Cladding Technology Shanxi Co., Ltd

HSE Electrical Safety Operation Procedure

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1 Purpose

To standardize operational behaviors across the Company's electrical usage scenarios (fixed electrical use, temporary electrical use, mobile equipment electrical use, high/low-voltage equipment operation, and electrical distribution room operation), clarify HSE requirements for pre-operation inspection, in-operation monitoring, post-operation maintenance, maintenance work, and emergency response. This procedure ensures electrical operations comply with national regulations (Code for Design of Low-Voltage Electrical Installations (GB 50054), Technical Code for Temporary Electrical Installations at Construction Sites (JGJ 46), Guidelines for Electrical Safety (GB/T 13869)), PIPING SYSTEM PTE LTD HSE requirements, and the Company's material procurement and supply business needs (warehouse storage, yard loading/unloading, project site operations, electrical distribution room management). It aims to prevent accidents such as electric shock, electrical fires, and wire burnout, protect employees' life and health, ensure the integrity of electrical equipment, and maintain environmental compliance in operation areas.

2 Scope of Application

2.1 Applicable Scenarios

• Fixed Electrical Use Scenarios: Warehouse lighting systems, fixed charging areas for forklifts, power supply lines for yard cranes, office electrical use in office buildings, fixed sockets in equipment acceptance areas;

• Temporary Electrical Use Scenarios: On-site equipment installation at project departments (welding machines, electric wrenches), temporary lighting in yards, warehouse shelf construction, emergency maintenance;

• Mobile Equipment Electrical Use Scenarios: Charging of electric forklifts, hand-held power tools (electric drills, angle grinders), mobile water pumps/fans;

• High/Low-Voltage Equipment Operation Scenarios: Operation of 10kV and below high-voltage distribution cabinets, low-voltage distribution panels, and transformer operation monitoring;

• Electrical Distribution Room Operation and Management Scenarios: Equipment patrol in electrical distribution rooms, operation parameter recording, access management;

• Electrical Maintenance Scenarios: Power-off maintenance of high/low-voltage equipment, live maintenance, and capacitor maintenance.

2.2 Applicable Equipment and Lines

• Electrical Equipment: Lighting fixtures (explosion-proof/ordinary), forklift chargers, crane electrical systems, power tools, temporary distribution boxes, welding machines, high/low-voltage distribution cabinets, transformers, capacitor banks;

• Power Supply Lines: Fixed cables (buried/overhead), temporary rubber-sheathed cables, power cords for mobile equipment, earthing lines, high-voltage cables;

• Protection Devices: Residual Current Devices (RCDs), air circuit breakers, fuses, earthing devices, high-voltage lightning arresters, interlocking devices.

2.3 Applicable Personnel

• Professional Electricians: Hold a valid *Special Operation Certificate (Electrician Trade)* (including high/low-voltage operation qualifications), responsible for wire laying, equipment maintenance, and earthing maintenance;

• Electrical Equipment Operators: Forklift operators, power tool users, qualified through HSE electrical safety training;

• Electrical Operation Supervisors: Project department safety officers, warehouse safety officers, responsible for on-site supervision of temporary electrical use/maintenance;

• Electrical Distribution Room Attendants: Hold high-voltage operation certificates, responsible for operation monitoring and equipment patrol in electrical distribution rooms;

• Equipment Management Department Staff: Responsible for electrical equipment archives, regular testing, and maintenance planning;

• Quality, Health, Safety and Environmental (QHSE) Department Staff: Responsible for safety supervision, violation investigation, and accident investigation.

3 Terms and Definitions

3.1 Residual Current Device (RCD)

A protective device that detects residual current (leakage current) in an electrical circuit. It automatically cuts off the power supply when the current exceeds a set value (generally ≤ 30mA, operating time ≤ 0.1s) to prevent electric shock accidents.

3.2 Protective Earthing

A measure that connects the metal casing and metal frame of electrical equipment to an earthing electrode via an earthing wire. When equipment leaks, the fault current is

conducted to the ground through the earthing line, preventing electric shock when personnel touch the casing (e.g., earthing of electric forklift frames).

3.3 Temporary Electrical Use

Temporarily laid power supply lines and supporting equipment (e.g., distribution boxes, sockets) for operational needs. The service period is generally ≤ 15 days (re-approval is required for longer periods), commonly used in project sites and emergency maintenance scenarios.

3.4 Explosion-Proof Electrical Equipment

Electrical equipment suitable for flammable and explosive environments (e.g., hazardous chemical warehouses, yard areas with flammable materials). It features flameproof or increased-safety structures to prevent internal sparks/high temperatures from igniting external combustible substances (e.g., explosion-proof lighting, explosion-proof sockets).

3.5 Step Voltage

The potential difference between different points on the ground when an earthing fault occurs. When personnel walk within 20m of the fault point, the voltage formed between their feet may cause electric shock.

3.6 Operation Ticket System

A system requiring the completion of an operation ticket (specifying operation steps, equipment numbers, operator/supervisor) for operating high/low-voltage electrical equipment. The ticket must be approved before operation to prevent misoperation.

