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Electrical Safety Work Regulations
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Preface

This part is based on the "Letter on Entrusting Supplemental Amendment to the "Safety Regulations"" ((A letter from safety supervision) [2008] No. 12) to amend and supplement the "State Grid Corporation of Electric Power Safety Work Regulations (Electrical Parts of Substations and Power Plants) (Trial)" form.

The main content of this part includes general rules and basic requirements for high-voltage equipment work, Organizational measures to ensure safety, Technical measures to ensure safety, safety measures for substations and power plants during line operation, live work, overhaul and maintenance of generator synchronizing cameras and high-voltage motors, work on sulfur hexafluoride (SF₆) electrical equipment, and low-voltage distribution including work on electrical installations and low-voltage wires, work on secondary systems, electrical tests, power cable work, general safety measures, lifting and transportation, and high-altitude operations.

Appendix A—H, K, N, O, P, Q of this part are informative appendices

Appendices I, J, L, and M to this part are normative appendices.

This part is proposed and explained by the Safety Supervision and Quality Department of State Grid Corporation of China.

This part is under the jurisdiction of the Science and Technology Department of State Grid Corporation of China.

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First release of this section.

Electric Safety Work Regulations

1. Scope

This section specifies the safety requirements that workers should comply with at the job site.

This part is applicable to the working personnel (including infrastructure installation, rural power personnel) in the use of power generation, transmission, transformation (including UHV, HVDC), power distribution and user electrical equipment and related places (including infrastructure installation, rural power personnel), other units and related personnel carried out.

2. Normative References

The following documents are essential for the application of this document. For dated reference documents, only the dated version applies to this document. For undated references, the latest version (including all amendments) applies to this document.

GB/T 3608—2008 Classification of high-altitude operations

GB 5905 Crane Test, Specification and Procedure

GB 6067 Safety Regulations for Lifting Machinery

GB/T 9465 Aerial Operating Truck

GB/T 18857—2002 Technical Guidelines for Live Working on Distribution Lines

GB 26859—2011 Electrical Safety Work Regulations (Part of Power Lines)

GB 26860—2011 Electrical Safety Work Regulations (electrical part of power plants and substations)

GB 26861—2011 Electric Power Safety Working Regulations (Part of High Voltage Laboratory)

DL/T 392—2010 Technical guidelines for live working on 1000kV AC transmission lines

DL 408—1991 Electricity Industry Safety Work Regulations (electrical part of power plants and substations)

DL 409—1991 Safety Work Regulations in Electricity Industry (Part of Power Lines)

DL/T 878—2004 Test guidelines for insulating tools for live working

DL/T 881—2004 ± 500 kV DC transmission line live working technical guide

DL/T 966—2005 Technical Guidelines for Live Working on Transmission Lines

DL/T 976—2005 Preventive test procedures for live working tools, devices and equipment DL/T 1060—2007 Technical guidelines for live working on 750kV AC transmission lines DL 5027 Typical fire protection regulations for electrical equipment

ZBJ 80001 truck crane and tire crane maintenance and maintenance

Q/GDW 302—2009 ± 800 kV DC transmission line live working technical guide.

3. Terms and Definitions

The following terms and definitions apply to this document.

1. Low voltage LV

LV is used for the voltage level of 1000V and below in the AC system of power distribution.

[GB/T 2900.50—2008, 601-01-26 in definition 2.1]

2. High voltage HV

Usually refers to a voltage level exceeding low voltage.

Under certain circumstances, it refers to the voltage level of power transmission in the power system.

[GB/T 2900.50—2008, 601-01-27 in definition 2.1]

3. Operating Electrical equipment

Electrical equipment that is fully energized, partly energized, or once operated.

4. Emergency Repair Work

Refers to the emergency repair and troubleshooting work that is forced to emergency stop operation when electrical equipment fails and needs to be restored in a short time.

5. Dual tag of Equipment

Device name and number

4. General

4.1 To strengthen the management of the power production site, regulate the behavior of various workers, and ensure the safety of personal, power grid and equipment, this part is formulated in accordance with relevant national laws and regulations, combined with the actual power production.

4.2 The basic conditions of the job site.

- a. The production conditions and safety facilities at the job site should meet the requirements of relevant standards and regulations, and the labor protection equipment of the staff should be qualified and complete.
- b. Places where people often work and construction vehicles should be equipped with first-aid kits to store first-aid supplies, and designated personnel should be regularly checked, supplemented or replaced.
- c. The safety tools and instruments used on site shall be qualified and meet relevant requirements.
- d. All types of operators should be informed of the dangerous factors, preventive measures and emergency treatment measures that exist at their job sites and positions.

4.3 Basic conditions for operators.

4.3.1 Approved by a doctor, there is no disease that hinders work (physical examination is at least once every two years).

4.3.2 Have the necessary electrical knowledge and business skills, and according to the nature of the job, be familiar with the relevant parts of this section, and have passed the exam.

4.3.3 Possess the necessary knowledge of safe production, learn emergency first aid methods, especially learn first aid for electric shock.

4.4 Education and training.

4.4.1 All kinds of operators should receive corresponding safety production education and job skill training and pass the examination to take up their posts.

4.4.2 Operators should test this part once a year. Those who have interrupted electrical work for more than 3 months should re-study this part and pass the examination before returning to work.

4.4.3 New electrical workers, interns, and temporary laborers (management personnel, part-time workers, etc.) shall be trained on safety knowledge before they can go to the site to participate in the designated work and may not work alone.

4.4.4 The staff undertaken by foreign units or participating in the electrical work of the company's system should be familiar with this part, pass the examination, and be approved by the equipment operation and maintenance management unit (department) before participating in the work. Before work, the equipment operation and maintenance management unit (department) should inform the wiring of the on-site electrical equipment, dangerous points, and safety precautions.

4.5 Anyone who finds a violation of this section should stop it immediately and resume operations only after correction. All types of operators have the right to refuse command violations and forced risky operations; when an emergency that directly endangers the safety of people, power grids and equipment is discovered, they have the right to stop operations or evacuate the workplace after taking possible emergency measures, and report immediately.

4.6 While testing and popularizing new technologies, new processes, new equipment, and new materials, corresponding safety measures should be formulated and implemented after approval by the production leader (chief engineer) in charge of the unit.

5. Basic Requirements for the Work of High-Voltage Equipment

5.1 General safety requirements

5.1.1 Operation and maintenance personnel should be familiar with electrical equipment. The individual on duty or the person in charge of operation and maintenance should also have actual work experience.

5.1.2 High-voltage equipment that meets the following conditions can be operated by a single person on duty or by a single person:

- a) The isolation room of the indoor high voltage equipment is equipped with barriers, the height of the barriers is above 1.7m, and the installation is firm and locked.
- b) The operating mechanism (operating mechanism) of the indoor high-voltage circuit breaker (switch) is isolated from the circuit breaker (switch) by a wall or metal plate, or is equipped with a remote operating mechanism (operating mechanism).

5.1.3 Single-person duty or single-person operation is not allowed in the converter station.

5.1.4 Regardless of whether the high-voltage equipment is live or not, the operator shall not move alone or go over the fence to work; if it is necessary to remove the fence, a guardian should be present and comply with the safety distance in Table 1.

5.1.5 When the exposed part of the outdoor (internal) power distribution device of 10, 20, 35kV crosses the pedestrian aisle or work area, if the conductive part of the ground height is less than 2.7 (2.5), 2.8 (2.5), and 2.9m (2.6m) respectively, and protective nets should be installed on both sides and bottom of the exposed part.

5.1.6 On the traffic passage of the outdoor 10kV and above high voltage power distribution installation site, the traffic safety height limit sign should be set according to Table 2.

5.1.7 In the indoor busbar section, busbar crossing part, and part of the power failure inspection and repair, it is easy to accidentally touch the electric equipment, there should be a permanent isolation baffle (protective net) with obvious signs.

5.1.8 The standby interval (bus connection bar, spare interval for which the lead wires have been connected to the bus) shall have a name and number, and shall be included in the dispatch jurisdiction. The operating handle of the isolation switch (knife switch) and the net door should be locked.

5.1.9 After the handcart switch is pulled out, observe whether the isolation baffle is reliably closed. The spare hole for the cable outlet of the enclosed combined electrical appliance or the spare hole for the terminal of the busbar shall be closed with a special appliance.

5.1.10 The neutral point of the neutral point grounding system of the high-voltage equipment in operation should be regarded as a live body. If the neutral point grounding point must be disconnected during operation, an effective bypass ground should be established before the disconnection can be performed. jobs.

5.1.11 In the converter station, the equipment in the neutral area of the DC field of the high-voltage DC system in operation, the temporary ground electrode, the ground electrode circuit and the ground electrode in the station shall be regarded as live bodies.

5.1.12 Before the valve hall of the converter station is transferred for maintenance, personnel are prohibited from entering the work (except the inspection channel).

5.2 Inspection of high-voltage equipment

5.2.1 Personnel who are allowed to patrol high-voltage equipment alone with the approval of this unit are not allowed to perform other work, and are not allowed to move or cross the fence.

5.2.2 In thunderstorms, when you need to patrol outdoor high-voltage equipment, you should wear insulated boots and not close to lightning arresters and lightning rods.

5.2.3 When fires, earthquakes, typhoons, ice and snow, floods, mudslides, sandstorms and other disasters occur, if equipment inspections are required, necessary safety measures should be formulated and approved by the responsible leader of the equipment operation and maintenance management unit (department), and At least two people should work in groups, and the inspectors should maintain communication with the dispatched department.

5.2.4 When the high voltage equipment is grounded, indoor personnel should be 4m away from the fault point, and outdoor personnel should be 8m away from the fault point. Personnel entering the above-mentioned range should wear insulating boots, and should wear insulating gloves when touching the enclosure and frame of the equipment.

5.2.5 Doors should be closed when patrolling indoor equipment.

5.2.6 There should be at least 3 keys to the high-voltage room, which should be kept by the operation and maintenance personnel and handed over according to their value. 1 It is dedicated to emergency use, 1 is dedicated to operation and maintenance personnel, and others can be loaned to approved personnel who inspect high-voltage equipment and approved personnel in charge of maintenance and construction teams, but they should register their signatures, patrol, or the same day Return after work.

5.3 Switching operation

5.3.1 The switching operation should be carried out according to the instructions of the on-duty control personnel or the person in charge of operation and maintenance, and after being repeated correctly. Issue instructions should be accurate and clear, using standardized scheduling terms and double names of equipment. The sender and the recipient should report each other's unit and name first, and the entire process of issuing instructions (including the other party's reciting instructions) and listening to the instructions should be recorded and recorded. Operators (including guardians) should understand the purpose and sequence of operations. If you have any questions about the

instruction, you should ask the sender for clear and correct execution. The sender, receiver, and operation personnel (including guardians) should all have corresponding qualifications.

5.3.2 The switching operation can be completed by local operation, remote control operation, and program operation. The equipment for remote operation and program operation shall meet the relevant technical conditions.

5.3.3 Classification of switching operations.

5.3.3.1 Monitoring operation: Two people perform the same operation.

During the monitoring operation, one of them is the one who is more familiar with the equipment to supervise. Particularly important and complex switching operations are operated by skilled operation and maintenance personnel and supervised by the operation and maintenance person in charge.

5.3.3.2 Single operation: operation completed by one person.

a) When a single-duty substation or power plant booster station is operated, the operation and maintenance personnel shall fill in the information according to the operation instructions communicated by the sender by telephone

Use the operation ticket to repeat it without error.

b) If there are reliable means of confirmation and automatic recording, the control personnel can perform single operation.

c) Equipment, items and personnel that implement single-person operation must be approved by the equipment operation and maintenance management unit(department) or dispatch control center. The personnel should pass the special assessment.

5.3.3.3 Operation by maintenance personnel: operations performed by maintenance personnel.

a) The maintenance personnel of this unit who have passed and approved the examination of the equipment operation and maintenance management unit (department) can perform 220kV and below

For the monitoring operation of electrical equipment from hot standby to overhaul or from overhaul to hot standby, the guardian should be the maintenance person of the same unit personnel or equipment operation and maintenance personnel.

b) The receiving and issuing procedures and safety requirements of the maintenance personnel should be reviewed by the chief engineer of the equipment operation and maintenance management unit (department) and report to relevant departments and dispatch control center for record.

5.3.4 Operation ticket.

5.3.4.1 1 The operator shall fill in the operation ticket for the switching operation (see Appendix A).

5.3.4.2 2 The operation ticket shall be filled out item by item with a black or blue steel (water) pen or ballpoint pen. The operation ticket issued by the computer should be unified with the handwritten ticket; the operation ticket surface should be clear and tidy, and not arbitrarily altered. The operation ticket should fill in the double name of the device. The operator and guardian should check the filled-in operation items according to the mimic diagram or wiring diagram, and sign manually or electronically respectively, and then the person in charge of operation and maintenance (the person in charge of work when the maintenance personnel operates) reviews and signs.

Only one operation task can be filled in each operation ticket.

5.3.4.1 3 The following items should be filled in the operation ticket:

- a) The equipment to be closed [circuit breaker (switch), isolating switch (knife switch), grounding switch (device), etc.], electrical inspection, installation and disassembly of the ground wire, closing (installation) or disconnection (removal) control Air switch and fuse of circuit or voltage transformer circuit, switch protection circuit and automatic device, and check whether there is no voltage, etc.
 - b) Check the position of the equipment after closing the equipment [circuit breaker (switch), isolating switch (knife switch), grounding knife switch (device), etc.].
 - c) When stopping and powering on, check that the circuit breaker (switch) is in the open position before pulling out and pushing in the disconnect switch (knife switch) and the handcart switch.
 - d) Check the related power supply operation and load distribution before and after the load reversal or solution and parallel operation.
 - e) After the equipment is overhauled, before closing and sending power, check that the grounding switch (device) within the power supply range has been opened and the grounding wire has been removed.
 - f) HVDC transmission system start and stop, power change and state conversion, control mode change, master control station conversion, control and protection
- The system is switched on and off, the converter transformer cooler is switched and the taps are manually adjusted.
- g) Operation of valve cooling, valve hall firefighting and air conditioning systems, and mode changes.
 - h) The locking operation of the circuit breaker (switch) by the DC transmission control system.

5.3.5 Basic conditions for switching operation.

5.3.5.1 1 There are primary system simulation diagrams (including various electronic wiring diagrams) consistent with the on-site primary equipment and actual operation mode.

5.3.5.2 2 The operating equipment shall have obvious signs, including naming, numbering, opening and closing instructions, directions of rotation, switching positions, and equipment color.

5.3.5.3 3 High-voltage electrical equipment should be equipped with a complete anti-mis operation locking device. The anti-mis operation locking device shall not be withdrawn from operation at will. The deactivation of the anti-mis operation locking device should be approved by the administrative deputy or chief engineer in charge of the production of the unit; when the anti-mis operation locking device is withdrawn for a short time, the substation master or power plant should be on duty. The duty chief approves and should be put into operation as soon as possible according to the procedures.

5.3.5.4 4 There are instructions officially issued by the on-duty control personnel and the person in charge of operation and maintenance, and the operation ticket that has been approved in advance is used.

5.3.5.5 5 Mechanical locks should be added in the following three situations:

- a) Knife gate handles, valve hall gates and net doors that are not equipped with anti-mis operation locking devices or locking devices fail.

- b) When the electrical equipment is in cold standby, the grid door lock is out of function.
- c) When the equipment is overhauled, the operating handles of each caller side switch and the door of the electric operating switch mechanism box in the loop. For mechanical locks, one key must be used to open one lock. The keys must be numbered and kept properly.

5.3.6 Basic requirements for switching operation:

5.3.6.1 The opening operation of power failure should be carried out in the order of circuit breaker (switch)-load side isolating switch (knife switch)-power side isolating switch (knife switch), and the power transmission and closing operation should be in the reverse order of the above get on. It is forbidden to close the disconnect switch (knife switch) with load.

5.3.6.2 Before starting the operation on site, perform a check-up simulation preview on the simulation diagram (or microcomputer anti-mis operation device, microcomputer monitoring device), and then perform the operation after it is correct. The system mode, equipment name, number and location should be checked before operation, and the guardianship and read-back system should be carefully implemented during operation (also should be chanted loudly for single-person operation), and the whole process should be recorded. During the operation, the operation should be performed one by one in the order in which the operation ticket was filled. After each step of the operation, a "√" mark should be made after the check is correct, and the recheck shall be performed after all operations are completed.

5.3.6.3 During the guardianship operation, the operator is not allowed to perform any operation without the consent of the guardian during the operation.

5.3.6.4 Before operating the equipment remotely, a prompt signal should be sent to the site to remind the on-site personnel to stay away from the operating equipment.

5.3.6.5 When any doubt occurs during operation, the operation shall be stopped immediately and a report shall be made to the dispatcher. The operation can only be carried out after the permission is issued. It is not allowed to change the operation ticket without authorization, and it is not allowed to remove the locking device at will. The unlocking tool (key) should be sealed and kept, and all operators and maintenance personnel are prohibited from using the unlocking tool (key) without authorization. If it is necessary to unlock the operation in special circumstances, the person in charge of the mis operation prevention device of the operation and maintenance management department or the personnel designated by the operation and maintenance management department and announced in writing shall go to the scene to verify and sign the correctness, and the operation and maintenance personnel shall inform the on-duty control personnel Only use the unlocking tool (key). Single operator and maintenance personnel are prohibited from unlocking during the switching operation. If you need to unlock it, you should send additional operation and maintenance personnel to the site to perform the above procedures before processing. The unlocking tool (key) should be sealed and recorded in time after use.

5.3.6.6 The position check after the operation of electrical equipment shall be based on the actual position of each phase of the equipment. When the actual position cannot be seen, the mechanical position indication, electrical indication, live display device, instrument and various telemetry, remote signals, etc. can be used. The signal changes to judge. When judging, at least two non-same principles or non-homologous indications should have corresponding changes, and all these confirmed indications have changed correspondingly at the same time, in order to confirm that the equipment has been operated in place. The above inspection items should be filled in the operation ticket as inspection items. If any other signal is found to be abnormal during the inspection, stop the operation and find out the cause. For remote control operations, the above-mentioned indirect methods or other reliable methods can be used to determine the location of the equipment.

5.3.6.7 When the relay protection is operated remotely, at least two indications should have corresponding changes, and all these confirmed indications have changed correspondingly at the same time, to confirm that the equipment has been operated in place.

5.3.6.8 The DC system of the converter station shall be operated by program. The program operation is unsuccessful, and the remote-control stepping operation can be carried out after the cause has been found out and approved by the on-duty regulator.

5.3.6.9 Use an insulating rod to pull or close the isolating switch (knife switch), high-voltage fuse, or to close the circuit breaker (switch) and isolating switch (knife switch) through the transmission mechanism, and wear insulating gloves. When operating outdoor high-voltage equipment on rainy days, the insulating rods should have a rain cover and insulating boots should be worn. If the resistance of the grounding grid does not meet the requirements, insulating boots should also be worn on sunny days. During thunder and lightning, generally no switching operation is performed, and it is forbidden to perform switching operations on the spot.

5.3.6.10 When loading and unloading high-voltage fuses, you should wear goggles and insulating gloves, use insulating clamps if necessary, and stand on insulating mats or insulating gloves.

5.3.6.11 The breaking capacity of the circuit breaker (switch) shall meet the requirements of the power grid. If the interrupting capacity is not enough, the operating mechanism (operating mechanism) should be separated from the circuit breaker (switch) with a wall or metal plate, remote operation should be performed, and the reclosing device should be disabled.

5.3.6.12 After the power failure of electrical equipment (including accidental power failure), before opening the relevant isolation switch (knife switch) and taking safety measures, you must not touch the equipment or enter the barrier to prevent sudden calls.

5.3.6.13 No ascending or pole climbing operations are allowed during single-person operation.

5.3.6.14 In the event of a personal electric shock, the power supply of the relevant equipment can be disconnected without permission, but it should be reported to the regulator [or the equipment operation and maintenance management unit (department)] and the superior department immediately afterwards.

5.3.6.15 When a system communication failure occurs between the converter stations at both ends of the same DC system, the operations between the two stations should be carried out according to the instructions of the on-duty control personnel.

5.3.6.16 During the unipolar outage of the bipolar DC transmission system for maintenance, it is forbidden to operate the bipolar public area equipment, and it is forbidden to close the neutral ground/metal return line isolation switch (knife switch) of the outage pole.

5.3.6.17 Before raising or lowering the power of the DC system, confirm that the power setting value is not less than the minimum power allowed by the current system and cannot exceed the maximum power limit allowed by the current system.

5.3.6.18 Before manually cutting off the AC filter (shunt capacitor), check that the system has enough spare numbers to ensure that the current transmission power and reactive power requirements are met.

5.3.6.19 The AC filter (shunt capacitor) should meet the capacitor discharge time requirements before it is put into operation after exiting operation.

5.3.7 Operation ticket is not required for the following tasks:

- a) Emergency handling of accidents.

- b) A single operation to close the circuit breaker (switch).
- c) Program operation.

The above operations should be recorded after completion, and the original records should be kept for emergency handling of accidents.

5.3.8 The operation tickets of the same substation shall be serially numbered in advance, the operation tickets generated by the computer shall be serially numbered before the official ticket issuance, and the operation tickets shall be used in the order of numbering. Voided operation tickets should be marked with the words "Voided", those that have not been implemented should be marked with the words "Not implemented", and those that have been operated should be marked with "Executed". The operation ticket should be kept for one year.

5.4 Working on high-voltage equipment

5.4.1 Working on high-voltage equipment in use is divided into three categories:

5.4.1.1 1 All power outage work refers to all power outages of indoor high-voltage equipment (including overhead lines and cable lead-in wires), all doors leading to adjacent high-voltage rooms are locked, and all outdoor high-voltage equipment power outages (including overhead lines and Cable lead-in included).

5.4.1.2 2 Partial power failure refers to the partial power failure of the high-voltage equipment, or although all the indoor power failures, the doors leading to the adjacent high-voltage chamber are not completely locked.

5.4.1.3 3 Working without power failure refers to:

- a) The work itself does not need to be powered off and it is impossible to touch the conductive part of the work.
- b) Work that can be performed on the housing of live equipment or on conductive parts.

5.4.2 Work on high-voltage equipment should be carried out by at least two persons and complete organizational and technical measures to ensure safety.

6. Organizational Measures to Ensure Safety

6.1 Organizational measures to ensure safety when working on electrical equipment

- a) On-site survey system.
- b) Work ticket system.
- c) Work permit system.
- d) Work guardianship system.
- e) Work interruption, transfer and termination system.

6.2 Site survey system

For substation maintenance (construction) operations, if the issuer of the work ticket or the person in charge of the work deems it necessary to conduct an on-site survey, the maintenance (construction) unit shall organize an on-site survey according to the work tasks and fill in the on-site survey records. The site survey is organized by the issuer of the work ticket or the person in charge of the work.

6.3 Work ticket system

6.3.1 For work on electrical equipment, a work ticket or emergency repair form should be filled in. There are six methods:

- a) Fill in the first type of work ticket for the substation (power plant) (see Appendix B).
- b) Fill in the first type of work ticket for power cables (see Appendix C).
- c) Fill in the second type of work ticket for the substation (power plant) (see Appendix D).
- d) Fill in the second work ticket for power cables (see Appendix E).
- e) Fill in the work ticket for live working of the substation (power plant) (see Appendix F).
- f) Fill the emergency repair form of the substation (power plant) accident (see Appendix G).

6.3.2 The work for filling in the first type of work ticket is:

- a) The work on high-voltage equipment requires complete or partial power outages.
- b) Those who need to power off high-voltage equipment or take safety measures for the work on the secondary system and lighting circuits.
- c) Work that requires power failure on high-voltage power cables.
- d) The converter transformer, DC field equipment and valve hall equipment need to disable the HVDC system or DC filter.
- e) The work of DC protection devices, channels and control systems requires that the HVDC system be disabled.
- f) The converter valve cooling system, valve hall air-conditioning system, fire alarm system and image monitoring system need to be disabled for the high-voltage DC system.
- g) For other work, it is necessary to power off the high-voltage equipment or take safety measures.

6.3.3 The work for filling in the second type of work ticket is:

- a) Work on control panels and low-voltage switchboards, distribution boxes, and power mains.
- b) The work on the secondary system and lighting circuit does not need to power off the high-voltage equipment or take safety measures.
- c) Work on the rotating generator, the excitation circuit of the synchronizing camera, or the resistance circuit of the high-voltage motor rotor.
- d) Non-operation and maintenance personnel use insulating rods, nuclear phase devices and voltage transformers to phase or use clamp-type ammeters to measure the current of the high-voltage circuit.
- e) Work on related places and housings of live equipment that are greater than the distance from Table 1, and work where there is no possibility of touching the conductive parts of live equipment.
- f) High-voltage power cables do not need to be powered off.
- g) Those working on converter transformers, DC field equipment and valve hall equipment without the need to disable DC single or double pole or DC filters.
- h) The work of the DC protection control system does not need to disable the HVDC system.

i) The water-cooling system of the converter valve, the air-conditioning system of the valve hall, the fire alarm system and the image monitoring system work without the need to disable the HVDC system.

6.3.4 The work of filling in the work ticket for live work is:

Live work or the distance from nearby live equipment is less than the work specified in Table 1 and greater than Table 4.

6.3.5 The work of filling in the emergency repair form of the accident is:

Emergency repairs for accidents do not require work tickets, but emergency repairs for accidents should be used. For non-continuous accident repair work, work tickets should be used.

