such as an electric shock, arc flash, fire, fuel spill, or crushing injury – the work shall stop immediately. 4.2 The site first-aider is called and the emergency response plan is activated. For arc flash or electrical shock, the power source is not touched until it is confirmed de-energised; instead, the victim is pulled	PM / CNM / SHO / SS	

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	away using a non-conductive hook or board. 4.3 For a fuel spill, the spill kit is deployed and the area is ventilated. The project manager notifies the consultant and the client's safety officer within 15 minutes. All incidents are documented and investigated to determine root cause and prevent recurrence.	PM / CNM / SHO / SS	
5	<u>Quality Assurance and ISO 9001 Compliance</u> 5.1 All activities described above are controlled under our ISO 9001 Quality Management System. 5.2 Key records include the approved risk assessment and method statement, daily toolbox talk attendance sheets, LOTO verification logs, torque tightening checklists, lifting equipment certificates and final test reports. These records are retained for the duration of the project and made available to the consultant upon request. 5.3 Project Manager (PM) shall conduct regular checks to ensure that the risk controls and safe work procedures are being followed on site.	PM / CNM / QE / SHO / SS	

Prepared By: Name: Muhammad Zuhaili Azri Appointment: Safety & Health Officer (SHO) Date: 01 Jan 2026	Approved By: Name: Ong Lay Cheong Appointment: Managing Director (MD) Date: 01 Jan 2026
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