3.7 Interlocking Device

A mechanical or electrical device that prevents misoperation of electrical equipment (e.g., interlocking between high-voltage cabinet doors and circuit breakers). Equipment cannot be operated until the interlock is released, ensuring operational safety.

4 Responsibility Assignment

4.1 Professional Electricians

• Work with a valid *Special Operation Certificate (Electrician Trade)* (including high/low-voltage qualifications), with the certificate re-examined every 3 years;

• Responsible for high/low-voltage equipment operation (implementing the operation ticket system), laying/maintaining fixed lines, installing/removing temporary electrical lines, and installing/testing earthing devices;

• Inspect electrical equipment and lines (warehouse lighting, forklift charging areas) daily, test earthing resistance (≤ 4Ω) and RCD operation performance monthly, and test insulating tools quarterly;

• Perform electrical maintenance work (power-off voltage testing, earthing wire installation, live maintenance supervision) and participate in emergency response for electrical accidents (power cutoff, emergency repair);

• Establish archives for electrical equipment/lines, record laying time, maintenance status, and test data, and organize operation records of electrical distribution rooms.

4.2 Electrical Equipment Operators

• Pass HSE electrical safety training (once a year) and master electrical safety requirements for the equipment used (insulation inspection of power tools, electric forklift charging operation);

• Inspect the integrity of equipment power cords, plugs, and switches before use; damaged equipment is prohibited;

• Operate strictly in accordance with procedures; wet-hand operation and unauthorized cable pulling are prohibited; do not tamper with equipment protection devices;

• Immediately shut down and cut off power if electrical abnormalities are found (abnormal equipment noise, cable overheating, RCD tripping), and report to professional electricians;

• Turn off power and unplug plugs after operation, organize power cords (wrapping around equipment is prohibited), and clean the operation area.

4.3 Electrical Operation Supervisors

• Responsible for on-site supervision of temporary electrical use/maintenance, set up warning zones (prohibiting unauthorized personnel entry), and post safety warning signs;

• Supervise operators to comply with procedures, stop violations (unauthorized wiring, live plugging/unplugging, use of unqualified tools);

• Inspect the "one machine, one switch, one protection" configuration of temporary distribution boxes and the setup of earthing wires/warning signs at maintenance sites to ensure safety measures are in place;

• Record temporary electrical use (time, power) and maintenance steps, and fill out *Temporary Electrical Use Supervision Record* and *Electrical Maintenance Supervision Record*;

• Immediately notify professional electricians to cut off power in case of electrical abnormalities and assist in evacuating personnel.

4.4 Electrical Distribution Room Attendants

• Work with high-voltage operation certificates, familiar with the performance of electrical distribution room equipment (transformers, distribution cabinets, capacitor banks) and operation procedures;

• Strictly implement access registration for electrical distribution rooms; unauthorized personnel are prohibited from entering (special cases require approval from the Equipment Management Department and accompaniment by attendants);

• Patrol equipment at specified frequencies (once every 2 hours under normal conditions, once every hour during peak load), record operation parameters (voltage, current, temperature), and immediately report abnormalities;

• Responsible for maintaining fire-fighting equipment in electrical distribution rooms (check pressure monthly) and testing emergency lighting (once a week), and keep the room clean and free of debris;

• Cooperate with professional electricians in equipment maintenance of electrical distribution rooms and perform power-off/power-on operations (based on operation tickets).

4.5 Equipment Management Department

• Responsible for procuring electrical equipment (chargers, power tools, high/low-voltage cabinets, transformers) that meets national safety standards (3C certification, explosion-proof rating);

• Establish electrical equipment archives (factory qualification certificates, acceptance reports, maintenance records, test certificates) and retain archives until equipment scrapping;

• Organize HSE training for professional electricians, operators, and attendants (once a quarter) and develop training materials (including electric shock first aid, high-voltage operation);

• Conduct special inspections of electrical equipment/lines quarterly, focusing on aging lines, damaged equipment, and protection settings of electrical distribution rooms, and arrange timely replacement/adjustment;

• Equip electrical safety protective gear (insulating gloves, insulating shoes, voltage testers, earthing wires) and conduct regular testing (insulating gloves every 6 months).

4.6 QHSE Department

• Supervise the implementation of this procedure, conduct special electrical safety inspections monthly, and investigate violations (unqualified operation, unauthorized wiring, non-compliance with operation tickets);

• Participate in the approval of temporary electrical use (> 7 days/ > 10kW) and live maintenance, and verify the compliance of wire laying and protection measures;

• Develop emergency plans for electrical accidents and organize emergency drills every 6 months (electric shock first aid, electrical fire fighting, electrical distribution room fault handling);

• Investigate electrical-related accidents (electric shock, electrical fire, equipment damage), analyze causes, formulate preventive measures, and update this procedure;

• Conduct electrical safety promotion (posting signs such as "No Wet-Hand Operation" and "High Voltage Danger") to enhance safety awareness among all personnel.