6.3.6 When operation and maintenance personnel implement integrated operation and maintenance business projects that do not require high-voltage equipment blackouts or safety measures, work tickets may not be used, but the corresponding operations and work should be recorded in written form.

Each unit shall clearly announce the implementation of integrated operation and maintenance business projects of power transformation and the form of written records adopted.

6.3.7 Filling and issuing of work ticket:

6.3.7.1 The work ticket should be filled out and issued with a black or blue steel (water) pen or ballpoint pen, in duplicate, the content should be correct, the filling should be clear, and no alteration should be allowed. If there are individual errors or omissions that need to be corrected, standard symbols should be used and the handwriting should be clear.

6.3.7.2 The work ticket generated or printed by a computer should use a uniform ticket format, which is verified by the issuer of the work ticket to be correct, and can only be executed after manual or electronic signature.

One copy of the work ticket should be kept at the work site and received by the person in charge of the work; the other should be received by the work permit and handed over according to its value.
work

The licensor shall enter the work ticket number, work task, permit and end time in the register.

6.3.7.3 In a work ticket, the work permit person and the person in charge of the work shall not concurrently serve each other. If the issuer of the work ticket concurrently serves as the work permit or person in charge, he shall have the corresponding qualifications and perform the corresponding safety responsibilities.

6.3.7.4 The work ticket shall be filled out by the person in charge of the work, or by the person who issued the work ticket.

6.3.7.5 The work ticket is issued by the equipment operation and maintenance management unit (department), and can also be issued by an approved maintenance and infrastructure unit that has been approved by the equipment operation and maintenance management unit (department). The list of the issuer and person in charge of the work ticket of the maintenance and infrastructure unit should be sent to the relevant equipment operation and maintenance management unit (department) for the record in advance.

6.3.7.6 In the contract issuance project, the work ticket can be in the form of "dual issuance". When a work ticket is issued, the work ticket issuers of both parties shall sign on the work ticket respectively, and each bears the corresponding security responsibilities of the work ticket issuer of this part.

6.3.7.7 When there are more than two work locations listed on the first type of work ticket, or two or more different work units (teams) work together, the total work ticket and the sub-work ticket can be used. The total and sub-work tickets shall be issued by the same work ticket issuer. The security measures listed on the total work ticket shall include the security measures listed on all sub-work tickets. When several shifts are working at the same time, only the person in charge of each sub-work ticket shall be filled in the working-class member column of the total work ticket, instead of filling in the names of all the working-class personnel. The name of the working-class personnel should be filled on the work ticket.

The total and sub-work tickets are in the same format as the first type of work ticket.

The sub-work ticket shall be in duplicate, and the person in charge of the general work ticket and the person in charge of the sub-work ticket shall receive and execute them separately. The approval and termination of the sub-work ticket shall be handled by the person in charge of the sub-work ticket and the person in charge of the general work ticket. The sub-work ticket shall be approved after the general work ticket is approved; the general work ticket shall be terminated after all the sub-work tickets are terminated.

6.3.7.8 When the power supply unit or construction unit goes to the user's substation for construction, the work ticket shall be issued by the power supply unit, construction unit or user unit that has the right to issue work tickets.

6.3.8 Use of work tickets.

6.3.8.1 A person in charge of a job cannot execute multiple work tickets at the same time, and the work location listed on the work ticket is limited to one electrical connection part.

a) The so-called electrical connection part refers to: the electrical device can be separated from other electrical devices by an isolating switch (knife switch)

part.

b) When the DC bipolar is disabled, the converter transformer and all HVDC equipment can be regarded as an electrical connection part.

c) DC unipolar operation, inactive converter transformer, valve hall, DC field equipment, water cooling system can be regarded as an electrical connection part. The bipolar public area is the operating equipment.

6.3.8.2 The maintenance equipment listed on a work ticket should be stopped and powered on at the same time. All safety measures in the work ticket should be completed at one time before the start of construction. If part of the work has not been completed by the scheduled time and needs to continue to work without hindering power transmission, before power transmission, you should apply for a new work ticket according to the power status of the on-site equipment after power transmission and arrange safety measures before proceeding jobs.

6.3.8.3 If the following equipment is stopped and powered at the same time, the same work ticket can be used:

a) It belongs to the same voltage level and is located in the same plane. Several electrical connections of live conductors will not be touched during work.

b) If a transformer is repaired after power failure, its circuit breaker (switch) will also cooperate with the repair.

c) Power failure of the whole station.

6.3.8.4 If the same type of work is performed on several electrical connections in the same substation without power failure, a second type of work ticket can be used.

6.3.8.5 In the same substation, the same type of live work performed in sequence can use a live work ticket.

6.3.8.6 If you hold a line or cable work ticket to enter a substation or power plant booster station for overhead lines, cables, etc., the number of work tickets should be filled in, approved by the substation or power plant work permit, and retained.

The list of issuers and persons in charge of work tickets of the above-mentioned units should be sent to the relevant operation and maintenance unit for record.

6.3.8.7 When it is necessary to change the members of the work team, the person in charge of the work shall agree to the new operator before proceeding to the work. The person in charge of the work shall not be changed without special circumstances. If it is necessary to change the person in charge of the work, the work permit issuer shall agree and notify the work permitter, and the work permitter shall record the change on the work permit. The person in charge of the job is allowed to change once. The person in charge of the original and current work shall handover work tasks and safety measures.

6.3.8.8 When adding work tasks within the scope of the power outage and safety measures of the original work ticket, the person in charge of the work shall obtain the consent of the work ticket issuer and the work permitter, and fill in additional work items on the work ticket. If you need to change or add security measures, you should fill in a new work ticket and go through the permit issuance procedures again.

6.3.8.9 If the person in charge of the work is changed or the task is added, if the issuer of the work ticket cannot handle it in person, it should be contacted by telephone and indicated on the work ticket register and the work ticket.

6.3.8.10 The first type of work ticket should be delivered to the operation and maintenance personnel one day before the work, and it can be delivered directly or by fax or local area network transmission. However, the work ticket permission for fax transmission should be performed after the official work ticket arrives. Temporary work can be directly handed over to the work permitter before the work starts.

The second type of work ticket and work ticket for live work can be given to the work permitter in advance on the day of work.

6.3.8.11 When the work ticket is damaged and cannot be used any more, a new work ticket shall be filled in and the permit issuance procedures shall be performed again.

6.3.9 Validity and extension of work tickets.

6.3.9.1 The valid time of the first and second types of work tickets and live work tickets is limited to the approved maintenance period.

6.3.9.2 The first and second types of work tickets need to go through the extension procedures, and the person in charge of the work should apply to the person in charge of operation and maintenance before the end of the construction period.), the person in charge of operation and maintenance will notify the work permitter to handle it. The first and second work tickets can only be postponed once. Work tickets for live work are not allowed to be postponed.

6.3.10 The basic conditions of the personnel listed on the work ticket.

6.3.10.1 The issuer of the work ticket should be a production leader, a technician who is familiar with the technical level of the personnel, familiar with the equipment, familiar with this part, and has

relevant work experience, or a person approved by the production leader in charge of the unit. The list of personnel issuing work tickets shall be published in writing.

6.3.10.2 The person in charge of work (guardian) should be a person who has relevant work experience, is familiar with the equipment and this part, and has been approved in writing by the production leader of the workshop (work area, company, center). The person in charge of the work should also be familiar with the work ability of the work class members.

6.3.10.3 The work permit should be an operation and maintenance personnel or maintenance operator (person who performs the task operation and safety measures) approved in writing by the production leader of the workshop (work area, company, center); , The work permit of the substation should be a high-voltage electrical worker with a valid certificate.

6.3.10.4 The dedicated guardian should be a person who has relevant work experience and is familiar with the equipment and this part.

6.3.11 The safety responsibilities of the personnel listed on the work ticket.

6.3.11.1 Issuer of work ticket:

- a) Necessity and safety of work.
- b) Whether the safety measures on the work ticket are correct and complete.
- c) Whether the assigned work person in charge and the staff in the work team are appropriate and sufficient.

6.3.11.2 Person in charge of work (guardian):

- a) Organize work correctly and safely.
- b) Responsible for checking whether the safety measures listed in the work ticket are correct and complete, whether they meet the actual conditions of the site, and supplement if necessary.
- c) Before work, inform the members of the work class of dangerous points, explain the safety measures and technical measures, and confirm that every member of the work class is aware of it.
- d) Strictly implement the safety measures listed in the work ticket.
- e) Supervise and supervise the members of the working class to abide by this section, use labor protection equipment correctly and implement on-site safety measures.
- f) Whether the working-class members are in good spirits and whether the changes are appropriate.

6.3.11.3 Work Permit:

- a) Responsible for reviewing whether the safety measures listed in the work ticket are correct and complete, and whether they meet the site conditions.
- b) Whether the safety measures arranged at the work site are complete and supplement them if necessary.
- c) Responsible for checking the maintenance equipment for sudden calls.
- d) Even if there are minor doubts about the contents of the work ticket, you should ask the issuer of the work ticket clearly and make detailed supplements if necessary.

6.3.11.4 Dedicated guardian:

- a) Clarify the guardian and guardianship scope.
- b) Before work, explain the safety measures to the guarded personnel, and inform the dangerous points and safety precautions.
- c) Supervise the custodial staff to comply with this section and on-site safety measures, and promptly correct unsafe behaviors.

6.3.11.5 Working class members:

- a) Familiar with the work content and work process, master safety measures, clarify the dangerous points in the work, and perform confirmation procedures.
- b) Strictly abide by safety rules and regulations, technical regulations and labor disciplines, be responsible for their own behaviors at work, care for each other's work safety, and supervise the implementation of this part and the implementation of on-site safety measures.
- c) Correctly use safety tools and labor protection equipment.

6.4 Work permit system

6.4.1 After completing the safety measures at the construction site, the work permit should also complete the following procedures before the work shift can start work.

6.4.1.1 In conjunction with the person in charge of the work, go to the site to re-check the safety measures taken, specify the actual isolation measures for the specific equipment, and verify

It is clear that the maintenance equipment is indeed without voltage.

6.4.1.2 Specify the location and precautions of live equipment to the person in charge of the work.

6.4.1.3 Confirm and sign on the work ticket with the person in charge of the work.

6.4.2 The operation and maintenance personnel shall not change the operation wiring mode of the related maintenance equipment. The person in charge of the work and the work permit person shall not change the safety measures without authorization. If there is a special situation in the work that needs to be changed, it shall first obtain the consent of the other party and restore it in time. The changes are recorded in the duty log in time.

6.4.3 The second type of work ticket for substation (power plant) can be approved by telephone, but it should be recorded and recorded separately. Take the work ticket approved by the telephone, the safety measures required for the work can be arranged by the staff themselves, and the work permit should be reported to the work permit after the work is over.

6.5 Work Guardianship System

6.5.1 After the work permit procedures are completed, the person in charge of the work and the dedicated guardian shall explain the work content, division of labor, live parts and on-site safety measures to the members of the work team, notify the dangerous points, and complete the confirmation procedures before the work team can start work. The person in charge of the work and the dedicated guardian should always be at the work site, carefully supervise the safety of the staff in the work shift, and correct unsafe behaviors in a timely manner.

6.5.2 All staff (including the person in charge of work) are not allowed to enter or stay alone in the high-pressure chamber, valve hall and outdoor high-pressure equipment area.

If the work needs (such as measuring polarity, loop continuity test, fiber optic loop inspection, etc.), and the field equipment allows, it can

One person or several people in the work class who have practical experience are working in other rooms at the same time, but the person in charge of the work should inform the relevant safety precautions in detail in advance.

6.5.3 The person in charge of work can participate in the work shift when all power is cut off. In the case of partial power outages, only when safety measures are reliable, personnel are concentrated in one work place, and there is no accidental touching of power parts, can they participate in work.

The issuer of the work ticket or the person in charge of the work shall add additional information according to the specific conditions of the site's safety conditions, construction scope, and work needs.

Dedicated guardian and determine the person to be guarded.

The dedicated guardian shall not concurrently do other tasks. When the designated guardian leaves temporarily, the ward should be notified to stop working or leave the work site, and resume work only after the designated guardian returns. If the dedicated guardian has to leave the work site for a long time, the person in charge of the work should change the dedicated guardian, perform the change procedures, and notify all the guardians.

6.5.4 During the working period, if the person in charge of the work temporarily leaves the work site for some reason, he should designate a competent person to replace him temporarily. Before leaving, he should clearly explain the work site and inform the members of the work team. When the original person in charge of the work returns to the work site, he should also perform the same handover procedures.

If the person in charge of the work must leave the work site for a long time, the original work ticket issuer should change the person in charge of the work and perform the change.

Continue, and inform all operators and work permitters. The original and current job leaders should make the necessary handovers.

6.6 Work break, transfer and termination system

6.6.1 When the work is interrupted, the staff in the work shift shall withdraw from the work site. At the end of the day, the work site should be cleaned, closed channels should be opened, and the work permit should be notified by telephone. If all safety measures and wiring methods remain unchanged after the work is interrupted, the work ticket can be held by the person in charge of the work. When resuming work the next day, the person in charge of work should call the work permitter and re-check to confirm whether the safety measures meet the requirements of the work ticket. Continue to work after an interruption, without the leadership of the person in charge of the work or the dedicated guardian, the operator shall not enter the work site.

6.6.2 Before going through the work ticket closing procedures, no personnel are allowed to switch on and send power to the power-off equipment.

During the work break, if there is an urgent need, the operation and maintenance personnel can switch on and send power without returning the work ticket, but the person in charge of the work should be notified first, and the power can be sent when all the staff in the work shift have left the work place. After the reply, the following measures shall be taken:

- a) Remove the temporary shielding fence, grounding wire and nameplate, restore the permanent shielding fence, and replace the nameplate with "Stop, high voltage danger!"

b) Special personnel should be sent to wait on all roads, so as to tell the crew "The equipment has been switched on and power is supplied, and it is not allowed to continue working". The waiting staff shall not leave the waiting place until the work ticket is returned.

6.6.3 Before the overhaul work is over, if it is necessary to test the equipment with working voltage, it shall be carried out according to the following conditions:

a) All operating personnel evacuated the work site.

b) Take back all the work tickets of the system, remove the temporary shielding fence, grounding wire and nameplate, and restore the permanent shielding fence. c) After the person in charge of the work and the operation and maintenance personnel have carried out a comprehensive inspection, the operation and maintenance personnel shall carry out the pressure test. If the work shift needs to continue to work, the work permit procedures shall be performed again.

6.6.4 When using the same work ticket in the same electrical connection part to transfer work in several work locations in turn, all safety measures are determined by operation and maintenance.

The personnel do it at one time before the start of work, and there is no need to go through transfer procedures. However, when the person in charge of the work transfers the work site, he should explain the charging range, safety measures and precautions to the operating personnel.

6.6.5 After all the work is completed, the work shift should clean and tidy up the site. The person in charge of the work should conduct a thorough inspection. After all the operators have evacuated from the work site, they should report the repaired items, discovered problems, test results and existing problems to the operation and maintenance personnel, and check the condition and status of the equipment together with the operation and maintenance personnel. , Whether there are any leftovers, whether it is clean, etc., and then fill in the work end time on the work ticket. After being signed by both parties, the work ends.

The temporary barrier on the work ticket has been removed, the sign has been removed, the permanent barrier has been restored, the grounding wire that has not been removed, the undrawn

The operation mode of the grounding switch (device) and other equipment has been reported to the regulator, and the work ticket has ended.

6.6.6 Only after all work tickets for the same power outage system have been terminated and the supervisor on duty or the person in charge of operation and maintenance has obtained the permission instruction, the power can be closed and transmitted.

6.6.7 The completed work tickets and emergency repair orders should be kept for 1 year.

7. Technical Measures to Ensure Safety

7.1 Technical measures to ensure safety when working on electrical equipment

a) Power failure.

b) Check electricity.

c) Grounding.

d) Hanging sign boards and installing barriers (fences).

The above measures are performed by operation and maintenance personnel or personnel authorized to perform operations.

7.2 Power failure

7.2.1 The equipment that should be powered off at the work site is as follows:

- a) Equipment for maintenance.
- b) The distance from the normal range of activities of the operator during work is less than the equipment specified in Table 3.

Table 3 The safe distance between the normal range of activities of the operator and the live part of the equipment

Voltage level (kV)	safe distance (m)	Voltage level (kV)	safe distance (m)
10 及以下 (13.8)	0.35	1000	9.50
20、35	0.60	±50 及以下	1.50

Table 3 (continued)

Voltage level (kV)	safe distance (m)	Voltage level (kV)	safe distance (m)
66、110	1.50	±400	6.70 ^①
220	3.00	±500	6.80
330	4.00	±660	9.00
500	5.00	±800	10.10
750	8.00 ^②		

Note: The voltages not listed in the table are based on the safety distance of the higher voltage level.

Note 1: The ±400kV data is calibrated at an altitude of 3000m, and the safety distance is 6.80m at an altitude of 4000m.

Note 2: 750kV data is calibrated at an altitude of 2000m, and data for other grades is calibrated at an altitude of 1000m.

- c) When working at 35kV and below equipment, the safety distance is greater than that specified in Table 3, but less than that specified in Table 1, and at the same time, there is no insulation partition or safety fence.
- d) Equipment with live parts behind, on both sides, up and down of operators, and without reliable safety measures.
- e) Other equipment that needs power failure.

7.2.2 When the maintenance equipment is out of power, all power sources should be completely disconnected (the neutral point of any running star-connected equipment should be regarded as a live equipment). It is forbidden to work on equipment that is only disconnected from the power source by a circuit breaker (switch) or is blocked by an inverter to isolate the power source. The isolation switch (knife switch) should be opened, the handcart switch should be pulled to the test or inspection position, and there should be an obvious disconnection point in all aspects. If the disconnection point of the power-off equipment cannot be observed, it should reflect the operation of the equipment Electrical and mechanical status indications. Transformers related to power failure equipment

With voltage transformer, each side of the equipment should be disconnected to prevent reverse power transmission to the power failure maintenance equipment.

7.2.3 The circuit breaker (switch) and isolating switch (knife switch) on the maintenance equipment and the side that may be called should disconnect the control power supply and closing energy. The operating handle of the isolation switch (knife switch) should be locked to ensure that power is not supplied by mistake.

7.2.4 For maintenance equipment that is difficult to be completely disconnected from the power supply, the electrical connection between the equipment and the power supply can be removed.

7.3 Electricity check

7.3.1 During the electrical inspection, a qualified contact electrocope of the corresponding voltage level shall be used to conduct electrical inspection on each phase at the place where the grounding wire or the grounding switch (device) is installed. Before the electrical inspection, the electrical equipment should be tested to confirm that the electrical equipment is good; when the electrical equipment cannot be tested, the power frequency high-voltage generator can be used to confirm that the electrical equipment is good.

7.3.2 Insulating gloves should be worn for high-voltage electrical testing. The length of the telescopic insulating rod of the electrocope should be extended enough, the hand should be held at the handle not to exceed the retaining ring during the electrical test, and the human body should keep the distance specified in Table 1 with the electrical test equipment. It is not allowed to conduct an outdoor direct electrical inspection in rain or snow.

7.3.3 For equipment that cannot be directly tested, high-voltage direct current transmission equipment, and outdoor equipment in rain and snow, indirect testing can be performed, that is, through the mechanical location of the equipment, electrical instructions, live display devices, meters and various It can be judged by changes in signals such as telemetry and tele signal. When judging, at least two non-same principles or non-homologous indications should have corresponding changes, and all these confirmed indications have changed correspondingly at the same time, in order to confirm that the device has no electricity. The above inspection items should be filled in the operation ticket as inspection items. If any other signal is found to be abnormal during the inspection, stop the operation and find out the cause. For remote operation, the above-mentioned indirect method or other reliable methods can be used for indirect electrical inspection.

Electrical equipment of 330kV and above can be tested by indirect testing methods.

7.3.4 A signal indicating that the device is disconnected and allowed to enter the interval, a voltmeter that is frequently connected, etc., if it indicates that there is electricity, it is prohibited to work on the device until the abnormal situation is eliminated.

7.4 Grounding

7.4.1 The installation of the grounding wire should be carried out by two persons (except for projects and operation and maintenance personnel who can install the grounding wire by one person after approval).

7.4.2 When it is verified that the equipment is indeed without voltage, the maintenance equipment should be grounded and three-phase short-circuited immediately. Cables and capacitors should be fully discharged phase by phase before grounding. The neutral point of the star-connected capacitors should be grounded. The series capacitors and capacitors separated from the entire group of capacitors should be discharged multiple times. The capacitor shell mounted on the insulating support should also be discharged.

7.4.3 All aspects of the equipment that may transmit power to the power failure should be installed with grounding wires or closed grounding switches (devices). The installed grounding wires and live parts should be considered to comply with the safety distance regulations when the grounding wires swing.

7.4.4 When the overhauled equipment may generate induced voltage due to parallel or adjacent live equipment, a work grounding wire should be installed or a personal security wire should be used. The additional grounding wire should be registered on the work ticket. Self-installation.

7.4.5 Perform power outage maintenance on the line side of the door-shaped frame. If the distance between the working place and the installed grounding wire is less than 10m, although the working place is outside the grounding wire, it is not necessary to install another grounding wire.

7.4.6 If the maintenance part is divided into several parts that are not electrically connected [for example, the section bus is separated into several sections by an isolating switch (switch) or circuit breaker (switch)], each section shall be checked separately Short to ground. When the step-down substation is completely out of power, each part of the possible incoming side should be grounded and short-circuited, and the remaining parts do not need to be equipped with a grounding wire or close the grounding switch (device).

7.4.7 No circuit breaker (switch) or fuse should be connected between the grounding wire, the grounding switch and the maintenance equipment. If due to equipment reasons, a circuit breaker (switch) is connected between the grounding switch and the maintenance equipment, after the grounding switch and the circuit breaker (switch) are closed, there should be a guarantee for the circuit breaker

(Switch) Measures that will not open.

7.4.8 On the power distribution device, the grounding wire should be installed at the specified location of the conductive part of the device, and the paint or insulation layer of these locations should be removed and marked with a black mark. Appropriate locations for all power distribution devices should be provided with grounding terminals connected to the grounding grid, and the grounding resistance should be qualified. The grounding wire should be a three-phase short-circuit grounding wire. If a split-phase grounding wire is used, a three-phase grounding terminal should be provided.

7.4.9 The grounding wire should be connected to the grounding terminal first, followed by the conductor end. The grounding wire should be in good contact and the connection should be reliable. The order of disconnecting the ground wire is reversed. Insulating rods and insulating gloves should be used to install and remove the conductor end of the grounding wire. The human body must not touch the ground wire or ungrounded wire to prevent electric shock. When disconnecting the device connector with a grounding wire, take measures to prevent the grounding wire from falling off.

7.4.10 The complete set of grounding wires shall be composed of multi-strand soft copper wires with transparent sheaths and special clamps. The cross-section of the grounding wires shall not be less than 25mm² and shall meet the short-circuit current requirements of the installation site.

It is forbidden to use other wires as grounding wires or short-circuit wires.

The grounding wire should be fixed on the conductor with a special wire clip, and it is forbidden to ground or short-circuit by winding method.

7.4.11 It is forbidden to move or remove the grounding wire without authorization. Work on the high-voltage circuit must remove all or part of the ground

Workers can only be carried out after the line [such as measuring the insulation resistance of the bus and cable, measuring the line parameters, and checking whether the contacts of the circuit breaker (switch) are in contact at the same time], such as:

- a) Remove one-phase grounding wire.
- b) Remove the ground wire and keep the short-circuit wire.
- c) Remove all grounding wires or pull off the grounding switch (device).

The above work shall be carried out with the permission of the operation and maintenance personnel (the grounding wire installed according to the instructions of the control personnel shall be approved by the control personnel). Resume immediately after finishing the work.

7.4.12 Each group of grounding wires and their storage locations should be numbered, and the number of the grounding wires should be consistent with the storage location number.

7.4.13 Assembling and disassembling the grounding wire should be recorded, and should be clearly explained when shifting shifts.

7.5 Hanging sign boards and installing barriers (fences)

7.5.1 The operating handles of the circuit breakers (switches) and isolating switches (switches) that can be sent to the work site as soon as they are closed should be hung with a sign indicating "No closing, someone working!" (see appendix I).

If there is someone working on the line, the operating handle of the line breaker (switch) and isolating switch (knife switch) should be hung on

Gate, someone is working on the line!" Sign.

For equipment reasons, a circuit breaker (switch) is connected between the grounding switch and the overhaul equipment. After the grounding switch and the circuit breaker (switch) are closed, the operating handle of the circuit breaker (switch) should be hung with "No switch Gate!" sign.

The operation of the circuit breaker (switch) and isolating switch (knife switch) that are operated on the display should be set to "No closing, someone working!" or "No closing, someone working on the line!" and "No opening!" Mark.

7.5.2 For partial power failure work, the safety distance is less than the non-power-off equipment within the distance specified in Table 1, and temporary shelter should be installed. The distance between the temporary shelter and the live part shall not be less than the specified value in Table 3. The temporary shelter can be made of dry wood, Rubber or other tough insulating materials, the installation should be firm, and the sign of "stop, high voltage danger!" should be hung.

For equipment of 35kV and below, insulating partitions directly in contact with live parts can be used instead of temporary barriers. The insulation performance of the insulating partition shall meet

Requirements of Appendix J.