5 Electrical Operation Procedures (HSE Full-Link Control)

5.1 Pre-Operation Preparation (HSE Pre-Control)

5.1.1 Personnel and Qualification Preparation

1. Professional Electricians/Attendants:

◦ Confirm the *Special Operation Certificate* is valid, and carry voltage testers, insulating gloves, and operation tickets (for high-voltage operation);

◦ Wear protective gear: insulating shoes (withstand voltage ≥ 6kV), insulating gloves (withstand voltage ≥ 5kV); add insulating clothing and insulating caps for high-voltage operation;

2. Electrical Equipment Operators:

◦ Participate in and pass HSE electrical safety training, and master electrical risks of the equipment (power tool leakage, electric forklift charging overload);

◦ Wear necessary protection: impact-resistant goggles for operating power tools; add insulating shoes and insulating gloves for operations in humid environments.

5.1.2 Equipment and Line Inspection

1. High/Low-Voltage Equipment Inspection (by Professional Electricians/Attendants):

◦ High-Voltage Equipment: Inspect that interlocking devices of distribution cabinets are intact, lightning arresters have no external damage, transformer oil level is normal (within the scale range), and no abnormal noise is present;

◦ Low-Voltage Equipment: RCD test buttons operate normally, rated current of air circuit breakers matches the line, and earthing lines are securely connected (no loosening or rust);

◦ Insulating Tools: Voltage testers have normal sound and light indicators, earthing wires have qualified cross-sectional area (≥ 25mm²), and insulating gloves have no damage/air leakage;

2. Fixed/Mobile Equipment Inspection:

◦ Fixed Equipment: Charger casings have no deformation, heat dissipation holes are unobstructed, lighting fixture covers are intact, and explosion-proof surfaces of explosion-proof fixtures have no damage;

◦ Mobile Equipment: Power cords of power tools have no damage, plugs are not loose, insulation layers of electric forklift charging plugs are intact, and cables have no crushing marks;

3. Temporary Electrical Use Inspection (by Supervisors):

◦ Distribution Boxes: Boxes are well-earthed, internal lines are neatly arranged (no tangling), "one machine, one switch, one protection" is properly configured, and locks are intact;

◦ Cables: Use rubber-sheathed flexible cables (plastic hard wires are prohibited), no damage/joints (waterproof junction boxes are required for joints if necessary), and overhead height ≥ 2.5m (≥ 4.5m when crossing roads).

5.1.3 Environment Confirmation

1. Ordinary Environments (Warehouses, Office Buildings):

◦ No standing water/oil stains on the ground (to prevent reduced cable insulation), and electrical equipment is kept away from flammable materials (distance between chargers and cartons ≥ 1m);

◦ Good ventilation (ventilation rate ≥ 6 times/hour in areas with chargers and welding machines) to avoid heat accumulation;

2. Special Environments:

◦ Humid Environments (underground warehouses, rainy days): Use equipment/sockets with IP65 or higher waterproof rating, seal cable joints, and personnel wear insulating shoes;

◦ Flammable and Explosive Environments (hazardous chemical warehouses): Only use explosion-proof equipment with Ex d Ⅱ BT4 or higher rating, route lines through galvanized steel pipes for sealing, and live operation is prohibited;

◦ Electrical Distribution Rooms: Indoor temperature ≤ 40℃, humidity ≤ 70%, no debris accumulation, and unobstructed fire-fighting passages (width ≥ 1.2m).

5.2 Fixed Electrical Operation (HSE Process Control)

5.2.1 Warehouse Lighting Electrical Use

1. Startup Operation:

◦ Professional electricians confirm that RCDs/air circuit breakers of lighting distribution boxes are off, close the main switch, and then close branch switches in sequence (by area);

◦ Operators check lighting brightness; if flickering/dimming is found, notify professional electricians (self-disassembly is prohibited);

2. In-Use Monitoring:

◦ Prohibit using fixtures to dry items (wet towels) and hitting fixtures (to prevent cover falling and line damage);

◦ After operation, turn off power in the sequence of "branch switches → main switch" and leave after confirming no fixtures are left on;

3. Maintenance Operation:

◦ Professional electricians turn off branch switches before maintenance, confirm no voltage with a tester, and post the sign "Maintenance in Progress, No Switching On";

◦ Use insulating tools (insulating screwdrivers) when replacing fixtures; one-handed operation is prohibited (to prevent electric shock).

5.2.2 Electrical Use in Fixed Forklift Charging Areas

1. Charging Preparation:

◦ Operators inspect that forklift battery interfaces have no corrosion/loosening and charger cable plugs are intact;

◦ Professional electricians confirm that RCDs of charging area distribution boxes are normal and cables are not crushed (forklift crushing is prohibited);

2. Charging Operation:

◦ First connect the forklift battery interface, then turn on the charger switch, and set matching parameters (voltage/current matches the battery);

◦ Monitor charger temperature (≤ 60℃); smoking/using open flames in the charging area is prohibited, and disassembly of battery interfaces is prohibited;

3. Post-Charging Operation:

◦ After the charger displays "Completion", first turn off the switch and then unplug the plug; hang cables on dedicated hooks and clean debris in the charging area.