7.5.3 When working on indoor high-voltage equipment, the signs "Stop, high-voltage danger!"

7.5.4 After the handcart switch in the high-voltage switch cabinet is pulled out, the baffle that isolates the live part is closed and it is forbidden to open, and a sign "Stop, high-voltage danger!" is set.

7.5.5 When working on outdoor high-voltage equipment, fences should be installed around the work site, and the entrances and exits should be enclosed by the adjacent roads, and there should be a sign "Enter and exit here!" An appropriate number of "Stop, High Voltage Danger!" signs should be hung

on the fences around the work site, and the signs should face the fence. If most of the equipment of the outdoor power distribution device is out of power, and only a few places keep the live equipment and other equipment has no possibility of touching the live conductor, a fully enclosed fence can be installed around the live equipment, and an appropriate number of "stops, high voltage" Danger!" The sign, the sign should face the outside of the fence.

It is forbidden to cross the fence.

7.5.6 Set up a "work here!" sign at the workplace.

7.5.7 When working on an outdoor structure, a sign "Stop, high voltage danger!" should be hung on the beam near the live part of the work site. On the iron frame or ladder, the operator should hang the sign of "Go up and down!" On other nearby live structures that may be mistakenly mounted, a sign indicating "No climbing, high voltage danger!" should be hung.

7.5.8 It is forbidden for operators to move or dismantle barriers (fences) and signs without authorization. The fence must be moved or removed for a short time due to work

(Fences) and sign boards should be approved by the work permit and carried out under the supervision of the person in charge of the work. It should be restored immediately after completion.

7.5.9 For DC converter station with unipolar power failure, a fence should be set up between the equipment in the bipolar public area and the power outage area, and a sign "Stop, high voltage danger!" should be hung on the fence facing the power failure equipment and the door of the operation valve hall. Set up "work here" signs at the maintenance valve hall and DC field equipment.

8. Safety Measures for Substations and Power Plants During Line Operation

8.1 The shutdown and power transmission of the line shall be performed in accordance with the instructions of the on-duty regulator or line work permit. It is forbidden to stop and transmit electricity on time. In the event of a power failure, all circuit breakers (switches), line isolation switches (knife switches), and bus isolation switches (knife switches) that may come on the line should be opened first, and the handcart switch should be pulled to the test or inspection position, and the inspection is clear After there is no voltage, install a grounding wire or close the grounding switch (device) at each end of the line that may call. In line circuit breaker (switch) and isolating switch (knife switch)

The operation handle or the door lock handle of the mechanism box should be hung with a sign indicating "No closing, someone working on the line!", and "No Close, someone is working on the line!" mark.

8.2 On-duty control personnel or line work permits should keep a record of the number of work teams and groups for line power outage maintenance, the name of the person in charge, work location and work tasks.

At the end of the work, you should get a work end report from the person in charge of the work (including the user) to confirm that all work teams have been completed.

The grounding wire has been removed, the operators have all evacuated the line, and the records are checked and recorded, and then the safety measures in the substation or power plant can be dismantled and the line can be sent to the line.

8.3 When the line under the user's jurisdiction requires a power outage, a written application from the user's power outage and transmission contact should be obtained, and the power outage can be performed after approval, and safety measures should be taken. To resume power transmission, the original applicant's work completion report shall be received, and the recording and recording shall be

made before proceeding. The list of contact persons for power outages should be filed in the control center and relevant departments.

9. Live Work

9.1 General provisions

9.1.1 This Part is applicable to high-voltage overhead power lines and electrical equipment in substations (power plants) at an altitude of 1000m and below, AC 10~1000kV, DC $\pm 500 \sim \pm 800$ kV (750kV is at an altitude of 2000m and below), etc. Potential, intermediate potential and ground potential methods for live working.

When working with electricity at an altitude above 1000m (750kV is above 2000m above sea level), repairs should be made according to different altitudes in the work area.

The safety distance and length of various types of air and solid insulation, the number of insulators, etc., and the preparation of live working site safety regulations, are implemented after the approval of the leader (chief engineer) in charge of production of the unit.

9.1.2 Live work should be carried out in good weather. In the event of thunder and lightning (thunder is heard, lightning is seen), snow, hail, rain, fog, etc., live work is not allowed. When the wind is greater than 5 or the humidity is greater than 80%, it is generally not suitable for live operation.

Under special circumstances, when live repairs must be carried out in inclement weather, relevant personnel should be organized to fully discuss and prepare necessary safety

Measures can only be carried out after approval by the leader (chief engineer) in charge of production of the unit.

9.1.3 For more complex and difficult new projects and new tools developed for live work, scientific tests should be carried out to confirm safety and reliability, and the operation process plan and safety measures should be prepared and approved by the leader (chief engineer) in charge of the production of the unit. After approval, it can be used.

9.1.4 Personnel participating in live work should receive special training, pass the examination and obtain the qualification, and the unit can only participate in the corresponding work after the written approval of the unit. The issuer of the work ticket for live working, the person in charge of the work, and the dedicated guardian shall be personnel with live working qualifications and practical experience in live working.

9.1.5 A dedicated guardian should be appointed for live work. Guardians are not allowed to operate directly. The scope of monitoring is not allowed to exceed one operating point. A guardian (on the tower) should be added when necessary for complex or tall tower operations.

9.1.6 When the issuer or the person in charge of the work ticket for live work deems it necessary, they should organize experienced personnel to conduct on-site surveys, make judgments on whether live work can be carried out based on the survey results, and determine the operation methods, required tools, applications and the measures taken.

9.1.7 If there is one of the following conditions for live work, the reclosing or DC circuit restart function should be disabled. Forced power transmission is not allowed. It is prohibited to disable or restore the reclosing or DC circuit restart function in time:

- a) Single-phase grounding operations may occur in a system where the neutral point is effectively grounded.

b) Operations in which the neutral point is not effectively grounded may cause a short circuit between phases.

c) Operations that may cause single-pole grounding or short-circuit between poles in the DC line.

d) The work ticket issuer or the person in charge of the work believes that it is necessary to disable reclosing or DC line restart functions.

9.1.8 The person in charge of live work should contact the supervisor on duty before the start of live work. Operations that require the function of reclosing the reclosing or restarting of the DC line, as well as live disconnection and wire connection, shall be permitted by the on-duty control personnel. After the live operation is over, report to the on-duty regulator in time.

9.1.9 If the equipment is suddenly powered off during live work, the operator should regard the equipment as still live. The person in charge of the work should contact the dispatcher as soon as possible, and the on-duty control personnel shall not force the power supply before contacting the person in charge of the work.

9.2 General safety technical measures

9.2.1 When conducting ground potential live work, the safety distance between the human body and the live body shall not be less than the provisions in Table 4. When live equipment of 35kV and below cannot meet the minimum safety distance specified in Table 4, reliable insulation and isolation measures should be taken.

Table 4 Safety distance between human body and live object during live work

Voltage level (kV)	10	35	66	110	220	330	500	750	1000	±400	±500	±660	±800
distance (m)	0.4	0.6	0.7	1.0	1.8 (1.6) ①	2.6	3.4 (3.2) ②	5.2 (5.6) ③	6.8 (6.0) ④	3.8 ⑤	3.4	4.5 ⑥	6.8

Note: The data in the table is based on the safety requirements of live line work.

Note 1: When the safety distance for 220kV live working is less than 1.8m due to equipment limitations, the value of 1.6m in brackets can be adopted after approval by the leader (chief engineer) in charge of production and taking necessary measures.

Note 2: If the altitude is below 500m, 500kV takes the value of 3.2m, but it is not suitable for 500kV compact lines. When the altitude is 500~1000m, 500kV takes the value of 3.4m. Note 3: Straight-line tower side phase or middle phase value. 5.2m is the value below 1000m above sea level, and 5.6m is the distance below 2000m above sea level.

Note 4: This is the data of single-circuit transmission line. The data in brackets 6.0m is the side phase value, and 6.8m is the middle phase value. The value in the table does not include the human body occupying gap, and the human body occupying gap must not be less than 0.5m during operation.

Note 5: The ±400kV data is calibrated at an altitude of 3000m, and the minimum safety distance when the altitude is 3500m, 4000m, 4500m, 5000m, 5300m is 3.90m, 4.10m, 4.30m, 4.40m, 4.50m in sequence.

Note 6: The ±660kV data is calibrated according to the altitude of 500~1000m; the minimum safe distance at the altitude of 1000~1500m and 1500~2000m is 4.7m and 5.0m in sequence.

9.2.2 The effective insulation length of insulated operating rods, insulated load-bearing tools and insulated ropes shall not be less than those specified in Table 5.

Table 5 Minimum effective insulation length of insulation tools

Voltage level (kV)	Effective insulation length (m)
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	Insulated operating lever	Insulated load-bearing tools, insulated ropes
10	0.7	0.4
35	0.9	0.6
66	1.0	0.7
110	1.3	1.0
220	2.1	1.8
330	3.1	2.8
500	4.0	3.7
750	5.3	5.3
Minimum effective insulation length of insulation tool (m)		
1000	6.8	
±400	3.75 ^①	
±500	3.7	
±660	5.3	
±800	6.8	
Note: ±400kV data is calibrated according to the altitude of 3000m, the minimum safety distance when the altitude is 3500m, 4000m, 4500m, 5000m, 5300m is as follows 3.90m, 4.10m, 4.25m, 4.40m, 4.50m.		

9.2.3 Non-insulated ropes (such as cotton yarn rope, white brown rope, steel wire rope) shall not be used for live working.

9.2.4 When replacing insulators with power on or working on insulator strings, ensure that the number of good insulators during the operation shall not be less than those specified in Table 6.

Table 6 Minimum number of good insulators in live working

Voltage Level (kV)	35	66	110	220	330	500	750	1000	±500	±660	±800
Distance	2	3	5	9	16	23	25 ^①	37 ^②	22 ^③	25 ^④	32 ^⑤
<p>Note 1: For values below 2000 meters above sea level, the minimum number of 750kV good insulators should be based on the height of a single insulator and the total length of good insulators shall not be less than 4.9m To confirm, determine the xwp300 insulator (single piece height is 195mm), the minimum number of good insulators is 25 pieces.</p> <p>Note 2: For values below 1000 meters above sea level, the minimum number of 1000kV good insulators should be based on the height of a single insulator and the total length of good insulators shall not be less than 7.2m It is confirmed that (the height of a single piece is 195mm), the minimum number of good insulators is</p>											

37 pieces. The value in the table does not include the human body occupying gap, and the human body occupying gap must not be less than 0.5m during operation. Note 3: The height of a single piece is 170mm.

Note 4: For values below 500-1000 meters above sea level, the minimum number of good insulators at $\pm 660\text{kV}$ should be based on the height of the single insulator and the total length of the good insulator shall not be less than 4.7m is determined, it is determined from this (single insulator height is 195mm), the minimum number of good insulators is 25.

Note 5: For values below 1000 meters above sea level, the minimum number of good insulators $\pm 800\text{kV}$ should be based on the height of a single insulator and the total length of good insulators shall not be less than 6.2m

Determined from this (the height of a single insulator is 195mm), the minimum number of good insulators is 32.

9.2.5 When replacing the insulator string and moving the wire, when a single-hanging (pulling) wire device is used, backup protection measures should be taken to prevent the wire from falling off.

9.2.6 Before the insulator string is separated from the conductor, when disassembling or installing the first insulator close to the cross arm, special short-circuit wires or shielding clothing should be used for direct operation.

9.2.7 When conducting live work in urban areas or densely populated areas, fences should be set up at the work site, and special personnel should be assigned to guard them. Non-operating personnel are prohibited from entering.

9.2.8 For non-special needs, no live wire racking or wire removal work should be carried out underneath the crossover or near the stalls with power lines or other weak current lines. If necessary, reliable safety technical measures shall be formulated and approved by the leader (chief engineer) in charge of production of the unit before proceeding.

9.3 Equipotential work

9.3.1 Equipotential work is generally performed on power lines and electrical equipment with voltage levels of 66, $\pm 125\text{kV}$ and above. If it is necessary to perform equipotential work at the voltage level of 35kV, reliable insulation and isolation measures should be taken. Equipotential operations are not allowed on power lines and electrical equipment with voltage levels of 20kV and below.

9.3.2 Equipotential operators should wear a full set of qualified shielding suits (including hats, underwear, gloves, socks and shoes, 750,

1000kV equipotential workers should also wear masks), and all parts should be well connected. Flame-retardant underwear should also be worn in the shielding suit. It is forbidden to break through the shielding service, connect the ground current, no-load circuit and the capacitive current of the coupling capacitor.

9.3.3 The distance between the equipotential operator and the grounding body should not be less than that specified in Table 4, and the distance between adjacent conductors should not be less than the provisions in Table 7.

Table 7 Minimum distance between equipotential operators and adjacent phase conductors

Voltage Level (kV)	66	110	220	330	500	750
Distance (m)	0.9	1.4	2.5	3.5	5.0	6.9 (7.2) ^①
Note 1: 6.9m is the side phase value, and 7.2m is the middle phase value. The values in the table						

do not include the range of human motion, and the range of human motion must not be less than 0.5m during operation.

9.3.4 When the equipotential operator is working on the insulating ladder or entering a strong electric field along the insulating ladder, the combined gap formed by the gap between the two parts of the grounding body and the charged body shall not be less than the provisions in Table 8.

Table 8 Minimum combined gap in equipotential work

Voltage Level (kV)	66	110	220	330	500	750	1000	±400	±500	±660	±800
Distance (m)	0.8	1.2	2.1	3.1	3.9	4.9 ①	6.9 (6.7 ②)	3.9 ③	3.8	4.3 ④	6.6
<p>Note 1: 4.9 is the neutral phase value of the linear tower. The value in the table does not include the human body occupying gap, and the human body occupying gap must not be less than 0.5m during operation.</p> <p>Note 2: 6.9 is the mid-phase value and 6.7 is the side-phase value. The value in the table does not include the human body occupying gap, and the human body occupying gap must not be less than 0.5m during operation.</p> <p>Note 3: The ±400kV data is calibrated at an altitude of 3000m, and the minimum combined gap when the altitude is 3500m, 4000m, 4500m, 5000m, 5300m is 4.15m, 4.35m, 4.55m, 4.80m, 4.90m.</p> <p>Note 4: For altitudes below 500m, ±660kV is taken as 4.3m; at altitudes of 500-1000m, 1000-1500m, and 1500-2000m, the minimum combined gap is 4.6m, 4.8m, 5.1m.</p>											

9.3.5 The work of equipotential workers entering the strong electric field along the insulator string is generally carried out on the insulator string of 220kV and above. The combined clearance shall not be less than the regulations in Table 8. If it does not meet the requirements of Table 8, a protective gap should be installed. After deducting the number of short-circuited and zero-value insulators, the number of good insulators shall not be less than those specified in Table 6.

9.3.6 The equipotential operator shall obtain the permission of the person in charge of the work before the potential transfer. When the potential is transferred, the distance between the exposed part of the human body and the charged body shall not be less than the regulations in Table 9. 750, 1000kV should use potential transfer rod for potential transfer.

Table 9 The minimum distance between the exposed part of the human body and the charged body when the potential is transferred by the equipotential operation

Voltage Level (kV)	35、 66	110 、 220	330 、 500	±400、 ±500	750、 1000
Distance (m)	0.2	0.3	0.4	0.4	0.5
Note: 750, 1000kV equipotential work is performed simultaneously.					

9.3.7 When transferring tools and materials between equipotential operators and ground potential operators, insulated tools or insulated ropes shall be used, and the effective length shall not be less than that specified in Table 5.

9.3.8 The operation of soft and hard ladders or flying vehicles suspended along the guide and ground wires into the strong electric field shall comply with the following regulations:

9.3.8.1 When the ladder (or flying car) is hung on the guide and ground wire with continuous pitch, the cross section of the guide and ground wire shall not be less than: steel core aluminum stranded wire and aluminum alloy stranded wire 120mm²; steel stranded wire 50mm² (equivalent to OPGW optical cable and supporting LGJ—70/40 wire).

9.3.8.2 Those who have one of the following conditions shall be qualified by experience and can only proceed with the approval of the production leader (chief engineer) of the unit:

- a) Work on the guide and ground lines of isolated files.
- b) Work on broken strands, ground wires and rusty ground wires.
- c) Work on conductors and ground wires other than those specified in 9.3.8.1.
- d) Two or more people work on the same guide and ground wire in the same gear.

9.3.8.3 Before carrying out equipotential operations by hanging a ladder or flying car on the conductor and ground wires, check the tightness of the conductor and ground wires at the poles at both ends of the gear. After the ladder is mounted, the safe distance between the ground wire and the human body and the live conductor below should be increased by 0.5m than the value in Table 4; It is 1m larger than the value in Table 4.

9.3.8.4 It is forbidden to hang ladders on porcelain crossarm lines, and the crossarm shall be fixed before the ladder is hung on the line where the crossarm is rotated.

9.3.9 Equipotential operators are prohibited from using flammable materials such as alcohol or gasoline to wipe the live parts and insulating parts during the operation to prevent fire.

9.4 Live disconnection and lead connection

9.4.1 When disconnecting and connecting no-load circuits when powered on, the following regulations shall be observed:

- a) When disconnecting or connecting a no-load circuit with power, confirm that the circuit breaker (switch) and isolating switch (switch) at the other end of the circuit are indeed disconnected, and the transformer and voltage transformer connected to the line side are indeed out of operation. Before proceeding.

It is forbidden to break or connect the lead with load.

- b) When the power is disconnected or connected to the no-load circuit, the operator should wear goggles and take arc suppression measures. The current interruption capability of the arc suppression tool should be compatible with the voltage level and capacitance current of the no-load circuit being disconnected or connected. If the arc suppression rope is used, the length of the disconnected and connected no-load line shall not be greater than that specified in Table 10, and the distance between the operator and the disconnection point shall be more than 4m.

Table 10 The maximum length of using arc suppression rope to break and connect no-load line

Voltage Level (kV)	10	35	66	110	220
Distance	50	30	20	10	3

(km)					
Note: The line length includes branches, but does not include cable lines.					

c) After checking that the line is not grounded, the insulation is good, no one is working on the line, and the phase is determined to be correct, then the live line can be disconnected and the leads can be connected.

d) The wires that are not connected to the phase when the lead is live and the wires that are disconnected when the lead is disconnected will be charged due to induction. To prevent electric shock, measures should be taken before personnel can reach it.

e) It is forbidden to touch two broken ends of unconnected or disconnected wires at the same time to prevent the human body from entering the circuit.

9.4.2 It is prohibited to disconnect or parallel the two power sources by disconnecting or connecting the no-load circuit.

9.4.3 When the coupling capacitor is disconnected or connected, the grounding switch should be closed, and the high-frequency protection and signal circuit should be disabled. The disconnected capacitor should be discharged to ground immediately.

9.4.4 Measures should be taken to prevent the drainage line from swinging when disconnecting or connecting the lead wires of no-load lines, coupling capacitors, arresters, wave traps and other equipment.

9.5 Live short circuit equipment

9.5.1 Use shunt wires to short circuit breakers (switches), isolating switches (knife switches), drop-out fuses and other current-carrying equipment, and the following requirements should be observed:

- The phase must be checked before shorting.
- The oxide layer should be removed at the wire assembly of the shunt line, and the clamp contact should be firm and reliable.
- 35kV insulation level insulating shunt line and equipment should comply with the following table 16 specified.
- The circuit breaker (switch) should be in the closed position, and the trip circuit fuse should be removed, and the tripping mechanism can be locked before short circuiting.
- The shunt line should be well supported to prevent grounding or short circuit caused by swing.

9.5.2 Before the wave trap is short-circuited, strictly prevent the human body of the equipotential operator from short-circuiting the wave trap.

9.2.3 The current-carrying capacity of the shunt line section of the short-circuit switchgear or the wave trap and the clamps at both ends shall meet the requirements of the maximum load current.

9.6 Rinse with electrified water

9.6.1 Rinsing with live water should generally be carried out in good weather. Greater than the wind 4 stage temperatures below [-3 deg.] C, or rain, when the snow, fog, dust storms, and is not suitable for lightning. When washing, the operator should wear insulating gloves and insulating boots.

9.6.2 The contamination of the insulators should be grasped before energized water washing operations. When the salt density value is greater than the maximum critical salt density value specified in Table 11, water washing is generally not suitable, otherwise, the water resistivity should

be increased to remedy. Surge arresters and poorly sealed equipment should not be flushed with live water.

Table 11 Critical Salt Density Value for Charged Water Washing ① (only applicable to 220kV and below)

Creepage ratio ② (mm/kV)	Power plant and substation pillar insulator or sealed porcelain bushing							
	14.8 ~ 16 (normal type)				20 ~ 31 (anti-pollution type)			
Critical salt density (Mg/cm ²)	0.02	0.04	0.08	0.12	0.08	0.12	0.16	0.2
Water resistivity (Ω · cm)	1500	3000	10 000	50 000 and above	1500	3000	10 000	50 000 and above
Creepage ratio ② (mm/kV)	Line suspension insulator							
	14.8 ~ 16 (normal type)				20 ~ 31 (anti-pollution type)			
Critical salt density (Mg/cm ²)	0.05	0.07	0.12	0.15	0.12	0.15	0.2	0.22
Water resistivity (Ω · c)	1500	3000	10 000	50 000 and above	1500	3000	10 000	50 000 and above
Note 1: The critical salt density of 330kV and above is not yet mature and will not be listed. Note 2: The creepage distance refers to the ratio of the creepage distance of the external insulation of the power equipment to the maximum working voltage of the equipment.								

9.6.3 The electrical resistivity of the flushing water with electrified water is generally not less than 1500 Ω · cm, and the resistivity of the water for flushing 220kV substation equipment is not less

3000 Ω · cm, and should meet the requirements of Table 11. Before each flushing, use a qualified water resistance meter to measure the water resistivity, and take a water sample from the outlet of the water gun for measurement. If water tanks such as water tankers contain water, the electrical resistivity of each water tank should be measured.

9.6.4 Water column based insulating large and medium-sized flush (nozzle diameter. 4 ~ 8mm are flush in said diameter of 9mm and above said large flush), the length of the water column between the gun nozzle and the charged body It shall not be less than the provisions of Table 12. Both large and medium-sized water gun nozzles should be reliably grounded.

Table 12: Length of water column between nozzle and charged body (m)

Nozzle diameter (mm)		4 ~ 8	9 ~ 12	13 ~ 18
Voltage level (KV)	66 and below	2	4	6
	110	3	5	7
	220	4	6	8

9.6.5 Before energized flushing, the pressure of the water pump should be adjusted so that the water column has a long range and dense water flow. When the water pressure is insufficient, do not aim the water gun at the charged equipment being flushed. The flushing water pump should be well grounded.

9.6.6 Washing with electrified water should pay attention to choosing a suitable washing method. Insulators with larger diameters should adopt the double-gun tracking method or other methods, and prevent sewage lines from appearing on the surface of the equipment being washed. When the washed insulator has not been washed clean, it is prohibited to interrupt the washing to avoid flashover.

9.6.7 Before flushing with live water, make sure that the equipment is well insulated. Insulators with zero and low values and porcelain with cracks are generally not washable.

9.6.8 When washing suspension, tensile insulator strings and porcelain crossarms, they should be washed sequentially from the conductor side to the crossarm side. When washing post insulators and insulating porcelain sleeves, wash them from bottom to top.

9.6.9 When flushing the insulators, pay attention to the wind direction, first rush to the downwind side and then to the upwind side; for insulators arranged on the upper and lower layers, the lower layer should be rushed first, and then the upper layer. Also pay attention to the flushing angle to prevent flashover of adjacent insulators in the splashing water mist.

9.7 Live cleaning machinery operations

9.7.1 When carrying out live cleaning work, the effective length of the insulated operating rod must not be less than that specified in Table 5.

9.7.2 Before using a live cleaning machine for cleaning, it should be confirmed that: the working conditions of the cleaning machine (motor and control parts, flexible shafts and transmission parts, etc.) are intact, the insulating parts are free of deformation, dirt and damage, and the brushes are turned correctly, and the cleaning the machine is reliably grounded.

9.7.3 The live-cleaning workers should stand on the windward side and wear masks and goggles.

9.7.4 During operation, the operator's hands should always hold the part below the insulating rod protection ring, and keep the relevant insulating parts clean and dry during cleaning.

9.8 Induced voltage protection

9.8.1 When working on line towers and substation structures with voltage levels of 330kV, ± 400 kV and above, anti-static induction measures should be taken, such as wearing electrostatic induction protective clothing, conductive shoes, etc. (conductive shoes should be worn when working on 220kV line towers).

9.8.2 The insulated overhead ground wire shall be regarded as a live body. The distance between the operator and the insulated overhead ground wire should not be less than 0.4m (1000kV is 0.6m). When working on an insulated overhead ground wire, use a ground wire or personal security wire to reliably ground it or use an equipotential method.

9.8.3 When using insulated ropes to transfer large metal objects (including tools, materials, etc.), operators on the tower or on the ground should ground the metal objects before touching them to prevent electric shock.

9.9 Operation of overhead insulated bucket truck

9.9.1 Elevated insulated bucket arm vehicles shall pass the inspection. Boom truck operators should be familiar with the relevant regulations on live work, and have been specially trained, pass the examination, and hold the certificate.

9.9.2 The working position of the overhead insulated bucket car should be selected appropriately, the support should be stable and reliable, and there should be anti-overturning measures. Before use, a test operation of the empty bucket at a predetermined position should be performed to confirm that the

hydraulic transmission, rotation, lifting, and telescopic systems are working properly, operating flexibly, and the braking device is reliable.

9.9.3 Operators in the insulated bucket should use safety belts and insulated tools correctly.

9.9.4 The operator of the overhead insulated bucket truck shall obey the command of the person in charge of the work, and pay attention to the surrounding environment and operating speed during operation. During work, the engine of the overhead insulated bucket truck is not allowed to stall. When approaching and leaving live parts, it should be operated by the personnel in the arm, but the lower operator is not allowed to leave the console.

9.9.5 The effective insulation length of the insulating arm should be greater than that specified in Table 13, and a leakage current monitoring device should be installed at the lower end.

Table 13 Minimum effective insulation length of insulating arm

Voltage level (kV)	10	35	66	110	220	330
Length of (m)	1.0	1.5	1.5	2.0	3.0	3.8

9.9.6 For the metal part of the lower section of the insulating arm, the distance to the charged body should be increased by 0.5m according to the value specified in Table 4 during the upward rotation.

The car body should be well grounded during work.

9.10 Protection gap

9.10.1 Multi-strand soft copper wire shall be used for the grounding wire of the protective gap. Its cross-section should meet the requirements of grounding short-circuit capacity, but not less than 25mm².

9.10.2 The distance of the protection gap should be adjusted according to the provisions of Table 14.

Table 14 Protection gap setting value

Voltage level (kV)	220	330	500	750	1000
Clearance distance (m)	0.7 ~ 0.8	1.0 ~ 1.1	1.3	2.3	3.6

Note: The data provided by the protection gap of 330kV and below is arc shape, and the data provided by the protection gap of 500kV and above is spherical.

9.10.3 When using the protective gap, the following requirements should be observed:

- Before hanging the protective gap, contact the regulator to disable the reclosing or DC line restart function.
- The suspension protection gap should be reliably grounded to the grounding grid, and then the protection gap should be hung on the wire and make good contact. The demolition procedure is the opposite.
- The protective gap should be hung on the wires of the adjacent towers. After hanging, special personnel should be sent to guard. In areas where people and animals pass by, fences should be added.
- Personnel who install and disassemble the protective gap should wear a full set of shielding suits.

9.11 Live detection insulator

9.11.1 When using a spark gap detector to detect insulators, the following requirements should be observed

- a) Before testing, the detector should be tested to ensure flexible operation and accurate measurement.
- b) Pin and suspension insulators with less than 3 pieces are not allowed to use spark gap detector for testing.
- c) When testing insulator strings with voltage levels of 35kV and above, when the number of zero-value insulators in the same string is found to reach the requirements in Table 15, the testing should be stopped immediately.

Table 15 Number of zero-value insulators allowed in a string

Voltage level (kV)	35	66	110	220	330	500	750	1000	± 500	± 660	± 800
Number of insulator string	3	5	7	13	19	28	29	54	37	50	58
Number of zero-value pieces	1	2	3	5	4	6	5	18	16	26	27
Note: If the number of insulator strings exceeds the specifications in Table 15, the allowable number of zero-value insulators can be increased accordingly.											

d) Should be carried out in dry weather.

9.12 Distribution live work

9.12.1 When directly contacting live equipment with voltage levels of 20kV and below, you should wear qualified insulating protective equipment (insulating clothes or insulating shawls, insulating gloves, insulating shoes); the safety belts and helmets used should have good insulation Performance, wear goggles when necessary. Before use, check the appearance of the insulating protective equipment. It is forbidden to take off the insulating protective equipment during the operation.

9.12.2 During operation, the live wires and insulators in the operation area shall be insulated and isolated from phase to phase and to the ground. The range of insulation and isolation measures should be increased by more than 0.4m over the range of activities of the operators. When implementing insulation and isolation measures, it should be carried out in the order of near first, then far, first down and then up. The order of removal is reversed. The insulation and isolation measures should be carried out phase by phase during installation and disassembly.

It is forbidden to remove the insulation isolation measures between the live conductor and the ground potential at the same time; it is forbidden to touch two non-connected live conductors or the live conductor and the grounding conductor at the same time.

9.12.3 The operator shall obtain the consent of the working guardian before the transfer of the commutation work.

9.13 Storage, use and test of live working tools

9.13.1 Storage of live working tools

9.13.1.1 Live working tools should be stored in a well-ventilated, clean and dry special tool room. The doors and windows of the tool room should be tightly closed, and the floor, wall and top surface should be made of dust-proof and flame-retardant materials. The relative humidity in the room should be maintained at 50% to 70%. The indoor temperature should be slightly higher than the outdoor, and should not be lower than 0 °C.

9.13.1.2 When the live working tool room is ventilated indoors, it should be done in dry weather, and the outdoor relative humidity should not be higher than 75%. After the ventilation is over, the relative humidity in the room should be checked immediately and adjusted.

9.13.1.3 tools for live working room should be equipped with: a hygrometer, a thermometer, dehumidifiers (subject number to meet the requirements), the radiation heater uniformly, sufficient paraphernalia, cradles and fire extinguishers.

9.13.1.4 Live working tools should be numbered uniformly, kept by a dedicated person, registered in a book, and records of testing, maintenance, and use should be established.

9.13.1.5 Defective live working tools should be repaired in time, unqualified ones should be scrapped in time, and continued use is prohibited.

9.13.1.6 The overhead insulated bucket truck should be stored in a dry and ventilated garage, and the insulated part should be moisture-proof.

9.13.2 Use of live working tools

9.13.2.1 Live working tools should be well insulated, firmly connected, flexible to rotate, and be used correctly in accordance with the manufacturer's instructions and on-site operating procedures.

9.13.2.2 Before using live working tools, the mechanical strength should be checked according to the workload and meet the specified safety factor.

9.13.2.3 During transportation of live working tools, live insulated tools should be packed in special tool bags, tool boxes or special tool carts to prevent moisture and damage. If the insulating tools are found to be damp, damaged or dirty, they should be treated in time and tested or tested before they can be used.

9.13.2.4 When entering the work site, the live working tools used should be placed on a moisture-proof canvas or insulating mat to prevent the insulating tools from being dirty and damp during use.

9.13.2.5 Before using live working tools, carefully check to confirm that there is no damage, moisture, deformation, or malfunction, otherwise it is prohibited to use. And use an insulation resistance meter or insulation tester of 2500V and above for segmented insulation detection (electrode width 2cm, electrode width 2cm), and the resistance should not be less than 700M Ω . Wear clean, dry gloves when handling insulated tools.

9.13.3 Test of live working tools

9.13.3.1 Electric work tools should be periodically tested for electrical and mechanical tests. The test cycle is as follows: Electrical test: preventive test once a year, check test once a year, and the interval between the two tests is half a year.

Mechanical test: once a year for insulated tools and once every two years for metal tools.

9.13.3.2 The electrical preventive test items and standards of insulating tools are shown in Table 16.

Table 16 Test items and standards for insulating tools

Rated voltage (KV)	Test length (M)	1min frequency power withstand voltage (KV)		3min frequency power withstand voltage (KV)		15 operations shock withstand voltage (KV)	
		Factory and type test	Preventive test	Factory and type test	Preventive test	Factory and type test	Preventive test
10	0.4	100	45	—	—	—	—
35	0.6	150	95	—	—	—	—
66	0.7	175	175	—	—	—	—
110	1.0	250	220	—	—	—	—
220	1.8	450	440	—	—	—	—
330	2.8	—	—	420	380	900	800

500	3.7	—	—	640	580	1175	1050
750	4.7	—	—	—	780	—	1300
1000	6.3	—	—	1270	1150	1865	1695
± 500	3.2	—	—	—	565	—	970
± 660	4.8	—	—	820	745	1480	1345
± 800	6.6	—	—	985	895	1685	1530
Note: ± 500, ± 600, ± 800kV preventive tests adopt 3min DC withstand voltage.							

The operating impact withstand voltage test should use a standard wave of 250/2500 μ s, with no breakdown or flashover as qualified.

The power frequency withstand voltage test is qualified with no breakdown, no flashover and overheating.

The high-voltage electrode should use a metal tube with a diameter of not less than 30mm, the test product should be hung vertically, and the distance between the ground electrode and the ground is 1.0 ~ 1.2m. The grounding electrode and the high-voltage electrode (when there is no hardware) are wound with 50mm wide platinum metal. The distance between the test products is not less than 500mm, the diameter of the equalizing balls on both sides of the single wire is not less than 200mm, and the distance between the equalizing balls is not less than 1.5m.

The test product shall be tested as a whole, and shall not be divided into sections.

9.13.3.3 The inspection test conditions for insulating tools are: divide the insulating tools into several sections for power frequency withstand voltage test, with a withstand voltage of 75kV per 300mm, and a time of 1min, with no breakdown, flashover and overheating as qualified.

9.13.3.4 See Appendix K for electrical test standards of overhead insulated bucket trucks for live work.

9.13.3.5 Combined insulated water flushing tools should be electrically tested under working conditions. Except for the items and standard tests in Table 16

(Referring to voltage levels of 220kV and below), power frequency leakage test should also be added. See Table 17 for test voltage. Leakage current is qualified as less than 1mA, and the test time is 5min.

The water resistivity during the test is 1500 $\Omega \cdot \text{cm}$ (applicable to voltage levels of 220kV and below). Table 17: Voltage value of power frequency leakage test for combined insulated water flushing tools.

Rated voltage (kV)	10	35	66	110	220
Test voltage (kV)	15	46	80	110	220

9.13.3.6 The resistance between the most remote points of the entire shielding garment shall not be greater than 20 Ω .

9.13.3.7 Mechanical preventive test standard for live working tools: Static load test: It is qualified if the tool has no deformation or damage under 1.2 times the rated working load for 1 min.

Dynamic load test: Operate 3 times under 1.0 times the rated working load, and the tool is qualified if it is flexible, light and no jamming.

10. Overhaul and Maintenance of Generators, Synchronous Tuning Cameras and High-Voltage Motors

10.1 The first type of work ticket for the substation (power plant) should be used for the maintenance of generators, synchronization cameras and high-voltage motors.

10.2 The main units of power plants (boilers, steam turbines, gas turbines, generators, water turbines, water pumps and water turbines) are out of service for maintenance. Only the first day is required to go through the start-up procedures. When the work starts every day, the person in charge should check the site and check the safety measures. During the maintenance period, the work ticket is always kept at the work place by the person in charge of the work.

When working sequentially on several motors of the same unit, one work ticket can be filled in.

10.3 The following safety measures should be taken for the maintenance of generators and synchronous regulators:

- a) Disconnect the generator, exciter (excitation transformer), circuit breakers (switches) and isolating switches (switches) of the synchronous regulators.
- b) After the generator and the synchronizing camera are completely stopped, hang on the operating handles, buttons and the operating handles of the unit's starting device, excitation device, synchronizing and turning device, and turning device " No closing, someone working!" Signboard.
- c) If the machine can still obtain the excitation current from other power sources, this power source should be disconnected, and a sign " No closing, someone working!" should be hung up.
- d) Disconnect the operating energy of the circuit breaker (switch) and isolating switch (knife switch). If the tuned camera has a motor for starting, the circuit breaker (switch) and isolating switch (knife switch) of the motor should also be disconnected, and a sign " No closing, someone working!" should be hung.
- e) The voltage transformer is disconnected from the high and low voltage sides.
- f) After verifying that there is no voltage between the generator and the circuit breaker (switch) or the generator stator three-phase outlet (lead wire), install the connection Ground wire.
- g) If the neutral point of the overhaul unit is connected with the neutral point of other generators, the neutral point of the generator should be overhauled before work separate.
- h) If the maintenance unit is equipped with carbon dioxide or steam fire extinguishing device, before working in the air duct, take measures to prevent the fire extinguishing device from malfunctioning
- i) If the maintenance unit is equipped with an automatic gate damper that can block the air circulation in the machine, measures shall be taken to ensure that the damper cannot be closed to prevent suffocation.
- j) The hydrogen cooling unit should be closed to the relevant valves of the hydrogen system, plugging plates and other isolation measures.

10.4 The rotating generator and synchronous adjustment camera, even if they are not excited, should be considered as having voltage.

It is forbidden to work on the circuit of a rotating generator or a synchronous camera, or touch the high-voltage winding with your hands. When emergency repairs must be made without stopping the machine, the excitation circuit should be cut off first, and the automatic de-excitation device should be put in, and then the stator lead wire and the neutral point should be short-circuited to ground. When disassembling the short-circuit grounding wire, wear protective gloves and insulating boots. Or stand on an insulating mat and wear protective glasses.

10.5 When measuring the shaft voltage and measuring the rotor insulation with a voltmeter on a rotating generator, special electric brushes should be used, and the brushes should be equipped with an insulating handle over 300mm.

10.6 When adjusting and cleaning the brushes and slip rings on the rotating motor, an experienced electrician should be responsible for it, and the following regulations should be observed:

- a) Operators should be especially careful not to make clothes and wiping materials caught by the machine, fasten the cuffs, and place the braids in the cap.
- b) When working, stand on the insulation pad (the insulation pad is a permanent fixed insulation pad), and must not touch two poles or one pole and the grounding part at the same time, nor can two people work at the same time.

10.7 When inspecting and repairing high-voltage motors and their auxiliary devices (such as starting devices, frequency conversion devices, the same below), the following safety measures should be taken:

- a) Disconnect the power circuit breaker (switch) and isolating switch (knife switch), and install a grounding wire or connect the isolating switch to the (Knife switch) Insulation partition is installed in between; the handcart switch should be pulled to the test or inspection position.
- b) Hang the signs of " No closing, someone working!" on the operating handles of the circuit breaker (switch) and isolating switch (knife switch).
- c) The disconnected cable head should be three-phase short-circuit grounded.
- d) Take measures to prevent the driven machinery (such as water pumps, air compressors, induced draft fans, etc.) from causing the motor to rotate, and hang a sign " No closing, someone working!" on the valve (air damper).

10.8 It is forbidden to work on the rotating high-voltage motor and its accessory circuit. When working on the resistance circuit of the rotating motor rotor, the carbon brush should be lifted first or the resistance should be completely cut off. Wear insulating gloves or use tools with insulating handles, wear insulating boots or stand on insulating mats when working.

10.9 The lead wires and cable heads of the motor, as well as the exposed rotating parts, should be equipped with a firm shield or guard.

10.10 The housing of the motor and accessory equipment should be grounded. It is forbidden to work on the ground wire of the rotating motor.

10.11 The work has not yet been completely completed, and when it is necessary to send power to test the motor or auxiliary devices, all work tickets shall be collected and the maintenance personnel of the relevant mechanical parts shall be notified before power is sent.

11. Work on SF₆ Electrical Equipment

11.1 Power distribution equipment rooms and SF₆ gas laboratories equipped with SF₆ equipment should be equipped with powerful ventilation devices. The air outlets should be set at the bottom of the room, and the exhaust outlets should not face residential houses or pedestrians.

11.2 Indoors, when the equipment is filled with SF₆ gas, the relative humidity of the surrounding environment should not be greater than 80%. At the same time, the ventilation system should be turned on to prevent SF₆ gas from leaking into the work area. Workspace air SF₆ gas content must not exceed 1000 [mu] L / L (i.e., 1000 ppm).

11.3 Air-tight isolation measures should be taken between the main control room and the SF₆ power distribution device room. The holes between the SF₆ power distribution device room and the cable layer and cable tunnel below should be blocked. The door of the SF₆ power distribution

device room and the cable layer tunnel below shall be set with a sign of " pay attention to ventilation".

11.4 The power switch of the exhaust fan of the SF₆ power distribution device room and the cable layer (tunnel) should be set outside the door.

11.5 In the low-level area of the SF₆ power distribution device room, an alarm oxygen meter and an SF₆ gas leakage alarm should be installed, and a display should be installed at the entrance of the staff. The above instruments should be inspected regularly to ensure that they are in good condition.

11.6 Workers enter the SF₆ power distribution device room. If there is no SF₆ gas content indicator at the entrance, they should first ventilate for 15 minutes and measure the SF₆ gas content with a leak detector. Try to avoid one person entering the SF₆ power distribution device room for inspection, and no one person is allowed to enter for maintenance work.

11.7 Workers are not allowed to stay near the explosion-proof membrane of SF₆ equipment. If an abnormal situation is found during the inspection, it should be reported immediately to find out the cause and take effective measures to deal with it.

11.8 When entering the low-level area of the SF₆ power distribution device or the cable trench for work, the oxygen content (not less than 18%) and the SF₆ gas content should be checked first.

11.9 Personnel working on the opened SF₆ electrical equipment should be trained in special safety technical knowledge, configure and use necessary safety protection equipment.

11.10 Before the equipment is disassembled for maintenance, SF₆ gas should be inspected. According to the toxic gas content, take safety protection measures. Maintenance personnel must wear protective clothing and wear gas masks or positive pressure air respirators as needed. After opening the equipment cover, all personnel on site should temporarily leave the site for 30 minutes. When taking out the adsorbent and removing dust, the maintenance personnel should wear gas masks or positive pressure air respirators and protective gloves.

11.11 The SF₆ gas in the equipment is not allowed to be discharged into the atmosphere, and it should be recovered by a purification device, and it is allowed to be reused after being processed and tested. Operators should stand on the upwind side during recovery.

After the equipment is evacuated, flush with high-purity nitrogen 3 times [pressure of 9.8×10^{-4} Pa (1 atmosphere)]. Put the removed adsorbent, metal powder and other wastes into a 20% sodium hydroxide aqueous solution for 12 hours and then bury it deeply.

11.12 When the gas is drawn from the SF₆ gas cylinder, the pressure reducing valve should be used to reduce the pressure. When the pressure in the cylinder drops to 9.8×10^{-4} Pa (1 atm), stop the gas extraction, close the cylinder valve and close the cap.

11.13 In the event of a large number of leaks in the SF₆ power distribution device, personnel should quickly withdraw from the scene and turn on all exhaust fans for exhaust. Persons who do not wear gas masks or positive pressure air respirators are not allowed to enter. Personnel are only allowed to enter after sufficient natural exhaust or forced exhaust, and the leak detector is used to measure the SF₆ gas and the oxygen content (not less than 18%) is qualified with the instrument.

When the explosion-proof film of the equipment is ruptured, the power supply should be cut off and wiped clean with gasoline or acetone.

11.14 When performing gas sampling and handling general leakage, wear a gas mask or positive pressure air respirator and perform ventilation.

11.15 When the SF₆ circuit breaker (switch) is operating, maintenance personnel are prohibited from working on its shell.

11.16 After the overhaul, the overhaul personnel should take a bath and clean the used tools and protective equipment.

11.17 SF₆ gas cylinders should be placed in a cool, dry, well-ventilated, open and special place, kept upright, and should be kept away from heat and oil, moisture, sun exposure, and no moisture or oil sticking to the valve. When handling, load and unload with care.

12. Work on Low-Voltage Power Distribution Devices and Low-Voltage Wires

12.1 For work on low-voltage switchboards, distribution boxes and mains power lines, the second type of work ticket for substation (power plant) should be filled.

Working on low-voltage motors and lighting circuits that cannot touch high-voltage equipment and secondary systems does not need to fill in work tickets, but corresponding records should be made. The work should be carried out by at least two people.

12.2 Safety measures for power failure of low-voltage circuit.

- a) Disconnect the power of all aspects of the maintenance equipment and remove the fuse, and hang a sign " No closing, someone working!" on the switch or switch operating handle.
- b) Check the electricity before work.
- c) Take other safety measures as needed.

12.3 After replacing the fuse after a power failure, you should wear gloves and goggles when you resume operation.

12.4 Low voltage work without power failure.

12.4.1 When working at low voltage without power failure, effective measures such as shielding the live parts to prevent phase-to-phase or grounding short-circuits should be taken; if shielding measures cannot be taken, the power equipment that affects the operation will be cut off.

12.4.2 When tools with insulated handles are used, insulation measures should be taken for the exposed conductive parts to prevent short-circuits between phases or relative to ground during operation. When working, you should wear insulated shoes and cotton long-sleeved overalls, and wear gloves, hard hats and goggles, and stand on dry insulation.

It is forbidden to use files, metal rulers, brushes and dusters with metal objects.

12.4.3 Before operation, the phase and neutral line should be separated first, and the working position should be selected. When disconnecting the wire, disconnect the phase wire first, and then the neutral wire.

When connecting wires, the sequence should be reversed.

The human body must not touch two thread ends at the same time.

13. Work on Secondary System

13.1 The first type of work ticket for substation (power plant) should be filled in the following situations:

- a) When conducting inspection tests on relay protection, safety automatic devices, instruments, etc. and their secondary circuits in the high-voltage room or the conductive part less than the safe distance specified in Table 1, the high-voltage equipment needs to be powered off.
- b) Those who need to power off the high-voltage equipment or take safety measures when working on high-voltage equipment relay protection, safety automatic devices and instruments, automatic monitoring systems, etc. and their secondary circuits.
- c) The communication system and relay protection, safety automatic devices and other multiplexed channels (including carrier, microwave, optical fiber channel, etc.) maintenance and linkage test need to power off high-voltage equipment or take safety measures.
- d) Those who need to cut off high-voltage equipment or take safety measures when working on the thermal protection, waterwheel protection and related circuits of the generator set that has been tripped by the relay protection outlet.

13.2 The second type of work ticket for substation (power plant) should be filled in the following situations:

- a) When the relay protection device, safety automatic device, and automatic monitoring system change the original fixed value of the device during operation, it will not affect the normal operation of the primary equipment.
- b) For the work of connecting the secondary windings of current transformers or voltage transformers and installing on the relay protection and safety automatic devices on the screen cabinet, the protected high-voltage equipment may not be stopped or safety measures are not required.
- c) For relay protection, safety automatic devices, automatic monitoring systems, etc. and their secondary circuits, as well as maintenance and test work on communication multiplex channel equipment, high-voltage equipment may not be stopped or safety measures are not required.
- d) Those who work on the thermal protection, waterwheel protection and related circuits of the generator set through the relay protection outlet, and the high-voltage equipment cannot be stopped or safety measures are not required.

13.3 In case of the following situations during maintenance, a secondary work safety measure ticket (see Appendix H) should be filled in:

- a) Disassembly and wiring work on the secondary circuit of the operating equipment.
- b) When performing isolation measures on maintenance equipment, it is necessary to disconnect, short-circuit and restore the secondary circuit connected with the operating equipment.

13.4 The second work safety measures are implemented.

13.4.1 The work content and safety measures content of the second work safety measure ticket shall be filled in by the person in charge of the work, and reviewed and issued by the technician or the monitor.

13.4.2 The guardian shall be a person with a higher technical level and experience, and the executor and recovery person shall be the work class members, in the order of the second work safety measures.

The above work should be carried out by at least two persons.

13.5 In the process of on-site work, operators should stop working immediately when they encounter abnormal conditions (such as DC system grounding, etc.) or circuit breaker (switch) tripping or valve blocking, regardless of whether it is related to their own work, and keep the status quo, pending investigation. You can continue to work when it is determined that it has nothing to do with the work; if an abnormal situation or a circuit breaker (switch) trips, and the valve lock is caused

by its own work, you should keep the site and notify the operation and maintenance personnel immediately for timely handling.

13.6 Make preparations before work to understand the working location, scope of work, operation of primary equipment and secondary equipment, safety measures, test plan, last test record, drawings, setting value notice, software modification application form, check control protection Whether the model, version number and jumper settings of the equipment, measurement and control equipment host or board card are complete and in line with reality, check whether the test equipment such as instruments and meters is in good condition, and check whether the software version numbers of the microcomputer protection and safety automatic devices are in line with reality.

13.7 Before the start of on-site work, check whether the safety measures that have been taken meet the requirements, whether the isolation measures between the operating equipment and the maintenance equipment are completed correctly, and the names of the maintenance equipment should be carefully checked during work to prevent the wrong position.

13.8 When working on a fully or partially charged operation screen (cabinet), the maintenance equipment shall be separated from the front and rear of the operation equipment by obvious signs.

13.9 When performing large-vibration work on or near the screen (cabinet) of the relay protection device, the safety automatic device and the automatic monitoring system, measures should be taken to prevent the malfunction of the equipment during operation. If necessary, apply to the control center. The duty regulator or the person in charge of operation and maintenance agrees to temporarily disable the protection.

13.10 When transporting or placing test equipment in the passage between the relay protection, safety automatic device and the automatic monitoring system screen, the passage must not be blocked, and a certain distance should be kept from the operating equipment to prevent the passage from being blocked during accident handling and prevent accidental touching of the operating equipment, Causing the malfunction of the relay protection of related operating equipment. When cleaning operating equipment and secondary circuits, use insulated tools to prevent vibration and accidental touch.

13.11 When the relay protection, safety automatic device and automatic monitoring system are tested for transmission or a power-on or a functional test of the DC transmission system, the operation and maintenance personnel and related personnel shall be notified, and the person in charge of the work or his designated person shall be on site to monitor. Before proceeding.

13.12 The secondary windings of all current transformers and voltage transformers shall have one and only one permanent and reliable protective grounding.

13.13 When working on the secondary circuit of a live current transformer, the following safety measures should be taken:

- a) It is forbidden to open the secondary side of the current transformer (except for the photocurrent transformer).
- b) For the secondary winding of short-circuit current transformer, short-circuit strips or short-circuit wires should be used, and wire winding is prohibited.
- c) Any work performed on the wire between the current transformer and the short-circuit terminal should have strict safety measures and fill in the " Secondary Work Safety Measures Ticket". If necessary, apply for deactivation of relevant protection devices, safety automatic devices or automatic monitoring systems.
- d) It is prohibited to disconnect the permanent grounding point of the loop during work.