5.2.3 Electrical Use for Yard Cranes

1. Power Supply Startup:

◦ Professional electricians inspect that crane power supply cables (drum-type) have no damage/tangling, earthing devices are secure, and close the main power switch;

◦ Operators test lifting/luffing/slewing mechanisms, confirm normal operation and no RCD tripping;

2. In-Use Monitoring:

◦ If electrical faults occur during operation (no mechanism movement/abnormal noise), immediately shut down and cut off power, and notify professional electricians (live troubleshooting is prohibited);

◦ Prohibit cable pulling during operation and washing electrical control cabinets with water (to prevent short circuits);

3. Power Supply Shutdown:

◦ After operation, park the crane at the designated location; operators turn off branch switches, professional electricians turn off the main switch, and inspect that cables have no damage.

5.2.4 High/Low-Voltage Equipment Operation (by Professional Electricians/Attendants)

1. High-Voltage Equipment Operation (Implementing Operation Tickets):

◦ Verify equipment numbers before operation (consistent with the operation ticket) and confirm interlocking devices are released;

◦ Follow the sequence: "Power Off: Circuit Breaker → Isolating Switch" and "Power On: Isolating Switch → Circuit Breaker"; inspect equipment status after each step;

◦ Operation must be supervised; single-person operation of 10kV and above equipment is prohibited; sign the operation ticket after operation;

2. Low-Voltage Equipment Operation:

◦ When closing switches, close the main switch first, then branch switches; when turning off switches, turn off branch switches first, then the main switch;

◦ Prohibit closing/opening isolating switches under load (to prevent arc burns) and operating switches with wet hands (to prevent electric shock).

5.3 Temporary Electrical Operation (HSE Risk Control)

5.3.1 Application and Approval

1. Application:

◦ The electrical user unit (project department) fills out the *Temporary Electrical Use Approval Form*, specifying the use location, equipment power, duration (≤ 15 days), protection measures, and attaching a line diagram;

2. Approval:

◦ The Equipment Management Department reviews the matching of power and lines; the QHSE Department reviews protection measures (RCD configuration, explosion-proof requirements);

◦ For durations ＞15 days or power ＞30kW, approval from the company’s designated leader is required; line laying can only be conducted after approval.

5.3.2 Line Laying and Use

1. Laying Operation (by Professional Electricians):

◦ Overhead Lines: Use insulating supports (height ≥ 2.5m, ≥ 4.5m when crossing roads); tangling around trees/scaffolding is prohibited;

◦ Buried Lines: Burying depth ≥ 0.7m, protected by PE pipes, with "Underground Cable" signs posted on the ground;

◦ Piped Lines: Pass through galvanized steel pipes in passages/doorways; pipe openings are smooth (to prevent cable scratching);

2. Use Operation (by Operators):

◦ Close switches in the sequence of "main switch → branch switch → equipment switch"; inspect that cables are not pulled/crushed before startup;

◦ When moving equipment during operation, first turn off the equipment switch, inspect cables after moving, and close the switch only after confirming no damage;

◦ Unauthorized addition of equipment (connecting multiple devices to temporary sockets) is prohibited, and overloaded electrical use is prohibited (line current ≤ rated value).

5.3.3 Temporary Electrical Use Removal

1. Removal Preparation:

◦ Professional electricians confirm all equipment is powered off, turn off main/branch switches, and confirm no voltage with a tester;

◦ Supervisors clear on-site personnel, set up warning zones, and prohibit unauthorized personnel from approaching;

2. Removal Operation:

◦ First remove equipment-end plugs, then disconnect wiring at the distribution box end; recover cables (dragging/throwing is prohibited) and store them in the tool room after organizing;

◦ Remove the distribution box, inspect that no residual lines are left inside, retain the earthing electrode (for future reuse), and fill out the *Temporary Electrical Use Removal Record*.

5.4 Mobile Equipment Electrical Operation (HSE Detail Control)

5.4.1 Electrical Use for Hand-Held Power Tools

1. Tool Selection:

◦ Use Class Ⅱ tools (double insulation, no earthing required) in ordinary environments; use Class Ⅲ tools (safety voltage ≤ 36V) in humid environments;

◦ Class Ⅰ tools (basic insulation only) are prohibited in non-earthing locations;

2. Operation Process:

◦ Operators inspect that power cords (no damage), plugs (no loosening), and switches (sensitive) of tools are intact; professional electricians test insulation resistance (≥ 7MΩ);

◦ When connecting power, plug in the tool plug first, then close the distribution box switch; keep cables away from sharp objects/high-temperature sources (welding sparks) during use;

◦ After operation, first turn off the switch and then unplug the plug; clean tool debris and store in a dry tool cabinet;

3. Safety Requirements:

◦ Single-handed operation of high-speed tools such as angle grinders is prohibited; excessive pressing of tools is prohibited (to prevent motor overload);

◦ If tools produce abnormal noise/overheating (casing ＞60℃), immediately shut down and notify professional electricians for maintenance.