- e) When working, someone should be supervised, use insulating tools, and stand on the insulating mat.

13.14 When working on the secondary circuit of a live voltage transformer, the following safety measures should be taken:

- a) Strictly prevent short circuit or grounding. Insulated tools and gloves should be used. If necessary, apply for deactivation of relevant protection devices, safety automatic devices or automatic monitoring systems before work.
- b) For temporary loads, special knife switches and fuses should be installed.
- c) Special personnel should be supervised during work, and it is forbidden to disconnect the safety grounding point of the loop.

13.15 Before the secondary circuit is energized or the withstand voltage test, the operation and maintenance personnel and related personnel should be notified, and personnel should be sent to the scene to guard, and the secondary circuit and the primary equipment can be pressurized only after no one is working.

During the energization test of the secondary circuit of the voltage transformer, in order to prevent reverse charging from the secondary side to the primary side, in addition to disconnecting the secondary circuit, the voltage transformer high-voltage fuse should be removed or the voltage transformer should be disconnected once Knife gate.

When the DC transmission system is operating in a single pole, it is forbidden to perform injection or pressure test on the transformer in the neutral area of the outage.

When a group of DC filters with running poles is out of service for maintenance, it is forbidden to perform a current injection test on the current transformers in the group of DC filters related to the DC pole protection.

13.16 When the optical fiber loop is working, corresponding protective measures should be taken to prevent the laser from damaging human eyes.

13.17 Operators inspecting relay protection, safety automatic devices, automatic monitoring systems and instruments are not allowed to operate equipment, signal systems, and protection plates in operation, but they must obtain permission from operation and maintenance personnel and switch on both sides of the inspection work panel. After taking measures to prevent mis operation on the handle, the breaker (switch) can be pulled and repaired.

13.18 The test switch should have a fuse and a cover. The equipment under repair and test equipment are prohibited from directly taking the test power supply from the running equipment. The fuse coordination should be appropriate to prevent the main power fuse from being overstepped. The test wiring must be reviewed by the second person before it can be energized.

13.19 When the secondary circuit of the relay protection device, the safety automatic device and the automatic monitoring system changes, it should be carried out according to the approved drawings, and the useless wiring should be separated clearly to prevent accidental disassembly or generation of parasitic circuits.

13.20 After the test work is over, restore the wiring related to the operating equipment item by item according to the " Secondary Work Safety Measure Ticket", remove the temporary wiring, check that there is no foreign matter in the device, the screen signal and various devices are in normal state, and the related pressure plates and switches the switch position is restored to the state at the time of the work permit. The second work safety measures ticket shall be archived and stored with the work ticket for 1 year.

14. Electrical Tests

14.1 High Voltage Test

14.1.1 The first type of work ticket for the substation (power plant) should be used for the high-voltage test. When testing in the high-voltage test room (including outdoor high-voltage test field), it shall be carried out in accordance with the provisions of GB 26861.

In the same electrical connection part, before permitting the high-voltage test work ticket, the approved maintenance work ticket should be taken back, and the second work ticket is prohibited. If during the test, maintenance cooperation is required, the maintenance personnel should be filled in the high-voltage test work ticket.

When an electrical connection part is repaired and tested at the same time, a work ticket can be filled in, but the permission of the person in charge of the repair work should be obtained before the test.

If the disconnection point between the pressurized part and the overhaul part has a sufficient safety distance according to the test voltage, and there is a ground short-circuit line on the other side, the test can be performed on one side of the disconnection point, and the other side can continue jobs. But at this time, there should be a sign " Stop, high voltage danger!" at the disconnection point, and a special person should be supervised.

14.1.2 High-voltage test work shall not be less than two persons. The person in charge of the test should be an experienced person. Before starting the test, the person in charge of the test should arrange the safety precautions in the test in detail to all the test personnel, explain the live parts adjacent to the interval, and other safety precautions.

14.1.3 When the equipment connector needs to be disconnected due to the test, it shall be marked before disassembly and inspection shall be carried out after connection.

14.1.4 The metal shell of the test device should be reliably grounded; the high-voltage lead should be as short as possible, and a dedicated high-voltage test wire should be used, and if necessary, it should be firmly supported by insulators.

The power switch of the test device shall use a bipolar switch with obvious disconnection. In order to prevent accidental closing of the knife switch, an insulating cover can be added to the knife edge. There should be two power switches in series in the low-voltage circuit of the test device, and an automatic overload trip device should be installed.

14.1.5 The test site should be equipped with a fence or fence. The fence or fence should have a sufficient safety distance from the high-voltage part of the test equipment, and a sign " Stop, high voltage danger!" should be hung outward and guards should be sent. When the two ends of the tested equipment are not in the same place, the other end should be guarded.

14.1.6 Check the test wiring carefully before pressurizing, use a standardized short-circuit wire, the meter magnification, range, zero position of the voltage regulator and the starting state of the meter are all correct. After confirmation, notify all personnel to leave the tested equipment. And obtain the permission of the person in charge of the test before pressurizing. Someone should watch and sing during the pressurization process.

During the entire pressurization process, the high-voltage test personnel should concentrate their energy and be alert to abnormal phenomena at any time, and the operator should stand on the insulating pad.

14.1.7 When the wiring is changed or the test is over, the test power supply should be disconnected, discharge, and the high voltage part of the booster device should be discharged and short-circuited to ground.

14.1.8 The large-capacitance device under test without a grounding wire should be discharged before the test. During the high-voltage DC test, the equipment should be discharged to the ground several times and short-circuited to the ground every time it comes to an end or when the test ends.

14.1.9 At the end of the test, the test personnel should remove the self-installed grounding short-circuit wire and inspect the equipment under test to restore the state before the test. After the test person in charge rechecks, the site cleans up.

14.1.10 When a system ground fault is found in a substation or power plant booster station, it is prohibited to measure the grounding resistance of the grounding grid.

14.1.11 Special important electrical tests should have detailed safety measures and be approved by the unit's production leader (chief engineer).

The unipolar operation of the DC converter station shall be carried out to test the out-of-service unipolar equipment. If the safety of the operation equipment is affected, measures shall be taken and approved by the leader (chief engineer) of the unit in charge of production.

14.2 Measurement work using portable instruments

14.2.1 Use portable instruments to work on high-voltage circuits with at least two people. If high-voltage equipment needs to be powered off or take safety measures, the first type of work ticket for the substation (power plant) should be filled in.

14.2.2 Except for special instruments, all measurements using portable instruments should be performed on the secondary side of current transformers and voltage transformers.

14.2.3 The wiring and disassembly of ammeters, current transformers and other measuring instruments that need to disconnect the high-voltage circuit should be carried out after all the equipment and instruments connected to this circuit are powered off.

14.2.4 The wiring and disassembly of voltmeters, portable voltage transformers and other high-voltage measuring instruments can work with electricity without disconnecting the high-voltage circuit. However, high-voltage-resistant insulated wires should be used, the length of the wires should be as short as possible, no joints are allowed, and the connections should be firm to prevent grounding and short circuits. Use insulators to fix it if necessary.

When working with a voltage transformer, you should first connect all the wiring on the low-voltage side, and then use an insulating tool to connect the voltage transformer to the high-voltage side. Wear gloves and goggles when working, stand on an insulating mat, and have special supervision.

14.2.5 The cross-section of the wire connecting the current loop should be suitable for the measured current value. The cross-section of the wire connecting the voltage circuit shall not be less than 1.5mm^2 .

14.2.6 Instruments with non-metallic enclosures should be insulated from the ground, and instruments with metal enclosures and transformer enclosures should be grounded.

14.2.7 When necessary, the measuring device should be equipped with a barrier or fence, and a sign " Stop, high voltage danger!" should be hung. The arrangement of the instrument should be such that the operator is not less than the safe distance specified in Table 1 from the live part.

14.3 Measurement work using clamp-type ammeter

14.3.1 Operation and maintenance personnel using clamp-type ammeters on high-voltage circuits should be carried out by two persons. When measuring by non-operation and maintenance personnel, the second type of work ticket for the substation (power plant) should be used.

14.3.2 When measuring on a high-voltage circuit, it is forbidden to use a wire from a clamp-type ammeter to measure with a meter.

14.3.3 If the shielding fence needs to be removed during measurement, it should be carried out immediately after removing the shielding fence. At the end of the work, the fence should be restored to its original state immediately.

14.3.4 When using a clamp-type ammeter, pay attention to the voltage level of the clamp-type ammeter. Wear insulating gloves when measuring, stand on the insulating mat, and do not touch other equipment to prevent short circuit or grounding.

When observing the time of the watch, pay special attention to keeping a safe distance between the head and the live part.

14.3.5 When measuring the current of low-voltage fuses and horizontally arranged low-voltage busbars, each phase fuse and busbar should be insulated with insulating materials before measurement to avoid short circuit between phases. At the same time, care should be taken not to touch other live parts.

14.3.6 When measuring the current of each phase of the high-voltage cable, the distance between the cable head and the line should be more than 300mm, and the insulation should be good, and the measurement can be carried out only if it is convenient.

When one phase is grounded, measurement is prohibited.

14.3.7 The clamp-on ammeter should be stored in a dry room and wipe it clean before use.

14.4 Use insulation resistance meter to measure insulation work

14.4.1 Use insulation resistance meter to measure the insulation of high voltage equipment, which should be carried out by two persons.

14.4.2 The measuring wire should use the corresponding insulated wire, and the end should be insulated.

14.4.3 When measuring the insulation, the equipment under test should be disconnected from all aspects, verified that there is no voltage, and it is confirmed that the equipment is not working before proceeding. Do not allow others to approach the device under test during the measurement.

Before and after measuring the insulation, discharge the device under test to ground.

When measuring the line insulation, permission should be obtained and the opposite side should be notified.

14.4.4 When measuring insulation on lines with induced voltage, the relevant lines should be powered off at the same time before proceeding. During lightning, it is prohibited to measure line insulation.

14.4.5 When measuring the insulation resistance near live equipment, the measuring personnel and the insulation resistance meter should be placed at an appropriate location and keep a safe distance to prevent the insulation resistance meter lead or lead support from touching the live part. When moving the lead, pay attention to monitoring to prevent the operator from electric shock.

14.5 Test in the valve hall of DC converter station

14.5.1 Before the high-pressure test of the thyristor (SCR), other work in the valve tower should be stopped and unrelated personnel should be evacuated; during the test, the operator should keep a distance of more than 0.7m from the test live position, and the test personnel should not directly touch the valve tower Shielding cover to prevent possible test induction damage.

14.5.2 The ground pressurizer and the valve body layer operator should keep in touch with each other through the walkie-talkie to prevent accidental pressurization by the high-altitude operator when the valve body is not evacuated. The working layer of the valve body should have a dedicated guardian (monitoring and commanding on the lift truck parallel to the working layer of the valve body), and someone should supervise and sing during the pressurization process.

14.5.3 Before the high-voltage test of the converter transformer, the personnel who are not involved in the high-voltage through-wall bushing side test in the valve hall should be notified to evacuate, and special personnel should be sent for supervision.

14.5.4 Before the high voltage through-wall bushing test in the valve hall is pressurized, the personnel who are not involved in the test on the converter transformer outside the valve hall should be notified to evacuate, confirm that the remaining windings are reliably grounded, and send special personnel to monitor.

14.5.5 Before the no-load pressurization test of the high-voltage DC system with line, confirm the corresponding DC line grounding switch (ground switch), pole bus outlet isolation switch (knife switch), and metal loop isolation switch (Knife switch) is in the opened state; when the single-pole metal loop is running, no-load pressurization test on the out-of-service pole is prohibited; before the no-load pressurization test on one side of the back-to-back HVDC system, the converter transformer on the other side should be checked In the cold standby state.

15. Power Cable Work

15.1 Basic requirements for power cable work

15.1.1 Before work, the name of the cable sign should be checked in detail and the work ticket is consistent, and the work can only be started after the safety measures are correct and reliable.

15.1.2 The work of filling the work ticket of the first type of power cable shall be approved by the regulator, and the work of filling the work ticket of the second type of power cable may not be permitted by the regulator. If you enter a transformer, distribution station, or power plant, you must obtain permission from the operation and maintenance personnel.

15.1.3 The signs of power cable equipment should be consistent with the names of the grid system diagram, cable direction diagram and cable data.

15.1.4 The keys of substations and power distribution stations and the keys of power cable ancillary facilities should be kept strictly by a dedicated person and registered when used.

15.2 Safety measures during power cable operation

15.2.1 Safety measures for cable construction

15.2.1.1 Before construction of cable direct buried facilities, check the drawings, and then excavate a sufficient number of sample holes and trenches to find out the distribution of underground pipelines to determine the location of cable laying and ensure that operating cables and other underground pipelines are not damaged.

15.2.1.2 In order to prevent damage to operating cables or other underground pipeline facilities, it is not advisable to use large machinery to dig trenches within the red line of urban roads. Small machinery and equipment can be used for hard pavement surface cracking, but supervision should be strengthened and no deepening of the soil. If you want to use large-scale machinery and equipment, you should go through the corresponding approval procedures.

15.2.1.3 Road digging construction should have corresponding traffic organization plan, and take safety measures to prevent traffic accidents. The construction area should be strictly separated by standard road fences, etc., and clearly marked. Construction personnel should wear reflective signs at night, and warning lights should be hung at the construction site.

15.2.1.4 When the trench excavation depth reaches 1.5m and above, measures should be taken to prevent the soil from collapsing.

15.2.1.5 During trench excavation, pavement paving materials and soil should be stacked separately, and passages should be reserved between the stacking place and trench for the construction personnel to walk normally. Tools, materials and other utensils shall not be placed on the slope where the piles are piled up.

15.2.1.6 After digging into the cable protection board, an experienced person should be present to guide it before proceeding.

15.2.1.7 Suspended protection measures shall be taken for the excavated cable or connector box if it needs to be hollowed out below. The cable suspension should be every 1 ~

Hang one 1.5m; the joint box suspension should be laid flat, and the joint box is not allowed to be subjected to tension; if the cable joint does not have a protective box, a widened and elongated wooden board should be placed under the joint before hanging. Do not use iron wire or steel wire when the cable is suspended.

15.2.1.8 Mobile cable joints should generally be powered off. If it is necessary to move with power, the historical record of the cable should be investigated first, and the experienced construction personnel should move smoothly under the unified command of a dedicated person.

15.2.1.9 Before disconnecting the cable, it should be checked and consistent with the drawing of the cable direction, and after using a special instrument (such as induction method) to confirm that the cable has no electricity, use a grounded iron solder with an insulating handle to nail into the cable core. jobs. The person holding the insulating handle should wear insulating gloves and stand on the insulating mat, and take measures to prevent burns (such as protective masks, etc.).

15.2.1.10 Special tools should be used when opening the cable manhole cover, cable trench cover and cable tunnel manhole cover. At the same time, pay attention to the standing position to avoid injuring people after slipping. After opening, a standard road fence should be set up and guarded. After the operator evacuates the cable shaft or tunnel, the manhole cover should be covered immediately.

15.2.1.11 Cable tunnels should have adequate lighting, and have fire-proof, waterproof and ventilated measures. When working in the cable well, it is forbidden to open only one well cover (except for single-hole wells). Before entering the cable well or cable tunnel, use a blower to remove the turbid

gas, and then use a gas detector to check whether the flammable, explosive and toxic gas content in the well or tunnel exceeds the standard, and make a record. After the cover of the cable trench is opened, it should be naturally ventilated for a period of time, and the trench can only be worked after passing the test. When working in cable shafts and tunnels, the ventilation equipment should be kept open. When conducting long-distance inspections in cable tunnels (ditches) with poor ventilation, operators should carry portable harmful gas testers and self-rescue respirators.

15.2.1.12 Oil-filled cable construction should do a good job of collecting cable oil. The cable oil scattered on the ground should be covered with yellow sand or sand immediately and removed in time.

15.2.1.13 Between the 10kV drop-out fuse and the 10kV cable head, a transition connection device should be installed to keep a safe distance from the electric part of the pile head of the drop-out fuse during operation. When the pile head of the 10kV drop-out fuse is electrified, before safety measures are taken, it is not allowed to install new pile heads under the drop-out fuse, exchange the cable tail, or hoist or overlap the cable terminal head. If it is necessary to carry out the above work, a special insulating cover should be used for isolation, and a grounding wire should be installed at the bottom of the pile. Operators stand in a low position, reach out their hands not to exceed the pile head of the drop-out fuse, and have a dedicated person for supervision.

Insulated tools should be used for the above-mentioned work with insulating cover. The above work is prohibited on rainy days.

15.2.1.14 When using a portable stove or blowtorch, the distance between the flame and the live part: if the voltage is 10kV and below, it should not be less than

1.5m; if the voltage is above 10kV, it shall not be less than 3m. It is not allowed to refuel or ignite the stove or blowtorch near live wires, live equipment, transformers, oil circuit breakers (switches), or in cable interlayers, tunnels, and trenches. Necessary fire prevention measures shall be taken when hot work is carried out on or near the cable trench cover.

15.2.1.15 Effective anti-virus and fire prevention measures shall be taken during the process of making epoxy resin cable heads and deploying epoxy resin.

15.2.1.16 After the completion of the cable construction, the holes that have passed through should be sealed.

15.2.1.17 Safety measures for trenchless construction:

- a) Before using trenchless technology for construction, the relative positions of various underground pipelines and facilities should be ascertained first.
- b) Trenchless passages should be kept a safe distance from various underground pipelines and facilities.

15.2.2 Safety measures for power cable line test

15.2.2.1 When the grounding wire is to be removed in the power cable test, the permission of the work permit shall be obtained (the grounding wire installed according to the instructions of the control personnel shall be approved by the control personnel). Resume immediately after finishing the work.

15.2.2.2 Before the cable withstand voltage test, safety measures should be taken at the pressure end to prevent personnel from entering the test site by mistake. At the other end, a fence should be set up and a warning sign should be hung up. If the other end is on the pole or where the cable is sawn off, a guard should be sent.

15.2.2.3 Before the cable withstand voltage test, the equipment should be fully discharged.

15.2.2.4 During the cable test, when changing the test leads, the equipment should be fully discharged first, and the operators should wear insulating gloves.

15.2.2.5 When the cable withstand voltage test is carried out in separate phases, the other two-phase cables should be grounded.

15.2.2.6 At the end of the cable test, the cable under test should be fully discharged, and a temporary grounding wire should be installed on the cable under test, which can be removed after the cable tail is connected.

15.2.2.7 When measuring the point of cable fault sound, it is forbidden to directly touch the cable sheath or smoke holes with your hands.

16. General Safety Measures

16.1 General notes

16.1.1 Anyone who enters the production site (except the office, control room, duty room and maintenance team room) should wear a safety helmet correctly.

16.1.2 Drilling holes on the floor and structure, or installing lifting tackles or stacking heavy objects outside the specified locations, should be approved by the relevant technical department of the unit in advance. It is stipulated that the place of placing heavy objects and installing the trolley shall be marked with obvious marks (marking the limit and the load limit).

16.1.3 The wells, pits, holes, holes or trenches in the working places inside and outside the substation (production building) shall be covered with a solid cover that is flush with the ground. If the cover needs to be removed during maintenance work, a temporary fence should be set up. Temporarily drilled holes and holes shall be restored to their original state after construction.

16.1.4 All elevator openings, large and small holes, stairs and platforms shall be equipped with railings not less than 1050mm high and guard plates not less than 100mm high. If the railing needs to be removed during the overhaul, temporary barriers should be installed, and the railings should be installed back immediately when the overhaul is completed. Temporary barriers should be composed of upper and lower rails and railing posts. Ground clearance upper rod 1050 ~ 1200mm, ground clearance of the lower rod 500 ~ 600mm, and is provided closely below the railing in a fixed height of not less than 180mm block foot plate. The original railing with a height of 1000mm can be left unchanged.

16.1.5 (production plant) cable outside the substation, entering the control room, the cable sandwich, control cabinets, switchgear etc. cable hole, fire-resistant material applied tightly closed.

16.1.6 Special equipment [boilers, pressure vessels (including gas cylinders), pressure pipes, elevators, hoisting machinery, special motor vehicles in the field (factory)] shall be inspected and qualified by special equipment inspection agencies before use Certification and formulate safe use regulations and regular inspection and maintenance systems. At the same time, the user unit shall register with the special equipment safety supervision and management department of the municipality directly under the Central Government or the city with districts before it is put into use or within 30 days after it is put into use.

16.1.7 Each production site should be marked with escape routes.

16.1.8 When the DC transmission system is in normal operation, personnel entering the valve hall patrol aisle should wear earmuffs.

16.1.9 It is forbidden to use steel tapes, leather tapes and wire gauges (with metal wires) around live equipment for measurement.

16.1.10 When moving long objects such as ladders and pipes in outdoor substations and high-voltage rooms, two people should put them down and carry them, and keep a sufficient safe distance from live parts.

16.1.11 The use of metal ladders is prohibited in the live area of the substation or distribution station (switch station) or near the live line.

16.2 Maintenance of equipment

16.2.1 The rotating part of the machine should be equipped with a protective cover or other protective equipment (such as a fence), and the exposed shaft end should be equipped with a protective cover to prevent clothes from being twisted. It is forbidden to remove the protective cover or other protective equipment from the coupling (back wheel) and gear when the machine is rotating.

16.2.2 The fixed climbing ladders on the outer walls and shafts of the substation (production plant) should be firm and reliable, with cages, and the climbing ladders with a height of more than 100 meters should have a resting platform in the middle, and should be regularly inspected and maintained. When climbing a ladder, check whether the ladder is firm or not, and grasp the ladder firmly. It is not allowed to grasp a step with both hands. Vertical ladders should be equipped with

anti-falling safety self-locking devices or speed difference automatic controllers for personnel to work up and down, and formulate corresponding use management regulations.

16.3 General electrical safety precautions

16.3.1 All metal shells of electrical equipment should have good grounding devices. Do not remove the grounding device or perform any work on it during use.

16.3.2 Hand-held electric tools and instruments should be repaired immediately if they have insulation damage, broken power cord sheath, protection cord falls off, cracked plugs and sockets, or mechanical damage detrimental to safety, and do not continue until repaired use.

16.3.3 When electrical equipment catches fire, the power supply of related equipment should be cut off immediately, and then the firefighting should be carried out. Equipped with fire-fighting equipment, use, maintenance, configuration of fire exits, etc. should comply with DL 5027 provisions.

16.3.4 The lighting in the workplace should ensure sufficient brightness. Accident lighting should also be provided in the operation panel, important meters, main stairs, passages, control center, machine room, control room and other places. The temporary lighting circuit on site should be relatively fixed, and frequently checked and repaired. The hanging height of lighting fixtures should not be less than 2.5m, and should not be moved arbitrarily; when it is less than 2.5m, a protective cover should be provided.

16.3.5 Maintenance of the branch circuit switch of the power supply box should be equipped with residual current action protector (leakage protector) and should be checked and tested regularly.

16.4 Use of tools

16.4.1 General tools

16.4.1.1 The tools should be checked before using them. The tools should be used in accordance with their factory instructions and nameplates. It is not allowed to use deformed, damaged or faulty tools.

16.4.1.2 The heads of sledgehammers and hand hammers should be complete, and their surfaces should be smooth and slightly convex, and no skewing, chipping, indentation, and cracks are allowed. The handles of sledgehammers and hand hammers should be made of a whole piece of hardwood. They are not allowed to be split and made with large wood, nor can they be replaced by other materials. They should be installed very firmly and the head should be fixed with a wedge bolt. There must be no oil stains on the hammer handle. Do not wear gloves or use a sledgehammer with one hand, and no one is allowed to approach. In narrow areas, pay attention to the surrounding environment when using a sledgehammer to avoid hurting people with counterattacks.

16.4.1.3 When using a chisel to chisel hard or brittle objects (such as pig iron, copper, cement, etc.), you should wear protective glasses, and it is necessary to set up safety fences to prevent debris from injuring others. The hammered part of the chisel is not allowed to be used because it has scars, unevenness, and oil stains.

16.4.1.4 The handles of files, hand saws, wood drills, screwdrivers, etc. should be installed firmly, and those without handles are not allowed to be used.

16.4.1.5 When using a drilling machine, the workpiece should be set firmly before starting to work. When removing metal debris from the drill hole, stop the rotation of the drill first. It is forbidden to directly remove iron filings by hand. Do not wear gloves when using the drill press.

16.4.1.6 When using the sawing machine, the workpiece should be clamped firmly, and the two ends of the long workpiece should be padded firmly to prevent hurting people when the workpiece is sawn off.

16.4.1.7 When using explosive tools such as nail guns, crimping guns, etc., in addition to strictly complying with the regulations of the manual, the relevant regulations on blasting shall also be observed.

16.4.1.8 The grinding wheel should be inspected regularly. The grinding wheel should be free of cracks and other undesirable conditions. The grinding wheel should be equipped with a protective cover made of steel plate, and its strength should be guaranteed to block the fragments when the grinding wheel breaks. The protective cover must cover at least the upper half of the grinding

wheel. It is forbidden to use grinding wheels without protective covers (except for portable small grinding wheels for special tasks). The safety cover of the grinder should be complete.

The adjustable guard plate of the protective cover should be adjusted frequently so that the distance between the adjustable guard plate and the grinding wheel is not more than 1.6mm.

The workpiece bracket should be adjusted at any time to compensate for the wear of the grinding wheel, so that the distance between the workpiece bracket and the grinding wheel is not more than 2mm.