5.4.2 Mobile Charging for Electric Forklifts (Temporary Charging)

1. Charging Preparation:

◦ Professional electricians set up waterproof distribution boxes (IP65) at temporary points, configure RCDs (leakage current ≤ 30mA), and use rubber-sheathed flexible cables (length ≤ 10m);

◦ Operators inspect that forklift battery interfaces have no corrosion, charging plugs are intact, and the vehicle is parked on a level ground (apply handbrake);

2. Charging Operation:

◦ First connect the battery interface, then close the distribution box switch; observe charger indicator lights (red for charging, green for completion);

◦ Supervisors inspect cable temperature (≤ 40℃) every hour; forklift movement and plug disassembly are prohibited;

3. Post-Charging Operation:

◦ After the charger indicator turns green, first turn off the switch and then unplug the plug; coil cables neatly and close the distribution box door.

5.5 Electrical Maintenance Work (HSE Special Control)

5.5.1 Power-Off Maintenance

1. Power-Off Operation:

◦ Professional electricians follow the process: "Power Off → Voltage Testing → Earthing Wire Installation → Warning Sign Posting → Fencing Setup";

◦ Power Off: Turn off switches in the sequence of "load side → power side"; Voltage Testing: Use a qualified voltage tester to test both incoming and outgoing terminals of the equipment to confirm no voltage;

◦ Earthing Wire Installation: Connect the earthing electrode first, then the equipment end; earthing wires must match the equipment (cross-sectional area ≥ 25mm²);

2. Maintenance Operation:

◦ Maintenance personnel wear insulating protective gear and use insulating tools; crossing over earthing wires is prohibited;

◦ For multi-person maintenance, appoint a general supervisor for unified command; single-person operation is prohibited;

3. Post-Maintenance Restoration:

◦ Clean on-site tools/debris, remove fencing/warning signs, and restore power in the sequence of "remove earthing wires → close switches";

◦ After power restoration, inspect equipment operation status (current, temperature, noise) and hand over for use only after confirming no abnormalities.

5.5.2 Live Maintenance

1. Preparation for Work:

◦ Apply for the *Live Work Permit*, which must be approved by the Equipment Management Department and QHSE Department;

◦ Professional electricians wear insulating clothing, insulating gloves, and insulating shoes, and use insulating tools (voltage testers, insulating pliers);

◦ Appoint a dedicated supervisor (holding a live work supervision certificate); the supervisor must not leave the site and is prohibited from operating;

2. Work Control:

◦ Maintain a safe distance (≥ 0.7m for 10kV, ≥ 1.0m for 35kV) from live parts; no part of the body is allowed to touch live components;

◦ Adjustment of safety measures during work is prohibited; replacement of workers is prohibited (re-approval is required if replacement is necessary);

3. Post-Work:

◦ Clean the work site, inspect that no tools are left on the equipment, record live work details, and file the permit.

5.5.3 Capacitor Maintenance

1. Discharging Operation:

◦ Professional electricians first turn off the capacitor power switch, then discharge using a dedicated discharge resistor (discharging time ≥ 5 minutes);

◦ After discharging, confirm no voltage with a tester and install earthing wires (earth both ends); single-end earthing is prohibited;

2. Maintenance Operation:

◦ Inspect that capacitor casings have no bulging/leakage, terminal blocks have no loosening/corrosion, and use dedicated tools for disassembly;

◦ When replacing capacitors, the model/capacity must match the original equipment; mixing capacitors of different specifications is prohibited;

3. Post-Maintenance:

◦ Remove earthing wires, close the switch, observe capacitor operating current (≤ 1.3 times the rated current), and put into use only after confirming no abnormalities.

5.6 Electrical Distribution Room Operation Management (Led by Attendants)

5.6.1 Access Management

1. Personnel Entry:

◦ Strictly implement the registration system; unauthorized personnel are prohibited from entering (special cases require approval from the Equipment Management Department and accompaniment by attendants);

◦ Entering personnel must wear insulating shoes and safety helmets; items brought in must be inspected by attendants (kindling is prohibited);

2. Environment Maintenance:

◦ Keep the room clean, free of debris/standing water/oil stains, and equipment surfaces free of dust;

◦ The ventilation system operates normally (≥ 6 times per hour), and temperature and humidity are controlled within the required range (temperature ≤ 40℃, humidity ≤ 70%).

5.6.2 Operation Monitoring

1. Patrol Inspection:

◦ Patrol at specified frequencies (once every 2 hours under normal conditions, once every hour during peak load), and record operation parameters (voltage, current, temperature, oil level);

◦ Focus on inspection: Transformer noise (no abnormal sounds), discharge sparks in distribution cabinets, capacitor bulging, and earthing line loosening;

2. Abnormality Handling:

◦ If abnormalities are found (voltage fluctuations, abnormal equipment noise, excessive temperature), immediately report to the Equipment Management Department and cut off power to faulty equipment if necessary;

◦ In case of fire, first cut off power, use carbon dioxide fire extinguishers for extinguishing; water is prohibited;

3. Record Management:

◦ Fill out the *Electrical Distribution Room Operation Record*, recording patrol time, parameters, abnormalities, and handling measures;

◦ Organize operation records monthly, analyze equipment operation trends (e.g., transformer temperature changes), and identify potential issues in a timely manner.