When using a grinding wheel to grind, you should wear protective glasses or install protective glasses. When grinding tools with a grinding wheel, the sparks should be downward. It is not allowed to grind with the side of the wheel.

The toothless saw shall comply with the above-mentioned regulations. When using, the operator should stand on the side of the saw blade, and the saw blade should slowly approach the object to be sawed, and excessive force is not allowed.

16.4.2 Electrical tools and appliances

16.4.2.1 Electrical tools and appliances should be kept by a dedicated person, and should be regularly inspected by the electrical test unit every 6 months; before use, check whether the wires are intact and whether there is a grounding wire; unqualified ones are prohibited from being used; use should be in accordance with relevant regulations Connect the residual current action protector

(Leakage protector) and grounding wire; if there is a failure during use, it should be repaired immediately.

16.4.2.2 Wear insulating gloves when using electrical tools with metal enclosures.

16.4.2.3 When using electrical tools, do not carry the wires or rotating parts of the electrical tools. When using electrical tools on ladders, safety measures should be taken to prevent electric shocks from falling. When working with electrical tools, if you leave the workplace or temporarily stop working for some reason, or encounter a temporary power failure, you should immediately cut off the power.

16.4.2.4 Pay attention to the following matters when using hand-held running lights:

- a) The voltage of the handheld running light must not exceed 36V. When working in particularly humid or surrounding metal conductors, such as inside metal containers or water tanks, the voltage of the running lights must not exceed 12V.
- b) The power supply of the running light should be supplied by a portable or fixed isolation transformer. The transformer is not allowed to be placed inside a metal container or water tank. c) The high-voltage side of the portable lamp transformer should be equipped with a plug and the low-voltage side should be equipped with a socket. Two types of plugs that cannot be inserted into each other should be used.
- d) The housing of the running light transformer should have a good grounding wire, and a single-phase two-pole grounded plug should be used on the high-voltage side.

16.4.2.5 Electric tools and implements should be grounded or well connected to zero.

16.4.2.6 The wires of electrical tools and appliances are not allowed to touch hot bodies, do not place them on wet ground, and avoid heavy vehicles and heavy objects from pressing on the wires.

16.4.2.7 The single-phase power cord of mobile electric machinery and hand-held power tools shall use three-core soft rubber cable; the three-phase power cord shall use four-core soft rubber cable in the three-phase four-wire system. Five-core soft rubber cables should be used in the system. The electrical circuit connecting electric machinery and electric tools should be equipped with a switch or socket separately, and a residual current operated protector (leakage protector) should be installed, and the metal shell should be grounded; electric tools should be "one machine, one brake and one protection".

16.4.2.8 long-term disabled or new application of an electric power tool requisitioned 500V insulation resistance meter to measure the insulation resistance, the insulation resistance as the charging member and the housing between the value of less than 2M [Omega], should repair process. Regular measurement and inspection of insulation resistance should also be carried out for electric tools that are in normal use.

16.4.2.9 After the electrical part of the power tool is repaired, the insulation resistance measurement and insulation withstand voltage test should be carried out. For the test voltage, see

Relevant regulations in GB3787-2006 "Safety Technical Regulations for the Management, Use, Inspection and Maintenance of Hand-held Electric Tools". The test time is 1min.

16.4.2.10 Power tools of 24V and below should be used on damp or acid-containing sites and in metal containers. Otherwise, tools with insulated shells should be used, and the rated operating current should not be greater than 10mA, general type (no delay) The residual current operated protector (leakage protector) should be set up to monitor continuously. Residual current operated protector (leakage protector), power connector and control box should be placed outside the container. The switch of the power tool should be located within the reach of the guardian.

16.4.3 Air compressor

16.4.3.1 The air compressor should be well lubricated, the pressure gauge should be accurate, the automatic start and stop device should be sensitive, the safety valve should be reliable, and should be maintained by a dedicated person; the pressure gauge, safety valve, regulator and gas storage tank should be checked regularly and inspection.

16.4.3.2 It is prohibited to use gasoline or kerosene to wash the air filter and other parts of the air passage.

16.4.3.3 The gas pipeline should avoid sharp bends. Before opening the air inlet valve, the relevant personnel at the work site should be notified in advance. No one is allowed to work at the air outlet, the place where the gas storage tank is placed should be ventilated, and sunlight exposure or high-temperature baking is prohibited.

16.4.4 Submersible pump

16.4.4.1 Submersible pumps should focus on checking the following items and should meet the requirements: a) The shell must not be cracked or damaged.

b) The power switch action should be normal and flexible.

c) The mechanical protection device should be intact. d)

The electrical protection device should be good.

e) Check the phase of the power supply, check the no-load operation when energized, and prevent reverse rotation.

16.4.4.2 When the submersible pump is working, no one is allowed to enter the water within 30m of the pump.

16.4.5 Pneumatic tools

16.4.5.1 Operators who are not familiar with the use and repair methods of pneumatic tools are not allowed to use or repair pneumatic tools without authorization.

16.4.5.2 Hammers, drills and other working parts of pneumatic tools should be installed firmly to prevent them from falling off during work. It is forbidden to point pneumatic tools with working parts at people. The working parts are not allowed to be disassembled and replaced before they stop rotating.

16.4.5.3 The hose of the pneumatic tool should be firmly connected to the tool. Blow off the hose before connecting. The hose can only be disassembled when the air supply is stopped.

16.5 Welding, Cutting

16.5.1 It is not allowed to weld on equipment with pressure (liquid pressure or gas pressure) or on equipment with electricity. Under special circumstances, when welding on pressurized and live equipment is required, safety measures should be taken and approved by the leader (chief engineer) in charge of production of the unit. Welding of the supporting structure shall be approved by the relevant technical department.

16.5.2 It is forbidden to weld on the wet paint structure or other objects.

16.5.3 When electric or gas welding is used in key fire-resistant parts, near flammable and explosive places, and on containers containing flammable materials, the relevant regulations on hot work shall be strictly followed, and hot work tickets shall be filled in according to relevant regulations. Have the necessary firefighting equipment.

16.5.4 Welding or cutting work is not allowed in the open air when the wind exceeds level 5 and when it rains or snows. If necessary, measures to prevent wind, rain and snow should be taken.

16.5.5 The shell of the welding machine should be grounded reliably, and the grounding resistance should not be greater than $4\ \Omega$.

16.5.6 The storage of gas cylinders should comply with relevant national regulations.

16.5.7 Special lifting racks or trolleys should be used to transport gas cylinders.

16.5.8 When transporting gas cylinders by car, the gas cylinders are not allowed to be placed in the longitudinal direction of the carriage, and should be placed horizontally and reliably fixed. Cylinder escorts should sit in the driver's cab and are not allowed to sit in the carriage.

16.5.9 It is forbidden to transport oxygen cylinders and acetylene gas cylinders together, nor to transport them together with flammable materials or containers containing combustible gas.

16.5.10 The pressure in the oxygen cylinder drops to 0.2MPa (megapascals), and it is not allowed to use it again. " Empty bottle " should be written on the used bottle.

16.5.11 The oxygen cylinders and acetylene cylinders in use should be placed vertically and fixed. The distance between the oxygen cylinders and the acetylene cylinders should not be less than 5m, cylinders or location close to the heat source allowed, open flames should 10m outside.

16.6 Hot work

16.6.1 Hot work tickets should be filled in at key fire prevention positions or places and areas where open flames are prohibited. There are two ways: a) First class hot work tickets (see Appendix N). b) Fill in the second-level hot work ticket (see Appendix O).

Hot work referred to in this section refers to welding and cutting operations in fire-prohibited areas and the use of blowtorches, electric drills, grinding wheels, etc. in flammable and explosive places for temporary operations that may generate flames, sparks and hot surfaces.

16.6.2 In the first-level hot-fire area, the first-level hot-fire work ticket should be filled in.

The first-level hot zone refers to the part or place where the fire hazard is very high and the consequences are serious in the event of a fire.

16.6.3 In the second-level hot-fire area, the second-level hot-fire work ticket should be filled in.

The second-level hot fire area refers to all key fire prevention parts or places and no open fire areas except the first-level hot fire area.

16.6.4 Each unit can refer to Appendix P and the site conditions to divide the first and second hot areas, formulate a list of work items that need to implement the first and second hot work tickets, and obtain the leadership or technology of the unit in charge of production Execute after approval by the person in charge (chief engineer).

16.6.5 Hot work tickets are not allowed to replace equipment decommissioning procedures or maintenance work tickets, work orders and emergency area. repair orders, and the hot work tickets should indicate the maintenance work tickets, work orders and emergency area. repairs. The number of the order.

16.6.6 Filling in and issuance of hot work tickets.

16.6.6.1 The hot work ticket should be filled out and issued with a black or blue steel (water) pen or ballpoint pen, the content should be correct, the filling should be clear, and it should not be arbitrarily altered. If there are individual errors or omissions that need to be corrected, standard symbols should be used and the handwriting should be clear. Computer-generated or printed hot work tickets should use a uniform face format, verified by the issuer of the work ticket, and can only be executed after manual or electronic signature.

Hot work tickets are generally at least in triplicate, one is received by the person in charge of the work, one is received by the hot executor, and one is kept in the safety supervision department (or department with fire management duties) (refers to the first-level hot work Tickets) or Hot Work Department (refers to second-level Hot Work Tickets). If the hot work is related to operation, that is, if the operation and maintenance personnel need to take fire safety measures such as isolation and flushing of the equipment system, an extra copy should be handed over to the operation and maintenance personnel for acceptance.

16.6.6.2 The first-level hot work ticket is issued by the hot work ticket issuer of the hot fire department (workshop, work area, company, center), the person in charge of the safety supervision of the department (workshop, work area, company, center), and fire management. The person-in-charge review, the department (workshop, work area, company, center) in charge of production or the technical person in charge (chief engineer) for approval, and if necessary, report to the local public security and fire department for approval.

The second-level hot work ticket is issued by the issuer of the hot work ticket applying for the hot fire department (workshop, work area, company, center), and reviewed by the department (workshop, work area, company, center), safety supervisors, and firefighters. The fire department (workshop, work area, company, center) in charge of production is approved by the leader or technical person in charge (chief engineer).

16.6.6.3 After the hot work ticket is approved, the person in charge of the work will send it to the operation and maintenance licensor.

16.6.6.4 The issuer of the hot work ticket is not allowed to concurrently serve as the person in charge of the work. The hot work ticket is filled out by the person in charge of hot work.

The approvers of hot work tickets and fire guardians are not allowed to issue hot work tickets.

16.6.6.5 When the hot-fire unit goes to the production area for fire, the hot-fire work ticket shall be issued and approved by the equipment operation and maintenance management unit (department), or the hot-fire unit and the equipment operation and maintenance management unit (department) can implement "dual issuance". If the hot-fire unit is a subordinate unit of the State Grid Corporation of China, the hot-fire unit can issue a hot work ticket.

16.6.7 The validity period of the hot work ticket.

The first-level hot work ticket should be processed in advance.

The valid period of the first-level hot work ticket is 24h, and the valid period of the second-level hot work ticket is 120h. If the hot work exceeds the validity period, the hot work ticket shall be reissued.

16.6.8 The basic conditions of the personnel listed on the hot work ticket.

The issuer of the first and second hot work ticket should be the relevant person who has passed the examination of the unit [hot unit or equipment operation and maintenance management unit (department)] and approved by the leader (chief engineer) in charge of production of the unit and announced in writing. Department heads, technical heads or related team leaders, technicians.

The person in charge of hot work should be a person who has the qualifications of the person in charge of maintenance work and has passed the examination of the department (workshop, work area, company, center).

The fire executor shall have a certificate issued by the relevant department.

16.6.9 The safety responsibilities of the personnel listed on the hot work ticket.

16.6.9.1 The examiners and issuers of hot work tickets at all levels:

- a) Necessity of work.
- b) Work safety.
- c) Whether the safety measures on the work ticket are correct and complete.

16.6.9.2 Person in charge of hot work:

- a) Organize hot work correctly and safely.
- b) Responsible for overhauling the safety measures and making them perfect.
- c) Arrange hot work to relevant personnel, explain fire safety measures and conduct safety education.
- d) Always supervise the on-site hot work.
- e) Responsible for handling the start and end of hot work tickets.
- f) Check that there is no residual fire on the scene when the hot work is interrupted and at the end.

16.6.9.3 Operation and maintenance licensor:

- a) Whether the safety measures listed in the work ticket are correct and complete, and whether they meet the site conditions.
- b) Whether hot-fire equipment and operating equipment are really isolated.

- c) Report the safety measures taken during operation to the person in charge of the work on site.

16.6.9.4 Fire guardian:

- a) Be responsible for the necessary and sufficient fire-fighting facilities at the fire scene.
- b) Responsible for checking the completeness and correctness of on-site fire safety measures.
- c) Measure or appoint a dedicated person to determine the combustible gas content of the combustible gas and combustible liquid at the hot spot (on-site) to meet the safety requirements.
- d) Always monitor the dynamics of the on-site hot work, and put out the fire in time if it is found.
- e) Check that there is no residual fire on the scene when the hot work is interrupted and at the end.

16.6.9.5 Fire executor:

- a) A hot work ticket that has been reviewed and approved and allowed for hot fire should be received before hot fire.
- b) Take safety measures in accordance with the fire safety requirements stipulated by this type of work.
- c) Fully understand the hot work tasks and requirements, and execute hot work within the specified scope.
- d) Intermittent hot work, clean up at the end, and check the site for no residual fire.

16.6.10 Fire safety requirements for hot work.

16.6.16.1 The components that are conditionally removed, such as oil pipes and valves, should be removed and moved to a safe place.

16.6.16.2 If it can be replaced by a non- moving method and the same effect can be achieved, try to use an alternative method.

16.6.16.3 As much as possible to reduce the time and scope of hot fire to the minimum.

16.6.16.4 All containers, equipment, pipelines and other production and storage devices that contain or have contained flammable and explosive chemical hazardous materials should be thoroughly isolated from the production system before hot work, and cleaned and replaced. After analysis After passing the test, it can be used for hot work.

16.6.16.5 Hot work should be supervised by a dedicated person. Before hot work, the flammable materials at and around the hot scene should be removed, or other effective safety and fire prevention measures should be taken, and adequate firefighting equipment should be equipped.

16.6.16.6 The ventilation and exhaust of the hot work site should be good to ensure that the leaked gas can be discharged smoothly.

16.6.16.7 After the hot work is interrupted or terminated, the site should be cleaned to confirm that there is no residual fire before leaving.

16.6.16.8 Hot fire is prohibited in the following situations:

- a) Before the pressure vessel or pipeline is depressurized.
- b) The container for storing flammable and explosive materials is not cleaned up or before effective replacement.
- c) Open air operations with a wind force of level 5 or higher.
- d) Painting scene.
- e) In the event of an abnormal fire risk, the cause has not been investigated and the cause has been eliminated.

16.6.11 On-site monitoring of hot fires.

16.6.11.1 When a first-level hot fire occurs for the first time, the approvers at all levels and the hot-fire work ticket issuer shall go to the site to check whether the fire safety measures are correct and complete, determine whether the combustible gas content of combustible gas and flammable liquid is qualified, and Perform an open flame test under guardianship and start the fire only after there is no problem.

In the event of a secondary fire, the production leader or technical person in charge (chief engineer) of the department (workshop, work area, company, center) may not be on site.

16.6.11.2 When there is a fire at the first level, the leader or technical person in charge of production (chief engineer) and fire-fighting (full-time) personnel in the fire department in charge of production should always be on site.

16.6.11.3 In the event of a second-level hot fire, the hot fire department shall designate personnel, and always monitor the scene with fire-fighting (full-time) personnel or designated volunteer firefighters.

16.6.11.4 Before the fire breaks out in the first and second stage, fire safety measures should be re-checked and the combustible gas content of combustible gas and flammable liquid should be measured.

During the first-level hot work, check whether the combustible gas content of the on-site combustible gas and flammable liquid is qualified every 2 to 4 hours. When it is found to be unqualified or abnormally elevated, the hot fire should be stopped immediately. Do not get into fire until the reason or the danger is eliminated.

16.6.11.4 Fire prevention measures should be re-examined and the combustible gas content of flammable gas and flammable liquid should be measured before the first and second hot-fire work.

16.6.11.5 During the first-level hot work, check whether the combustible gas content of the on-site combustible gas and flammable liquid is qualified every 2 to 4 hours. When it is found to be unqualified or abnormally elevated, the hot fire should be stopped immediately. The fire is not allowed until the cause is identified or the danger is eliminated.

16.6.12 After the hot fire work is completed, the hot fire executor, the fire guardian, the person in charge of hot fire work, and the operation and maintenance permit should check whether there is any residual fire and whether it is clean. After confirming that there is no problem, fill in the end time of the hot work on the hot work ticket, after signing by the four parties

(If the hot work has nothing to do with the operation, the three parties can sign it), affix the "finished" seal, and the hot work ends.)

16.6.13 Hot work tickets are kept for 1 year.

17. Lifting and transportation

17.1 General notes

17.1.1 The lifting equipment must be inspected by the inspection and testing agency and registered with the special equipment safety supervision and management department.

17.1.2 Operators and commanders of lifting equipment should receive professional technical training, and pass the actual operation and relevant safety regulations examinations, and obtain a certificate before they can work independently. The type of certificate should be consistent with the type of operation (command). The crane type matches. Lifting equipment operators shall strictly implement the lifting equipment operating procedures and relevant safety rules and regulations during the operation.

17.1.3 The working load of lifting equipment, slings and other lifting gear shall not exceed the nameplate regulations.

17.1.4 The lifting and handling of all major objects should be handled by experienced personnel. Technical clarifications should be made to all personnel participating in the work before the operation, so that all personnel are familiar with the lifting and handling plans and safety measures. When lifting and carrying, only one person can command it, and if necessary, an intermediate commander can be set to transmit signals. The lifting command signal should be concise, unified, unobstructed, and the division of labor should be clear.

17.1.5 In any of the following situations, special safety technical measures should be formulated, approved by the leader (chief engineer) in charge of production of the unit, and a technical person in charge should be present to guide the operation, otherwise construction is not allowed.

17.1.5.1 The weight reaches 90% or more of the rated load of the lifting equipment.

17.1.5.2 Two or more lifting equipment lift the same object.

17.1.5.3 Lift important equipment, precision objects, large objects that are not easy to hoist or carry out large objects in complex places.

17.1.5.4 When explosives and dangerous goods must be lifted.

17.1.5.5 When the lifting equipment is under a live conductor or close to a live body.

17.1.6 Lifting objects should be tied firmly, and the hook should be hung on the center of gravity of the object.

17.1.7 In the event of a strong wind above level 6, it is forbidden to carry out lifting work in the open. When the wind reaches level 5 or higher, objects with a large wind-receiving area should not be lifted.

17.1.8 In the event of heavy fog, insufficient lighting, the commander cannot see the working places or the crane operator has not obtained effective command, no lifting work is allowed.

17.1.9 No people are allowed to stand on hanging objects, and operators are forbidden to use hooks to ascend or descend.

17.1.10 The installation, use, inspection, and testing of various lifting equipment shall not only comply with the provisions of this section, but shall also implement the relevant regulations, procedures and technical standards issued by the relevant state and industry departments.

17.1.11 For the inspection and testing of various lifting equipment, please refer to the relevant information in Appendix M.

17.2 Various cranes

17.2.1 General provisions

17.2.1.1 Without the approval of the crane driver, no one is allowed to board the crane or bridge crane track.

17.2.1.2 The crane shall be equipped with a fire extinguishing device, rubber insulation pads shall be laid in the cab, and it is forbidden to store flammable materials.

17.2.1.3 Lifting appliances in use should be checked regularly before each use, and records should be kept. Hoisting machinery should undergo a comprehensive technical inspection at least once a year.

17.2.1.4 Before lifting a heavy object, the person in charge of the work should check the suspension and the binding of the object, and try to lift it only when it is deemed reliable. Lift the heavy object slightly off the ground (or support), check the suspension and binding conditions again, and continue lifting only after it is deemed reliable.

17.2.1.5 It is forbidden for persons irrelevant to work to walk or stay in the lifting work area.

17.2.1.6 Lifting heavy objects are not allowed to hang in the air for a long time. When heavy objects are suspended in the air, drivers are prohibited from leaving the cab or doing other tasks.

17.2.1.7 It is prohibited to use cranes to lift objects buried in the ground.

17.2.1.8 When hoisting machinery is used in the substation, a grounding device should be installed, and the grounding wire should be multi-strand soft copper wire, and its cross-section should meet the requirements of grounding short-circuit capacity, but not less than 16mm².

17.2.1.9 All types of cranes should be equipped with hoist limiters, overload limiters, boom pitch limiters, stroke limiters, interlock switches and other safety devices according to their needs; their lifting, luffing, running, and rotating the mechanism should be equipped with brakes, among which the brakes of the lifting and luffing mechanism should be normally closed. Boom cranes should be equipped with torque limiters and amplitude indicators. Railroad cranes should be equipped with rail clamps.

17.2.2 Cranes

17.2.2.1 Bridge cranes should be equipped with a reliable micro-adjustment control system to ensure the reliability of large lifting. The boarding signal should be set at the position where the crane is boarded from the plant platform.

17.2.2.2 No one is allowed to stand or walk on the track of the bridge crane. When working on the track under special circumstances, the operator of the bridge crane should be contacted, and the bridge crane should be stopped.

17.2.2.3 When the crane is overhauled on the track, the power supply should be cut off, the rails at both ends of the work area should be clamped with rail clamps, and nameplates should be set up. Other cranes are not allowed to enter the inspection area.

17.2.2.4 The bridge crane in the workshop shall be parked at the designated place after the operation is completed.

17.2.2.5 Facilities for increasing the wind-receiving area shall not be installed on the fuselage of the crane used in the open air. The cab can be equipped with electrical heating equipment in winter, and the power supply should be cut off when the operator leaves. Coal stoves or electric stoves are not allowed for heating.

17.2.3 Mobile crane

17.2.3.1 When using a crane or a bucket truck in the area of live equipment, the body shall be reliably grounded with soft copper wire of not less than 16mm². Fences should be set up for construction on the road, and appropriate warning signs should be set up.

17.2.3.2 When the crane is parked or traveling, the distance between the front end or outside of the wheel, outrigger or crawler track and the edge of the ditch or pit must not be less than 1.2 times the depth of the ditch or pit; otherwise, anti-tilting and anti-collapse measures should be taken.

17.2.3.3 During operation, the crane should be placed on a flat, solid ground, and the inclination of the fuselage must not exceed the manufacturer's regulations. It is not allowed to work on concealed

trenches, underground pipelines, etc.; when it is unavoidable, protective measures should be taken to not exceed the allowable bearing capacity of the concealed trenches and underground pipelines.

17.2.3.4 During operation, the minimum safe distance between the crane boom, spreaders, auxiliary equipment, steel wire ropes and hanging objects, and overhead transmission lines and other live objects shall not be less than the provisions of Table 18, and special personnel shall be supervised. If it is less than Table 18 and greater than Table 1, safety measures to prevent accidental touching of live equipment shall be formulated and approved by the leader (chief engineer) in charge of production of the unit. When it is less than the safety distance in Table 1, it should be powered off.

Table 18 Minimum safety distance from live objects

Voltage (kV)	<1	1~10	35~ 66	11 0	22 0	33 0	500
Minimum safety distance (m)	1.5	3.0	4.0	5.0	6.0	7.0	8.5

17.2.3.5 When working near overhead lines or other live objects for a long time or frequently, isolation protection measures should be taken.

17.2.3.6 When the truck crane is running, the boom should be placed on the support, the hook should be hung on the hook and the wire rope should be tightened. It is forbidden to sit in the operating room of the vehicle.

17.2.3.7 All outriggers of truck cranes and rubber-tyred cranes should be supported before other operations can be carried out; after the operation is completed, the boom should be placed on the support first, and then the legs can be raised. Truck cranes are not allowed to travel with hanging objects except those with the ability to move objects.

17.2.3.8 The car crane test shall comply with GB 5905, and the maintenance and maintenance shall comply with the regulations of ZBJ 80001.

17.2.3.9 Aerial work vehicles (including insulated aerial work vehicles and vehicle-mounted vertical lifts) shall be tested, maintained and maintained in accordance with the GB/T 9465 standard.

17.3 Lifting equipment

17.3.1 Wire rope

17.3.1.1 The steel wire rope should be used according to the factory technical data. When there is no technical data, a single wire breaking force test shall be carried out.

17.3.1.2 The steel wire rope shall be selected according to its mechanical properties and shall be equipped with a certain safety factor. The safety factor of the steel wire rope and the diameter of the matching pulley shall not be less than those specified in Table 19.

Table 19 Safety factor of steel wire rope and matching pulley diameter

Use of wire rope	Pulley diameter D	Safety factor K
Cable wind rope and drag	$\geq 12d$	3.5

rope				
Drive way	Manpower		$\geq 16d$	4.5
	mechanical	Light	$\geq 16d$	5
		intermediate	$\geq 18d$	5.5
		Heavy	$\geq 20d$	6
Jack rope	Detour		$\geq 2d$	6~8
	No winding			5~7
Ground anchor rope				5~6
Binding rope				10
Manned lift			$\geq 40d$	14
Note: d is the diameter of the wire rope.				

17.3.1.1 The steel wire rope should be immersed in oil regularly, and should be scrapped in one of the following situations :

The wire rope has the number of broken wires in Table 20 in one pitch.