5.6.3 Equipment Management

1. Equipment Labeling:

◦ All equipment (distribution cabinets, transformers, capacitors) have clear numbers consistent with drawings, and equipment parameter plates are posted;

◦ Protection devices (lightning arresters, RCDs) are labeled with operating values and test dates; arbitrary adjustment of settings is prohibited;

2. Regular Testing:

◦ Test RCD operation performance and emergency lighting effectiveness monthly;

◦ Test earthing resistance (≤ 4Ω) and insulation performance of insulating tools quarterly;

◦ Conduct transformer oil quality testing and preventive testing of high-voltage equipment annually; archive test reports.

5.7 Post-Operation Closure (HSE Closed-Loop Control)

1. Equipment and Line Inspection:

◦ Professional electricians inspect that fixed lines have no damage/loose earthing, test RCD operation performance, and fill out the *Electrical Equipment Inspection Record*;

◦ Operators organize power cords of mobile equipment, inspect that tools have no damage, and store them in designated locations;

◦ Attendants inspect the status of electrical distribution room equipment, cut off non-essential power, close doors and windows, and lock the main door;

2. Record and Maintenance:

◦ Professional electricians update electrical equipment/line archives, recording usage status and maintenance issues (e.g., "Aging lighting lines in the east warehouse, to be replaced next month");

◦ The Equipment Management Department organizes monthly cleaning of equipment heat dissipation holes and tightening of earthing bolts, and quarterly replacement of aging plugs/switches and testing of insulating tools.

6 HSE Special Safety Requirements

6.1 Electric Shock Protection Requirements

1. Direct Electric Shock Protection:

◦ Electrical equipment casings must have reliable protection (insulation layers, protective covers); removing casings for use is prohibited (e.g., power tools without protective covers);

◦ Line laying must meet safety distances (≥ 0.5m from thermal pipes, ≥ 0.1m from metal components); exposed lines (wires without insulation layers) are prohibited;

◦ Personnel are prohibited from touching live components (exposed phase wires, damaged cables); use insulating tools (insulating pliers, screwdrivers) during operation;

2. Indirect Electric Shock Protection:

◦ All electrical equipment (except Class Ⅱ tools) must be earthed, with earthing resistance ≤ 4Ω (≤ 10Ω for hand-held tools);

◦ Temporary electrical use and mobile equipment must be equipped with RCDs, with leakage current ≤ 30mA and operating time ≤ 0.1s, tested monthly;

◦ Safety voltage (≤ 36V) is used for operations in humid/narrow spaces; insulating mats (thickness ≥ 5mm) are provided, and external supervisors are assigned.

6.2 Electrical Fire Prevention and Control Requirements

1. Fire Source Prevention:

◦ Overloading of electrical equipment is prohibited (10A lines connected to 20A equipment); cable dragging/crushing is prohibited (to prevent insulation damage and short circuits);

◦ Electrical equipment is kept away from flammable materials (distance between chargers and cartons ≥ 1m, between lighting fixtures and shelves ≥ 0.5m);

◦ Unauthorized modification of equipment is prohibited (replacing switches with larger capacities, removing RCDs); modifications require approval from the Equipment Management Department;

2. Fire Fighting and Handling:

◦ In the early stage of an electrical fire, immediately cut off power and use dry powder (ABC type) or carbon dioxide fire extinguishers for extinguishing; water is prohibited (if power is not cut off);

◦ For cable trench/distribution box fires, use fire blankets to cover and smother the fire to prevent spread;

◦ After the fire is extinguished, professional electricians inspect lines for residual fire sources and confirm safety before restoring power.

6.3 Electrical Use Requirements in Special Environments

1. Humid Environments (Underground Warehouses, Rainy Days):

◦ Electrical equipment must have a waterproof rating ≥ IP65; cable joints are sealed with waterproof junction boxes; personnel wear insulating shoes/insulating gloves;

◦ Temporary distribution boxes are placed ≥ 0.3m above the ground to prevent rainwater immersion; close the box door promptly after use;

◦ Test earthing resistance daily (humidity easily reduces resistance); immediately shut down if earthing is poor;

2. Flammable and Explosive Environments (Hazardous Chemical Warehouses):

◦ Only use explosion-proof equipment with Ex d Ⅱ BT4 or higher rating; equipment casings have no damage, and explosion-proof surfaces are coated with anti-rust oil;

◦ Lines are laid through sealed galvanized steel pipes; use explosion-proof union joints at pipe connections; plastic hoses are prohibited;

◦ Plugging/unplugging in this environment is prohibited (operation must be conducted in non-explosion-proof areas); live operation is prohibited;

3. Outdoor Operations (Yards, Project Sites):

◦ Use waterproof equipment/sockets and install lightning protection (lightning rods, earthing electrodes);

◦ Stop outdoor electrical operations when wind speed ≥ 10.8m/s (Level 6 wind); immediately cut off power during thunderstorms;

◦ When cables cross roads, protect them with steel pipes (buried depth ≥ 0.7m) and post "Underground Cable" warning signs on the road surface.

6.4 Insulation and Earthing Protection Requirements

1. Insulation Protection:

◦ Insulating tools (gloves, shoes, pliers) are tested regularly (insulating gloves every 6 months); damaged/expired tools are prohibited;

◦ Line insulation layers have no aging/cracks; test insulation resistance regularly (≥ 0.5MΩ for low-voltage lines, ≥ 10MΩ for high-voltage lines);

◦ Enhance insulation protection for operations in humid environments (lay insulating mats, use insulating rods for operation);

2. Earthing Protection:

◦ Earthing electrodes use galvanized steel pipes (diameter ≥ 50mm, length ≥ 2.5m), buried depth ≥ 0.7m, with no stones/debris around;

◦ Earthing lines use multi-strand copper core wires (cross-sectional area ≥ 25mm²), securely connected (bolts tightened, coated with anti-rust paint);

◦ Test earthing resistance monthly (≤ 4Ω); immediately investigate and rectify if exceeding the limit (earthing electrode corrosion, loose lines).

7 Emergency Response (HSE Risk Response)

7.1 Electric Shock Accident Handling

1. Power-Off Rescue:

◦ Immediately cut off power to the shocked equipment (turn off switches, unplug plugs); if power cannot be cut off, use insulating tools (dry wooden sticks, insulating pliers) to move the cable away; touching the shocked person with bare hands is prohibited;

◦ If the shocked person is at height, set up a safety net after power-off to prevent falling;

2. First Aid Treatment:

◦ Move the shocked person to a ventilated area, loosen the collar/belt, and check consciousness and breathing:

▪ Conscious/Breathing: Let the person lie flat and keep warm; call 120 and wait for medical treatment;

▪ Unconscious/Not Breathing: Immediately perform Cardiopulmonary Resuscitation (CPR) at a rate of 100-120 compressions per minute and depth of 5-6cm; call 120 simultaneously;

◦ Cover burns with clean gauze; applying ointment is prohibited to avoid infection;

3. Accident Investigation:

◦ Professional electricians inspect the cause of electric shock (line damage, no earthing, RCD failure) and fill out the *Electrical Accident Report*;

◦ The QHSE Department analyzes responsibilities, formulates preventive measures (replacing non-earthed tools, enhancing RCD testing), and organizes training for all personnel.

7.2 Electrical Fire Handling

1. Early Fire Fighting:

◦ Immediately cut off power to the fire area (branch switch → main switch); live fire fighting is prohibited;

◦ Use dry powder/carbon dioxide fire extinguishers to spray at the base of the flame; use fire blankets to cover cable trench fires;

◦ Evacuate surrounding personnel to prevent smoke poisoning and set up warning zones;

2. Large-Scale Fire Handling:

◦ Call 119, notify the company's fire emergency team, and cooperate with firefighters (provide equipment layout diagrams and hazardous chemical information);

◦ Cut off power to areas surrounding the fire to prevent the fire from spreading to other lines/equipment;

3. Post-Fire Handling:

◦ After the fire is extinguished, professional electricians inspect line/equipment damage and replace burned components;

◦ Test earthing resistance and RCD performance; restore power only after confirming no safety hazards;

◦ The QHSE Department investigates the cause of the fire (short circuit, overloading) and formulates rectification measures (replacing aging lines, limiting load).

7.3 Electrical Distribution Room Fault Handling

1. High-Voltage Tripping:

◦ Attendants immediately check tripped equipment (circuit breakers, isolating switches) and record tripping time and current/voltage parameters;

◦ Professional electricians inspect the cause of the fault (short circuit, earthing, overloading); restore power based on the operation ticket only after troubleshooting;

◦ Blindly closing switches is prohibited (to prevent fault escalation);

2. Transformer Abnormalities:

◦ If abnormal transformer noise (explosions, buzzing), abnormal oil level (too high/too low), or excessive temperature (> 85℃) is found, immediately cut off power;

◦ Professional electricians inspect transformer winding insulation and oil quality; contact the manufacturer for maintenance if necessary;

3. Capacitor Bulging/Leakage:

◦ Attendants immediately cut off power and notify professional electricians if capacitor bulging/leakage is found;

◦ Professional electricians discharge and remove the faulty capacitor, replace it with a capacitor of the same model, and put it into use only after passing the test.

8 Supplementary Provisions

8.1 This procedure shall take effect from the date of issuance. In case of any inconsistency between existing electrical safety regulations and this procedure, this procedure shall prevail.

8.2 This procedure shall be revised under the leadership of the Company's Equipment Management Department, with the cooperation of the QHSE Department. The revision cycle is 2 years; timely revision is required if national regulations (GB 50054, JGJ 46, GB/T 13869), Group requirements are updated, or electrical accidents occur.