Table 20 Number of wire rope scrapped and broken wires

Safety factor	Wire rope structure					
	6×19+1		6×37+1		6×61+1	
	Number of broken wires in a pitch (pieces)					
	Alternate twisting	Same direction twisting	Alternate twisting	Same direction twisting	Alternate twisting	Same direction twisting
<6	12	6	22	11	36	18
6~7	14	7	26	13	38	19
>7	16	8	30	15	40	20
Note: A pitch refers to the axial distance of each wire rope winding one round						

- The steel wire of the wire rope is worn or corroded to 40% or more of the original wire diameter, or the wire rope has been severely twisted or burned by local arc.
- The rope core is damaged or the rope strands are squeezed out.
- Cage deformities, severe kinks or bends.
- The steel wire rope is flattened and deformed and the surface has serious burrs.
- There are not many broken wires in the wire rope, but the broken wires increase rapidly.

17.3.1.2 When the ends of the steel wire rope are fixedly connected by rope clamps, the rope

clamp pressure plate should be placed on the side of the steel rope where the main force is applied, and it is not allowed to cross the front and back; the rope clamp spacing should not be less than 6 times the diameter of the wire rope; the number of rope clamps should conform to the table 21 rules.

Table 21 Number of rope clamps for fixing the end of steel wire rope

Wire rope diameter (mm)	7~ 18	19~ 27	28~ 37	38~ 45
Number of rope clamps (a)	3	4	5	6

17.3.1.3 The length of the inserted loop rope or rope sleeve shall not be less than 15 times the diameter of the steel wire rope and shall not be less than 300mm. The newly inserted wire rope sleeve shall be subjected to a sampling test of 125% allowable load.

17.3.1.4 The wire rope passing through the pulley and drum shall not have joints. The ratio of the diameter of the groove bottom or waist of the pulley and drum to the diameter of the wire rope shall comply with the following regulations: Lifting tackle: not less than 11 when driven by machinery; not less than 10 when driven by manpower.

17.3.2 Jack

17.3.2.1 Check whether all parts are in good condition before use. When the safety bolt of the hydraulic jack is damaged, the thread or rack of the screw jack or rack jack has a wear of 20%, it is prohibited to use.

17.3.2.2 It should be set in a flat and solid place, and be levelled with a wooden stow. The jack should be perpendicular to the load surface, and a non-slip cushion should be added between the top of the jack and the contact surface of the weight.

17.3.2.3 It is forbidden to use overload, not to extend the handle or to operate beyond the specified number of people.

17.3.2.4 When using hydraulic jacks, no one is allowed to stand in front of the safety bolt.

17.3.2.5 When two or more jacks are used to lift an object at the same time, the total lifting capacity of the jacks should not be less than twice the load. When jacking, a special person should be in charge to ensure that the jacking speed and force of each jack are basically the same.

17.3.2.6 The jacking height of hydraulic jacks shall not exceed the limit mark line; the jacking heights of screw and rack jacks shall not exceed 3/4 of the height of the screw or rack.

17.3.2.7 It is forbidden to place jacks under long-term unattended loads.

17.3.2.8 The descending speed should be slow, and it is forbidden to descend suddenly under load.

17.3.3 Chain hoist

17.3.3.1 Check whether the hook, chain, transmission device and brake device are in good condition before use. It is forbidden to use it when the hook, sprocket, back card, etc. are deformed, and when the wear of the chain diameter reaches 10%.

17.3.3.2 When two or more chain hoists lift the same heavy object, the weight of the heavy object should not exceed the allowable lifting weight of each chain hoist.

17.3.3.3 The lifting chain shall not be twisted, nor shall it be broken into single strands for use.

17.3.3.4 It is not allowed to use overload. If the lifting capacity is less than 5t, one person is allowed to zipper, and if the lifting capacity is more than 5t, two people are allowed to zipper. During operation, personnel are not allowed to stand directly under the chain hoist.

17.3.3.5 If the lifted weight needs to stay in the air for a long time, the hand zipper should be tied to the lifting chain, and a safety rope should be added to the weight.

17.3.3.6 If a chain jam occurs during use; the heavy objects should be padded before inspection and repair.

17.3.3.7 The girder or building for hanging the chain hoist shall be calculated, otherwise it shall not be suspended. It is forbidden to use chain hoist to hang heavy objects for a long time.

17.3.4 Synthetic fiber lifting strap

17.3.4.1 The synthetic fiber sling should be used according to the factory data, and it is prohibited to use it when there is no data. Avoid contact with sharp edges and corners during use. If it is unavoidable, install the necessary sheath.

17.3.4.2 Operating environment temperature: $-40\sim 100^{\circ}\text{C}$.

17.3.4.3 When the sling is used for different load-bearing methods, it should be used strictly in accordance with the label.

17.3.4.4 When it is found that the outer sheath is damaged and reveals the inner core, stop using it immediately.

17.3.5 Fiber rope

17.3.5.1 When hemp rope or fiber rope is used as a sling, the allowable stress shall not be greater than 0.98kN/cm^2 . When used as a lashing rope, the allowable stress should be reduced by 50%. Those with mildew, corrosion, or damage are not allowed to use for lifting operations, and fiber ropes with loose strands, loose strands, severe wear, or broken strands are prohibited from using.

17.3.5.2 The allowable load of fiber ropes in wet conditions should be reduced by half, and the use of asphalt-coated fiber ropes should be reduced by 20%. Generally, fiber ropes are prohibited to be used under mechanical drive.

17.3.5.3 When cutting the rope, the two sides to be cut should be tied with soft steel wires to avoid loosening the rope after cutting, and the broken ends should be knotted.

17.3.6 Shackle

17.3.6.1 The shackle shall be forged. Shackles are not allowed to receive lateral force.

17.3.6.2 Shackle pins are not allowed to be buckled in rigging with greater mobility.

17.3.6.3 Do not place the shackle at the corner of the lifting piece.

17.3.7 Blocks and blocks

17.3.7.1 The pulley and pulley block should be inspected before use. If cracks or wheel edge

damage are found, they are not allowed to be used. During the use of the pulley block, the minimum distance between the centers of the two pulleys must not be less than the requirements in Table 22.

Table 22 the minimum allowable distance between the pulley centers of two pulleys in the pulley block

Lifting weight of pulley (t)	1	5	10~ 20	32~ 50
Minimum allowable distance of pulley center (mm)	70 0	900	1000	1200

17.3.7.2 The tackle is not allowed to be tied to an unstable structure. The pulley used in the line operation should have a safety device to prevent decoupling, otherwise sealing measures should be taken. When using the door-opening trolley, fasten the door-opening hook to prevent the rope from running out automatically.

17.3.7.3)7.3.7.3The piles or anchors that fasten the fixed tackle shall be calculated according to the different soil conditions, so that they can be buried firmly and reliably. If the used trolley may touch the ground, planks should be placed under the trolley to prevent garbage from entering the trolley.

17.4 Manual handling

17.4.1 The conveying aisles should be flat and unobstructed, and adequate lighting should be provided for conveyance at night. If it is necessary to pass through steep mountain slopes or uneven places, a transportation plan should be formulated in advance and necessary safety measures should be taken.

17.4.2 The following regulations shall be observed when rolling and transporting by pipe :

- a) Special personnel should be responsible for command.
- b) Approximately 30cm is exposed at both ends of the pipe after bearing the heavy object to adjust the steering. When manually adjusting the tube, care should be taken to prevent finger injuries.
- c) Wooden wedges should be used to secure the pipe when going uphill to prevent the pipe from rolling down; at the same time, no matter the uphill or downhill, measures should be taken to prevent the heavy objects from sliding down.

18. Working at Heights

18.1 General notes

18.1.1All operations carried out at a height of 2m and above the fall height reference plane shall be regarded as high-altitude operations.

18.1.2 All personnel involved in high-altitude operations should undergo a physical examination once a year.

18.1.3 All high-altitude operations should first be carried out by erecting scaffolding, using high-altitude operating vehicles, lifting platforms or taking other fall prevention measures.

18.1.4 When working on the roof and other dangerous edges, safety nets or protective railings should be installed on the side facing the air, otherwise, the operators should use safety belts.

18.1.5 When working on a scaffold without scaffolding or railing, and the height exceeds 1.5m, safety belts should be used or other reliable safety measures should be taken.

18.1.6 Safety belts and ropes designed to secure safety belts should be visually inspected before use. Safety belts should be inspected regularly according to Appendix L, and those that are unqualified are not allowed to be used.

18.1.7 Safety belts or safety ropes used in electric welding operations or other places with sparks, melting sources, etc. should be equipped with heat insulation and wear protection sleeves.

18.1.8 The hook or rope of the safety belt should be hung on a strong and firm member, or a steel wire rope specially designed for hanging the safety belt, and the way of hanging high and low should be adopted. It is forbidden to hang on moving or unstable objects [such as isolation switch (knife switch) support insulator, CVT insulator, bus post insulator, arrester post insulator, etc.].

18.1.9 Personnel working at height should check whether the safety belt is fastened at any time during the operation. Workers at heights must not lose their safety protection when transferring their work positions.

18.1.10 Scaffolding used for high-altitude operations should be accepted after passing the experience. The upper and lower scaffolding should use ramps or ladders, and operators are not allowed to climb along the scaffolding poles or railings.

18.1.11 Tool bags should be used for all work at heights. Larger tools should be tied to solid components with ropes. Work pieces and leftover materials should be placed in a secure place or fastened with iron wires and have measures to prevent falling. They are not allowed to be placed randomly to prevent accidents from falling from a height.

18.1.12 When carrying out high-altitude operations, except for the relevant personnel, no others are allowed to pass or stay under the working place. There should be fences or other protective devices under the working place to prevent falling objects from hurting people. If working on a grid-like platform, in order to prevent tools and equipment from falling, effective isolation measures should be taken, such as laying wooden boards.

18.1.13 It is forbidden to throw tools and materials up and down, and use ropes to pass them firmly to avoid injuring the workers below or destroying the scaffolding.

18.1.14 Covers, safety nets or fences should be set up around holes and trenches in high work areas, and measures should be taken to fix their positions. At the same time, safety signs should be set, and red lights should be set to warn at night.

18.1.15 When working in low temperature or high temperature environment, measures to keep warm and prevent heatstroke should be taken, and the working time should not be too long.

18.1.16 In severe weather such as strong winds of level 5 and above, heavy rain, thunder and lightning, hail, heavy fog, sandstorm, etc., operations at high places in the open air should be stopped. Under special circumstances, when it is really necessary to carry out emergency repairs in bad weather, personnel should be organized to fully discuss the necessary safety measures, and they can be carried out only after the approval of the production leader (chief engineer) of the unit.

18.1.17 The installation, dismantling and use of scaffolding shall be carried out in accordance

with the relevant regulations of the State Grid Corporation's Electric Safety Work Regulations [Fire (Hydro) Power Plant (Power Part)] and relevant national regulations.

18.1.18 When using aerial work vehicles, live working vehicles, forklifts, high-altitude work platforms, etc. for high-altitude operations, the high-altitude work platform should be in a stable state. When the vehicle needs to be moved, no people should be on the work platform.

18.2 Ladder

18.2.1 The ladder should be firm and complete, with anti-skid measures. The pillars of the ladder should be able to bear the total weight of the climbing staff and the tools and materials they carry.

18.2.2 The crosspieces of rigid ladders should be embedded in the pillars, the distance between the steps should not be greater than 40cm, and a height limit sign should be set at 1m from the top of the ladder. When working with a single ladder, the slope angle between the ladder and the ground is about 60°. The ladder is not suitable for binding. The herringbone ladder should have measures to limit the opening. Do not move the ladder when you are on the ladder.

18.3 The work of the valve hall

18.3.1 When the valve body is used for up and down using a lift truck, the lift truck should be reliably grounded, a safety helmet should be used on the lift truck, and the safety belt should be used correctly. Before entering the valve body, the safety helmet and the safety hook on the safety belt should be removed. Prevent damage to components and optical cables caused by metal blows, but pay attention to prevent falling from high places.

18.3.2 The valve body shall not sit on the edge of the valve body working layer to prevent falling from high altitude.

Appendix A

(Informative appendix)

Substation (power plant) switching operation ticket format

Substation (power plant) switching operation ticket

Unit _____ Number _____

Inspire		Unpredictable		Order time	year month day hour minute
Operation start time: Year month day hour minute				Operation end time: Year month day hour minute	
() Operation under supervision () Single operation () Operation by maintenance personnel					
Operation task:					
Sequence	Operation Items				√
Remarks:					
Operator: value):		Guardian:		Person in charge of operation and maintenance (long value):	

Appendix B

(Informative appendix)

Substation (power plant) first work ticket format

Substation (power plant) first work ticket

Unit _____ Number _____

1. Person in charge (guardian) _____ team

2. Working class staff (not including the person in charge of work)

_____ Total _____ People

3. The name of the substation and substation and the double name of the equipment

4. Tasks

Double name of work place and equipment	Work content

5. Plan working hours

From _____ Year _____ Month _____ Day _____ Hour _____ Minute

To _____ Year _____ Month _____ Day _____ Hour _____ Minute

6. Safety measures (drawing instructions can be attached if necessary)

Should pull the circuit breaker (switch), isolating switch (knife switch)	It has been executed*
Grounding wire should be installed and grounding switch should be closed (indicate the exact location, name and grounding wire number*)	It has been executed

Table (continued)

Measures such as shielding fences, signboards and preventing accidental collision of the secondary circuit	It has been executed

Note: The executed column and the grounding wire number are filled in by the work permitter.

Keep live parts or precautions in the workplace (Filled by the issuer of the work ticket)	Supplementary work place to keep live parts and safety measures (To be filled out by the work permit)

Signature of issuer of work ticket _____ Date of issue _____ Year _____ Month _____ Day _____ Hour _____ Minute

7. Time of receipt of work ticket _____ Year _____ Month _____ Day _____ Hour _____ Minute

Signature of operation and maintenance personnel _____ Signature of person in charge of work _____

8. Confirm items 1 ~ 7 of this work ticket

Signature of person in charge of work _____ Signature of work permit _____

Allowed start time _____ Year _____ Month _____ Day _____ Hour _____ Minute

9. Confirm the work tasks and safety measures assigned by the work leader :

10. Changes in the person in charge

Original job leader _____ Leave, change for the job leader _____

Work ticket issuer _____ Year _____ Month _____ Day _____ Hour _____ Minute

11. Operating personnel changes (name, date and time of change)

12. Postponement of work ticket

Validity extended to _____ Year _____ Month _____ Day _____ Hour _____ Minute

Signature of person in charge of work _____ Year _____ Month _____ Day _____ Hour _____ Minute

Signature of work permit _____ Year _____ Month _____ Day _____ Hour _____ Minute

13. Daily start and end time (you don't need to fill in one day's work ticket)

Closing time				Job leader	Work permit	Start time				Work permit	Job leader
Month	day	hour	minute			Month	Day	Hour	Minute		

14. End of work

All work was completed by the end of the month, equipment and security measures had been restored to their pre-work status, staff had been evacuated, material tools had been cleaned up and work had been completed.

Signature of person in charge of work _____ Signature of work permit _____

15. End of work ticket

Temporary fences and signs have been removed, and permanent fences have been restored. The grounding wire numbers that have not been dismantled or unopened are grouped together, and the grounding switch (trolley) has a total of assistants (sets), which have been reported to the duty control personnel.

Signature of work permit _____ Year _____
Month _____ Day _____ Hour _____ Minute

16. Remarks

(1) Appointed dedicated guardian _____ Responsible for guardianship _____

(Location and specific work)

(2) Other matters _____

Note: If total and split votes are used, the prefix "total (n) number contains points (m)" on the number of total votes, and "total (n) number points (n)" on the number of split votes.

CC

Appendix C

(Informative appendix)

The first work ticket format for power cables

The first work ticket for power cables

Unit _____ Number _____

1. Person in charge (guardian) _____ team _____

2. Working class staff (not including the person in charge of work) _____

Total _____ People

3. Power Cable Name _____

4. Tasks

Work location or lot	Work content

5. Plan working hours

From _____ Year _____ Month _____ Day _____ Hour _____ Minute

To _____ Year _____ Month _____ Day _____ Hour _____ Minute

6. Safety measures (drawing instructions can be attached if necessary)

(1) The name of the equipment that should be opened, and the insulating partition should be installed			
Substation, substation or line name	Circuit breakers (switches), isolating switches (knife switches), fuses, and insulation partitions that should be installed (indicate the double name of the equipment)	Executor	executed

(2) should be closed or grounding wire should be installed		
Double name of grounding switch and grounding wire installation location	Grounding wire number	Executor
(3) Fences should be set up, and signs should be hung up		
(4) Keep live parts or precautions at the work place (Filled by the issuer of the work ticket)	(5) Supplementary work place to keep live parts and safety measures (To be filled out by the work permit)	

Signature of issuer of work ticket____Date of issue____Year____Month____Day____Hour____Minutes

7. Confirm items 1~6 of this work ticket

Signature of person in charge of work

8. Additional security measures

Signature of person in charge
of work _____

9. Work permit

(1) Cable work on the line:

Work permit____use____Way permission

From____year____month____day

____Time Split up Signature
of the person in charge of starting
work_____

(2) Cable work in substation or power plant :

the measures listed in the safety measures item____ (Substation, distribution station/power plant)
has been implemented

Work permit time____Year____Month____Day____Hour____Minutes

Signature of work permit____ Signature of person in charge of work ____

10. Confirm the work tasks and safety measures assigned by the work leader :

11. Daily start and end time (you don't need to fill in one day's work ticket)

Closing time				Job leader	Work Permit	Start time				Work permit	Job Leader
Month	day	hour	minute			month	day	hour	minute		

12. Postponement of work ticket

Validity extended to _____ Year _____ Month _____ Day _____ Hour _____ Minutes

Signature of In charge _____ Year _____ Month _____ Day _____ Hour _____ Minutes

Signature of Work permit _____ Year _____ Month _____ Day _____ Hour _____ Minutes

13. Change of job manager

Original job leader _____ Leave, change _____ for the job leader.

Work ticket issuer _____ Year _____ Month _____ Day _____ Hour _____ Minutes

14. Operator changes (name, date and time of change)

Signature of person in charge of work _____

15. End of work

(1) Cable work on the line: all the operators have been evacuated, the materials and tools have been cleaned up, and the work is over;

The grounding wires have all been removed. _____ Year _____ Month _____ Day _____ Hour _____ Minutes

The person in charge of the work uses the work permit _____ Way to report.

Signature of person in charge of work _____

(2) Cable work in substation, distribution station or power plant :

In _____ (Substations/power plants) work in _____ Year _____ Month _____ Day _____ Hour _____ Minutes

End, equipment and safety measures

It has been restored to the state before the start of construction, all operators have been evacuated, and materials and tools have been cleaned up.

Signature of person in charge of work _____ Signature of work permit _____

16. End of work ticket

Temporary fences and signs have been removed, and permanent fences have been restored ;

Number of ground wire that has not been removed or pulled apart _____ Equal _____ group, the grounding switch has a total of assistants (sets), and the dispatch has been reported.

Signature of work permit _____

17. Remarks

(1) Designated dedicated guardian_____Responsible for guardianship_____

(Location and specific work)

(2) Other matters_____

Note: If total and split votes are used, the prefix "total (n) number contains points (m)" on the number of total votes, and "total (n) number points (n)" on the number of split votes.

Appendix D

(Informative appendix)

Substation (power plant) second work ticket format

Substation (power plant) second work ticket

Unit _____ Number _____

1. Person in charge (guardian) _____ team _____

2. Working class staff (not including the person in charge of work)

Total _____ people

3. The name of the substation and substation and the double name of the equipment

4. Tasks

Work location or lot	Work content

5. Plan working hours

From _____ Year ____ Month ____ Day ____ Hour ____ Minute

To _____ Year ____ Month ____ Day ____ Hour ____ Minute

6. Working conditions (power failure or non-power failure, or nearby and keep the name of live equipment)

7. Matters needing attention (safety measures) _____

Signature of Issuer of Work Ticket _____ Date of Issue ____ Year ____ Month ____ Day ____ Hour ____ Minute

8. Supplementary safety measures (filled by the work permit)

9. Confirm items 1~8 of this work ticket

Signature of person in charge of work _____ Signature of work permit _____

Permitted working hours Year ____ Month ____ Day ____ Hour ____ Minute

10. Confirm the work tasks and safety measures assigned by the work leader :

11. Extension of work ticket _____ Year ____ Month ____ Day ____ Hour ____ Minute

Signature of person in charge of work_____Year__Month_Day____Hour____Minute
Signature of work permit_____Year__Month_Day____Hour____Minute

12. End of work ticket

All work on_____Year__Month_Day____Hour____Minute

At the end, all operators have been evacuated, and the materials and tools have been cleaned up.

Signature of person in charge of work_____Year__Month__Day_Hour
Minute

Signature of work permit_____Year__Month_Day____Hour____Minute

13. Remarks

Appendix E

(Informative appendix)

Power cable second work ticket format

Power cable second work ticket

Unit _____ Number _____

1. Person in charge (guardian) _____ team _____

2. Working class staff (not including the person in charge of work)

Total _____ people

3. Tasks

Power cable name	Work location or lot	Work content

4. Plan working hours

From _____ Year _____ Month _____ Day _____ Hour _____ Minute

To _____ Year _____ Month _____ Day _____ Hour _____ Minute

5. Working conditions and safety measures

Signature of issuer of work ticket _____ Date of issue _____ Year _____ Month _____ Day _____ Hour _____ Minute

6. Confirm items 1~5 of this work ticket

Signature of person in charge of work _____

7. Supplementary safety measures (filled by the work permit)

8. Work Permit

(1) Cable work on the line: work start time _____ Year
_____ Month _____ Day _____ Hour
_____ Minute

(2) Signature of person in charge of work _____

Cable work in substation or power plant: _____

The part (transformation, distribution station/power plant) has been implemented. Licensed from _____ to _____ Year _____ Month
_____ Day _____ Hour _____ Minute to start of work

Signature of work permit _____ Signature of person in charge of work _____

9. Confirm the tasks and safety measures assigned by the person in charge of the work.

Signature of staff member:

10. Extension of work ticket

Extended to ____ Year ____ Month ____ Day ____ Hour ____ Minute

Signature of person in charge of work ____ Year ____ Month ____ Day ____ Hour ____ Minute

Signature of work permit ____ Year ____ Month ____ Day ____ Hour ____ Minute

11. End of work ticket

(1) Cable work on the line:

Work end time ____ Year ____ Month ____ Day ____ Hour ____ Minute

Signature of person in charge of work _____

(2) Cable work in substation, distribution station or power plant:

in _____ (Transformation, distribution station/power plant) works in
Year ____ Month ____ Day ____ Hour ____ Minute

At the end, all operators have exited, and the materials and tools have been cleaned up

Signature of person in charge of work _____ Signature of work permit _____

12. Remarks

Note: If total and split votes are used, the prefix "total (n) number contains points (m)" on the number of total votes, and "total (n) number points (n)" on the number of split votes.

Appendix F

Substation (power plant) live work ticket format

Work ticket for live working in substation (power plant)

Unit _____ Numbering _____

1. Person in charge of work (guardian) team _____
2. Working class staff (not including the person in charge of work)

To _____ pe

3. Double name of working transformer and substation name and equipment

4. work tasks

Work location or lot	Work content

5. Planned working hours

Since the year month day

Time Points to ____ year
month day Time Minute

6. Working conditions (equipotential, intermediate or ground potential work, or name of nearby live equipment)

7. Matters needing attention

Signature of issuer of work ticket Date of ye m da Ti Mi

8. Confirm the signature of the person in charge of items 1 to 7 of this work ticket _____

9. Specify As a dedicated guardian Signature of dedicated guardian _____

10. Supplementary safety measures (filled by the work permit)

11. Permitted working hours year month day Time Signature of Sub-Work Permit

_____ Signature of person in charge of work_____

12. Confirm the work tasks and safety measures assigned by the person in charge.

Signature of working team member:

13. Work ticket end

All work on _____ year month day Time_____The division is over, all operators have been evacuated, and the materials and tools have been cleaned up.

Signature of person in charge of work_____Signature of work permit_____

14. Remarks

GG

Appendix G

Substation (power plant) accident emergency repair form format

Emergency Repair Form for Substation (Power Plant) Accident

unit _____ Numbering _____

1. Person in charge of emergency repair work (guardian) team _____
2. Emergency repair crew (excluding the person in charge of emergency repair work)

To _____ pe

3. Emergency repair tasks (emergency repair location and repair content)

4. Safety measures

5. Keep live parts or precautions at the repair

6. Above 1~ 5 The person in charge of the Arrange people according _____ Fill in the layout.

7. The following safety measures need to be

- | | | | | | |
|---|---------|-------|-------------|--------------------------------------|--|
| Licensed person (control/operation and maintenance personnel) | agree (| month | Time of day | After sub), it has been implemented. | |
| 8. Allowed repair time | year | month | Time | Minute | On-site equipment status and retention safety measures |
| Japanese licensor (control/operation and maintenance personnel) | _____ | | | | |
| 9. Report on the end of the repair | | | | | |
| This repair work is on | year | month | day | Time | End of points |

The emergency repair team has all been evacuated, the materials and tools have been cleaned up, and the emergency repair order has been terminated.