8.3 For matters not covered in this procedure, refer to *Code of Practice for Electrical Safety at Work*, *Code for Design of Low-Voltage Electrical Installations* (GB 50054), *Technical Code for Temporary Electrical Installations at Construction Sites* (JGJ 46), *Guidelines for Electrical Safety* (GB/T 13869), and 's *Electrical Safety Management Measures*.

8.4 This procedure shall be distributed to all professional electricians, operators, attendants, supervisors, and relevant management departments. The electronic version shall be uploaded to the HSE column on the Company's intranet for easy access and learning.

9 Appendices

Appendix A: Inspection Standards for Electrical Safety Tools

Tool Name	Inspection Content	Inspection Standards	Inspection Frequency
Insulating Gloves	Sealing, aging, damage	No damage or air leakage; no cracks in insulation layer	Before Use / Every 6 Months
Insulating Shoes	Wear, aging, voltage resistance	Clear treads with no damage; voltage resistance ≥ 6kV	Before Use / Every 6 Months
Voltage Tester	Sound and light indication, insulation layer	Sensitive sound and light; no damage to insulation layer	Before Use
Earthing Wire	Cross-sectional area, connection terminals, insulation layer	Cross-sectional area ≥ 25mm²; no loose terminals; intact insulation layer	Before Use
Insulating Rod	Insulation layer, end accessories	No cracks in insulation layer; secure accessories	Before Use / Every 1 Year

Appendix B: Safety Distance Requirements

B1 Equipment Safety Distances (Indoor)

Equipment Type	Passage Width	Distance from Other Equipment	Distance from Wall
High-Voltage Distribution Cabinets	Patrol passage ≥ 0.8m	≥ 0.5m	≥ 0.3m
Low-Voltage Distribution Panels	Operation passage ≥ 0.6m	≥ 0.3m	≥ 0.2m

Transformers (≤ 1000kVA)	Surrounding space ≥ 1.0m	≥ 0.5m	≥ 0.3m
Capacitor Banks	Surrounding space ≥ 0.8m	≥ 0.5m	≥ 0.3m

B2 Operational Safety Distances (from Live Parts)

Voltage Level	Safety Distance	Remarks
Below 1kV	≥ 0.1m	Low-voltage operations
10kV	≥ 0.7m	High-voltage operations/patrols
35kV	≥ 1.0m	High-voltage operations/patrols
110kV	≥ 1.5m	High-voltage operations/patrols

Appendix C: Temporary Electrical Use Inspection Checklist

Inspection Item	Inspection Content	Inspection Standards	Inspection Result	Handling Measures
Approval Procedures	*Temporary Electrical Use Approval Form*	Complete approval with full content	□Qualified □Unqualified	
Distribution Box Configuration	"One machine, one switch, one protection", earthing	Proper configuration; normal RCD operation; secure earthing	□Qualified □Unqualified	
Cable Lines	Laying method,	Compliance with overhead/buried requirements; no	□Qualified □Unqualified	

	insulation layer, joints	damage/bare joints		
Electrical Equipment	Casing earthing, power matching	Reliable earthing; equipment power ≤ line rated capacity	□Qualified □Unqualified	
Safety Signs	Warning signs, caution signs	Complete and clear; posted in prominent locations	□Qualified □Unqualified	
Protection Measures	Insulation protection, rainproof measures	Waterproof measures in humid environments; personnel equipped with insulation protection	□Qualified □Unqualified	
Inspector:		Inspection Date: Year Month Day		

Appendix D: Electrical Operation Prohibitions

D1 Operation Prohibitions

1. Prohibit unqualified operation of high/low-voltage electrical equipment;
2. Prohibit scheduled power-off/power-on (without operation tickets);
3. Prohibit live work without supervision;
4. Prohibit using unqualified insulating tools;
5. Prohibit operating switches/plugs with wet hands.

D2 Maintenance Prohibitions

1. Prohibit maintenance work without voltage testing and earthing;
2. Prohibit unauthorized entry into live areas;
3. Prohibit arbitrary removal of interlocking devices;
4. Prohibit single-person high-voltage maintenance;
5. Prohibit capacitor maintenance without discharging.

D3 Management Prohibitions

1. Prohibit storing debris/kindling in electrical distribution rooms;
2. Prohibit unauthorized wiring;
3. Prohibit overloading of electrical equipment;
4. Prohibit using damaged/aging electrical equipment;
5. Prohibit arbitrary adjustment of protection device settings.

Appendix E: Electric Shock First Aid Flowchart

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flowchart TD
    A[Detect Electric Shock] --> B[Cut Off Power/Move Cable Away]
    B --> C[Move to Ventilated Safe Area]
    C --> D[Check Consciousness and Breathing]
    D -->|Conscious/Breathing| E[Lie Flat and Keep Warm, Call 120]
    D -->|Unconscious/Not Breathing| F[Immediately Perform CPR]
    F --> G[Continue CPR Until Medical Personnel Arrive]
    E --> H[Follow-Up Observation After Medical Treatment]
    G --> H
    H --> I[Accident Report and Analysis]
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