Person in charge of repair work _____ Licensor (control/operation and maintenance personnel) _____ Fill in time year month day
Time Minute

(Informative appendix) Form of second
work safety measures ticket

Numbering_____

Executor: guardian: Recovery guardian:

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Appendix I

(Normative
appendix)

Nameplate style

name	Suspension	formulakind		
		Size (mm)	Color	Typeface
It is forbidden to close, someone is working!	Once closed, it can be sent to the circuit breaker (switch) and isolating switch of the construction equipment (Knife switch) on the operating handle	200×160 and 80×65	White background, red round slash, black prohibition sign symbol	White on red background
Closing is forbidden, someone is working on the line!	Circuit breaker (switch) and isolating switch (Knife switch) on the handle	200×160 and 80×65	White background, red round slash, black prohibition sign symbol	White on red background
No opening is allowed!	On the operating handle of the circuit breaker (switch) between the grounding switch and the overhaul equipment	200×160 and 80×65	White background, red round slash, black prohibition sign symbol	White on red background
Work here!	Work place or maintenance equipment	250×250 and 80×80	The substrate is green with white circles with diameters of 200mm and 65mm	Black letters, written in white circles
only Step, high voltage is dangerous!	The construction site is close to the fence of live equipment; on the fence of the outdoor work site; on the forbidden passage; high-voltage test site Point; on the outdoor frame; on the beam near the live equipment	300×240 and 200×160	White background, black equilateral triangle and logo symbol, the substrate is yellow	Black
From now on!	Operators can go up and down the iron frame and climb the ladder	250×250	The substrate is green with a medium diameter 200mm white circle	Black letters, written in white circles
In and out from now on!	Entrance and exit of fence at outdoor work site	250×250	The substrate is green with a medium diameter 200mm white circle	Bold in black, written in a white circle

Climbing is prohibited, high voltage is dangerous!	On the climbing ladder of the high-voltage power distribution device frame, the climbing ladder of the transformer, reactor and other equipment	500×400 and 200×160	White background, red round slash, black prohibition sign symbol	White on red background
--	---	---------------------	--	-------------------------

Note: The operating handles of the circuit breaker (switch) and isolating switch (knife switch) at the work site can be sent to the operating handle of the computer display screen as soon as the switch is closed, "No closing, someone working!" and "No closing, there is someone working on the line!" and "No opening" signs can refer to the style of the relevant signs in the table.

J J

Appendix J

(Normative appendix) Test items, cycles and requirements of safety tools and appliances

Safety equipment test items, cycle and requirements

Serial number	appliance	project	cycle	wantbegging				Say Bright
1	Capacitance electroscope	A. Starting voltage test	1 year	Starting voltage value is not higher than 40% of rated voltage and not lower than 15% of rated voltage				The contact electrode should be in contact with the test electrode during the test
		B. Power frequency withstand voltage test	1 year	Rate voltage (KV)	Test length (M)	Power frequency withstand voltage (KV)		
						1min	5min	
				10	0.7	45	—	
				35	0.9	95	—	
				66	1.0	175	—	
				110	1.3	220	—	
				220	2.1	440	—	
				330	3.2	—	380	
				500	4.1	—	580	
2	Portable short-circuit ground wire	A. Group DC resistance test	No more than 5 years	Measure the DC resistance between the wiring lugs. For various cross-sections of 25, 35, 50, 70, 95, 120mm ² , the average resistance value per meter should be less than 0.79, 0.56, 0.40, 0.28, 0.21, 0.16mW				The same batch of random tests, no less than 2 pieces, the test should be done if the lug is crimped with the flexible wire
3	Portable short-circuit ground wire	B. Power frequency withstand voltage test of operating rod	5 years	Rate d volta ge (KV)	Test lengt h (M)	Power frequency withstand voltage (KV)		The test voltage is applied between the guard ring and the fastening head
						1min	5min	
				10	—	45	—	
				35	—	95	—	
				66	—	175	—	

				110	—	220	—	
				220	—	440	—	
				330	—	—	380	
				500	—	—	580	
3	Personal security line	Group DC resistance test	No more than 5 years	Measure the DC resistance between the wiring lugs. For 10, 16. For various cross sections of 25mm ² , the average resistance per meter should be less than 1.98, 1.24, 0.79mW				No less than two samples in the same batch

Table (continued)

	Edge bar	test		(KV)	Leng th (m)	(KV)		
						1min	5min	
				10	0.7	45	—	
				35	0.9	95	—	
				66	1.0	175	—	
				110	1.3	220	—	
				220	2.1	440	—	
				330	3.2	—	380	
				500	4.1	—	580	
5	Nuclear phaser	A. Connect ion guide Wire insulation strength test	when necess ary	Rated voltage (KV)	Power frequency withstand voltage (KV)		Duration (min)	Immersion in resistivity less than 100Ω·M in water
				10	8		5	
				35	28		5	
		B. Insulatio n Power frequency withstand voltage test	1 year	Rated voltage (KV)	Test lengt h (M)	Power freque ncy withst and voltage (KV)	contin ued Time (min)	
				10	0.7	45	1	
				35	0.9	95	1	
		C. Resistanc e tube leakage current test	Half a year	Rated voltage (KV)	Powe r frequ ency withs tand volta ge (KV)	durati on (Min)	Leakag e current (MA)	
				10	10	1	≤2	
				35	35	1	≤2	
		D. Operating voltage test	1 year	The minimum operating voltage should reach 0.25 times the rated voltage				
6	Insulation cover	Power frequency withstand	1 year	Rated voltage (KV)	Power frequency withstand	time (Min)		

		voltage test			voltage (KV)		
				6~10	30	1	
				35	80	1	
7	Insulating partition	A. Surface engineering Frequency withstand voltage test	1 year	Rated voltage (KV)	Power frequency withstand voltage (KV)	Duration (min)	e Distance between electrodes 300mm
				6~35	60	1	

Table (continued)

Serial number	appliance	project	cycle	want begging			Say
7	Insulating partition	B. Power frequency withstand voltage test	1 year	Rated voltage (KV)	Power frequency withstand voltage (KV)	Duration (min)	
				6~10	30	1	
				35	80	1	
8	Insulating rubber pad	Power frequency	1 year	Voltage level	Power frequency withstand voltage	duration	Used in the area of live equipment
		Withstand voltage test			(KV)	(Min)	
				high pressure	15	1	
				Low pressure	3.5	1	
9	Insulated boots	Power frequency withstand voltage test	Half a year	Power frequency withstand voltage (KV)	Duration (min)	Leakage current (mA)	
				15	1	≤7.5	
10	Insulated gloves	Power frequency	Half a year	Voltage level	Power frequency withstand voltage	duration (Min)	Leakage current

		withstand voltage test			(KV)		(MA)	
				high	8	1	≤9	
				pressure				
				Low pressure	2.5	1	≤2.5	
11	Conductive shoes	DC resistance test	Do not wear exceed 200h	Resistance value is less than 100kΩW				Meet the "Safety Technical Requirements for Anti- static Shoes and Conductive Shoes"
12	Insulated clamp	Power frequency withstand voltage test	1 year	Rated voltage (KV)	Test length (M)	Power frequency withstand voltage (KV)	duration (Min)	
				10	0.7	45	1	
				35	0.9	95	1	
13	Insulated rope	high pressure	Once every 6 months	105kV/0.5m				

Note: For the test method of insulating safety tools and appliances, refer to the relevant content of "Preventive Test Procedures for Electric Safety Tools and Appliances (Trial)" Gouldian Fa [2002] No. 777.

KK

Appendix K

(Informative appendix) Electric test standard table of
overhead insulated bucket car for live working

Standard table for electrical test of overhead insulated
bucket arm car for live working

Voltage level (kV)	Test part	Test items and standards					Preparation
		Handover test		Preventive test			
		Power frequency withstand voltage	Leakage current	Power frequency withstand voltage	Leakage current	Creeping discharge	
Voltage at all levels	Single layer operation	50kV 1min	—	45kV 1min	—	—	The bucket is immersed in water, 200mm above the water surface
	Work bucket	50kV 1min	—	45kV 1min	—	—	
	Outer bucket	20kV 1min	—	—	0.4m 20kV ≤0.2mA	0.4m 45kV 1min	Leakage current test is creeping test
All levels	Hydraulic oil	Oil cup: 2.5mm electrode, average breakdown voltage of 6 tests ≥20kV, any single breakdown voltage ≥10kV					The replaced and added hydraulic oil should be tested
10	Upper arm (Main arm)	0.4m 50kV 1min	—	0.4m 45kV 1min	—	—	The withstand voltage test is a vehicle test, but a test electrode should be added to the insulating arm
	Lower arm (Sleeve)	50kV 1min	—	45kV 1min	—	—	
	Whole vehicle	—	1.0m 20kV ≤0.5mA	—	1.0m 20kV ≤0.5mA	—	Add test electrodes on the insulating arm
35	Upper arm (Main arm)	0.6m 105kV 1min	—	0.6m 95kV 1min	—	—	The withstand voltage test is a vehicle test, but a test electrode should be added to the insulating arm
	Lower arm (Sleeve)	50kV 1min	—	45kV 1min	—	—	

	Whole vehicle	—	1.5m 70kV ≤0.5mA	—	1.5m 70kV ≤0.5mA	—	Add test electrodes on the insulating arm
66	Upper arm (Main arm)	0.7m 175kV 1min	—	0.7m 175kV 1min	—	—	The withstand voltage test is a vehicle test, but a test electrode should be added to the insulating arm
	Lower arm (Sleeve)	50kV 1min	—	45kV 1min	—	—	
	Whole vehicle	—	1.5m 70kV ≤0.5mA	—	1.5m 70kV ≤0.5mA	—	Add test electrodes on the insulating arm. At the same time, check the leak list
110	Upper arm (Main arm)	1.0m 250kV 1min	—	1.0m 220kV 1min	—		The withstand voltage test is a vehicle test, but a test electrode should be added to the insulating arm

Table (continued)

Voltage level (kV)	Test part	Test items and standards					Prepare Note
		Handover test		Preventive tes			
		Power frequency	leaka ge	Powe r frequency	Leaka ge	Along the surfac e	
		Withst and voltage	Curre nt	Withst and voltage	Curre nt	Discha rge	
110	Lower arm (Sleeve)	50kV 1min	—	45kV 1min	—	—	
	Whole vehicle	—	2.0m 126kV ≤0.5mA	—	2.0m 126kV ≤0.5mA	—	Add test electrodes on the insulating arm. At the same time, check the leak list
220	Upper arm (Main arm)	1.8m 450kV 1min	—	1.8m 440kV 1min	—	—	The withstand voltage test is a vehicle test, but a test electrode should be added to the insulating arm
	Lower arm	50kV 1min	—	45kV 1min	—	—	

	(Sleeve)						
	Whole vehicle	—	3.0m 252kV ≤0.5mA	—	3.0m 252kV ≤0.5mA	—	Add test electrodes on the insulating arm. At the same time, check the leak list

Appendix L

(Normative appendix)

Climbing equipment test standard table

Serial number	name	project	cycle	Claim			Description
1	seat belt	Static load test	1 year	Speci es	Test static tension (N)	Load time (Min)	The leather belt test cycle is half a year
				Pole belt	2205	5	
				Round rope	2205	5	
				Protec tion belt	1470	5	
				safety rope	2205	5	
2	helmet	A Impact performance test	Accor ding to the stipula ted period	Impact force is less than 4900N			Service life: from the date of manufacture, plastic cap ≤ 2.5 years, glass fiber reinforced plastic cap ≤3.5 years
		B puncture resistance test	Accor ding to the stipula ted period	The steel cone does not touch the surface of the head mold			
3	Foot buckle	Static load test	1 year	Apply 1176N static pressure, duration 5min			
4	Lifting board	Static load test	Half a year	Apply 2205N static pressure, duration 5min			
5	ladder	Static load test	Half a year	Apply 1765N static pressure, duration 5min			
6	Anti-falling self-locking device	Static load test	1 year	Load 15kN load on the guide rail and keep it for 5min.			The standard comes from GB/T 6096—2009 "Safety Belt Test Method" 4.7.3.2 and 4.10.3.3
		Impact test	1 year	Connect the 100±1kg load to the self-locking device with a 1m long rope and release it from the horizontal position with the self-locking device. The peak value of the test			

				impact force is $6\pm$ Between 0.3kN is qualified.	
7	buffer	Static load test	1 year	<p>1、 Hang a 5kN weight at the end of the suspension state, and measure the end length of the buffer.</p> <p>2、 Load 2kN between the stress points at both ends and hold for 2min. After unloading for 5 minutes, check whether the buffer is opened, and measure the length between the two ends while maintaining the length. Hang a 5kN weight at the end in a hanging state, and measure the end length of the buffer.</p> <p>Calculate the difference between the two measurement results, that is, the initial deformation, accurate to 1mm.</p>	GB/T6096-2009 "Safety belt test method 4.11.2
8	Speed diffe rence automatic controller	Static load test	1 year	Load 15kN load on the speed difference automatic controller and keep it for 5min.	The standard comes from GB/T 6096—2009 "Safety Belt Test Method" 4.7.3.3 and 4.10.3.4
		Impact test	1 year	Connect the $100\pm 1\text{kg}$ load with a 1m long rope and release it from the horizontal position with the speed difference automatic controller. The peak value of the test impact force is $6\pm$ Between 0.3kN is qualified.	

Note: After the expiration of the use period, the batch of safety helmets can be used only after the spot check is qualified, and the spot check will be carried out once a year. The test method of climbing tools refers to

The relevant content of the Preventive Test Regulations for Power Safety Tools and Appliances (for Trial Implementation)" Guadiana [2002] No.777.

MM

Appendix M

(Normative appendix)

Period and requirements for inspection and test of
common lifting equipment

Serial number	name	Inspection and test requirements		cycle
1	White brown rope fiber rope	an examination	The rope is smooth, dry and without wear	January
		test	Carry out a static test for 10 minutes at 2 times the allowable load, and there should be no breaks or significant local extension	1 year
2	Wire rope (For lifting)	an examination	(1) The rope buckle is reliable and has no looseness; (2) The wire rope has no serious wear and tear; (3) The number of broken wires in the wire rope is within the limit specified in the regulations	January
		test	Carry out a static test for 10 minutes at 2 times the allowable load, and there should be no fracture or significant local extension.	1 year
3	Synthetic fiber sling	an examination	The outer sheath of the hoisting belt is not damaged, and the inner core is not broken	Check once a month and test once a year
		Test	Perform a static test for 12 minutes with 2 times the allowable working load, and there should be no fracture	
4	Iron chain	an examination	(1) The chain links are not severely rusted or worn, and the chain links are worn to the original straight 10% of the diameter should be scrapped; (2) There should be no cracks in the chain links, and the cracks should be scrapped	January
		Test	Perform a static test for 10 minutes with 2 times the allowable working load. The chain should not be broken, markedly extended, and individual chain links elongated. When the plastic deformation reaches 5% of the original length, it should be scrapped.	1 year
5	Chain hoist	an examination	(1) There is no serious corrosion, cracks, and slippage of the chain links; (2) The gears are complete, the axles are not worn, and the split pins are complete; (3) The supporting teeth are flexible and can act as a brake; (4) The spacers on the supporting tooth plane are thick enough to prevent slipping after being loaded;	January

			<p>(5) The hook has no cracks and no deformation;</p> <p>(6) Adequate lubricating oil</p>	
5	Chain hoist	Test	<p>(1) Newly installed or overhauled, after a static test with 1.25 times the allowable load for 10 minutes, and then a dynamic test with 1.1 times the allowable load, the braking performance is good and the chain is not elongated;</p> <p>(2) General periodic test, static test for 10 minutes at 1.1 times the allowable load</p>	1 year
6	pulley	an examination	<p>(1) The pulley is intact without cracks and can rotate flexibly;</p> <p>(2) The pulley shaft has no wear and tear, and the split pin is complete;</p> <p>(3) The hook has no cracks and no deformation;</p> <p>(4) Adequate lubricating oil</p>	January
		Test	<p>(1) Newly installed or overhauled, 10 minutes at 1.25 times the allowable load After the static test, do a dynamic load test with 1.1 times the allowable load, and there is no crack;</p> <p>(2) For general periodic tests, static test is carried out for 10 minutes at 1.1 times the allowable load;</p> <p>(3) Wear measurement: The wall thickness of the wheel groove wears up to 20% of the original size, the uneven wear of the wheel groove reaches more than 3mm, and the bottom diameter of the wheel groove decreases by 50% of the wire rope diameter and should be scrapped</p>	1 year

Table (continued)

Serial number	name	Inspection and test requirements		cycle
		Test	<p>(1) Newly installed or overhauled, 10 minutes at 1.25 times the allowable load After the static test, do a dynamic load test with 1.1 times the allowable load, and there is no crack;</p> <p>(2) For general periodic tests, static test is carried out for 10 minutes at 1.1 times the allowable load;</p>	1 year
			<p>(3) Wear measurement: the wall thickness of the wheel groove wears up to 20% of the original size, the uneven wear of the wheel groove reaches more than 3mm, and the</p>	

			reduction of the bottom diameter of the wheel groove reaches 50% of the wire rope diameter should be scrapped	
7	Rope clips, shackles, etc.	an examination	Good thread, no cracks on the surface	January
		Test	Perform a static test for 10 minutes at 2 times the allowable load	1 year
8	Hook	an examination	(1) No cracks or significant deformation; (2) No serious corrosion or wear; (3) The anti-decoupling device is intact; (4) Full lubricating oil, flexible rotation	January
		Test	(1) Perform a static test for 10 minutes at 1.25 times the allowable working load, and check with 20 times magnifying glass or other methods. There should be no residual deformation, cracks and cracks; (2) Wear and deformation measurement. It shall be scrapped when one of the following situations occurs: 1) Dangerous section wear reaches 10% of the original size; 2) The opening degree is increased by 15% compared to the original size; 3) The torsional deformation exceeds 10°; 4) Plastic deformation of dangerous section or neck of hook	1 year
9	jack	an examination	(1) The shape of the top weight can prevent the sliding of the object; (2) Screw or rack jack, the device to prevent the screw or rack from separating from the thread is good; (3) The thread wear rate does not exceed 20%; (4) Screw jack with good automatic braking function	January
		Test	(1) Newly installed or overhauled, after a static test of 1.25 times the allowable working load for 10 minutes, use 1.1 times the allowable working load as power The test results should not have cracks or significant local extension; (2) General periodic test, static test for 10 minutes at 1.1 times the allowable working load	1 year

10	Electric and motorized winches	an examination	<p>(1) The gearbox is complete and well lubricated;</p> <p>(2) The boom is flexible, and the screws at the connection are not loose or missing;</p> <p>(3) The wire rope has no serious wear and tear, and the number of broken wires is within the specified range;</p> <p>(4) The hook has no cracks and no deformation;</p> <p>(5) No wear of the pulley rod;</p> <p>(6) The height of the flange of the drum is at least 2 times higher than the surface of the outermost wire rope than the diameter of the rope; when the hook is placed at the lowest point, there are at least 5 loops of the wire rope on the drum and the rope head is well fixed;</p> <p>(7) The protective cover of the mechanical transmission part is complete, and the switch and motor shell are well grounded;</p> <p>(8) The hoisting limiter will automatically stop when the hook is lifted 300mm from the lifting frame;</p> <p>(9) The load controller operates normally;</p> <p>(10) The brake is flexible and good</p>	January
		Test	<p>(1) For new installations or major repairs, perform a static test at 1.25 times the allowable load for 10 minutes, and then perform a dynamic test at 1.1 times the allowable load. The brakes are good and the wire rope has no significant local extension;</p> <p>(2) General periodic test, static test for 10 minutes at 1.1 times the allowable load</p>	1 year

Table (continued)

Serial number	name	Inspection and test requirements		cycle
11	Bridge crane	an examination	<p>Carefully check the entire lifting equipment and its various components:</p> <p>(1) Insurance and protective devices</p> <p>(1) The hoisting limiter can automatically stop the hook when the hook is lifted 300mm from the lifting frame. If the manufacturer has other regulations, it shall comply with the manufacturer's regulations;</p> <p>(2) The travel limiter at the end of the rail is effective;</p> <p>(3) The load controller operates normally;</p> <p>(4) The brakes are flexible and reliable;</p> <p>(5) Gears, bolts on shafts, pins, backrest wheels, and brake disc guards are secure</p>	<p>(1) 1-year test inspection 1 time</p> <p>(2) Check in combination with major and minor repairs</p>

			<p>Solid and complete</p> <p>(6) The electrical interlocking protection is reliable; the crane and motor switch housings are well grounded.</p> <p>(2) Crane parts</p> <p>(1) The wire rope has no serious wear and tear, and the number of broken wires is within the range specified in the regulations;</p> <p>(2) The hook has no cracks and deformation, and the pins and ball bearings are in good condition;</p> <p>(3) The height of the drum flange is at least one diameter higher than the outermost rope surface; when the hook is placed in the lowest position, there are at least 5 ropes left on the drum, and the rope fixing points are good;</p> <p>(4) The gearbox is good, and the bearings are not severely worn</p>	
		Test	<p>(1) Newly installed or overhauled cranes should be subjected to load test, according to the following methods:</p> <p>1) Suspend at 100% rated working load for 10 minutes in the middle of the span, check the condition of the entire lifting equipment and the components should be normal, and measure the deflection of the main beam should not exceed the specified value;</p> <p>2) Suspend at 125% of the rated working load for 10 minutes in the middle of the span. After unloading, check that there is no permanent deformation of each part of the structure;</p> <p>3) With 110% rated working load, reciprocating in the full stroke of each working mechanism</p> <p>Run 3 times and check that each working organization should work normally.</p> <p>(2) For general periodic tests, carry out a static test for 10 minutes at 1.1 times the allowable working load</p>	<p>Commonly carried out in 1 year</p> <p>1 time; rarely used, every</p> <p>Once every 3 years</p>

Note 1: New lifting equipment and tools are allowed to be retested within 12 months from the date of issuance of the equipment certificate.

Note 2: All machinery and equipment should be tested after major repairs, without being restricted by the specified test period.

Note 3: All test results should be recorded.

NN

Appendix N

Substation Level One Hot Work Ticket Format

Substation Level One Hot Work Ticket

Unit (workshop) _____ Numb _____

1. Person in charge of _____ team _____

2. Executor _____

3. Hot spot and equipment _____

4. Hot work content (drawing instructions can be attached if necessary)

5. Hot way _____

The hot mode can be filled with welding, cutting, polishing, electric drill, using blowtorch, etc.

6. Apply for hot time
 from _____ year month day TimePoints to _____ year Mo day Tim Minute
 7. Safety measures to be taken by _____ nth e
 (equipment manager)

8. Safety measures to be taken by (hot work party)

_____ Date of issue _____ m da Ti Mi

Signature of Issuer Work Ticket _____ t

(The hot fire operator) Signature of the person in charge of the fire management department

(The hot worker) Signature of the _____ person in charge of the
 safety supervision department _____

Signature of the leader or technical person in charge of production (chief engineer)

9. Confirm that all the above safety measures have been implemented

Signature of person in charge of hot work O&M Licensee

Signature _____ Permission time year month day Time
 Minute

10. The fire-fighting facilities to be equipped and the fire-fighting measures and safety measures taken have met the requirements. The flammable, explosive gas content or dust concentration is qualified.

(The hot work party) Signature of the fire guardian

(The hot working party) Signature of the person in charge of the safety supervision department _____

(The hot working party) Fire fighting management Signature of department head _____

Signature of the head of the fire department _____

Signature of person in charge of hot work _____ Hot executor's signature _____

Production leader or technical person Chief engineer signature _____

Permitted hot time year month day TimeMinute

11. End of hot work

Hot work on year month day Time After the division, the materials and tools have been cleaned up, and there is indeed no residual fire on the site. All relevant personnel involved in the on-site hot work have been evacuated, and the hot work has ended. Hot executor's signature (The hot work party) Signature of the fire guardian signature of the person in charge of hot work O&M Licensee Signature _____

12. Remarks

- (1) Corresponding maintenance work ticket, work task list and emergency repair order number
- (2) something else

Appendix O

Substation secondary hot work ticket format

Stamp "Passed/Failed"	Stamp "Ended/Voided"
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Substation secondary hot work ticket

Unit (workshop) _____ Numbering _____

1. Person in charge of hot work team _____

2. Executor _____

3. _____

Hot spot and equipment name

4. Hot work content (drawing instructions can be attached if necessary)

5. Hot way _____

The hot mode can be filled with welding, cutting, polishing, electric drill, using blowtorch, etc.

6. Apply for hot time

from _____ year month day TimePoints to _____ year mon day Tim Minute

7. Safety measures to be taken by _____ th e

(equipment manager)

8. Safety measures to be taken by (hot work party)

Signature of Issuer of Hot _____ Issue time _____ ye m da Ti Mi

Fireman signature _____ Signature of safety _____

S

Signature of the leader or technical person in charge of production (chief engineer)

9. Confirm that all the above safety measures have been implemented

Signature of person in charge of hot work _____ O&M

licensor's signature license time _____ year month day

Time Minute

10. The fire-fighting facilities to be equipped and the fire-fighting measures and safety measures taken have met the requirements. Flammable, explosive gas content or powder

The dust concentration is qualified.

(The hot work _____ party) Signature of the fire guardian

(The hot work _____ Hot executor's _____ party) Signature of safety supervisor

Signature of person in charge of hot work

Permitted hot time _____ year month day TimeMinute

11. End of hot work

Hot work on_____ year month day Time After the division, the materials and tools have been cleaned up, and there is indeed no residual fire on the site. All relevant personnel involved in the on-site hot work have been evacuated, and the hot work has ended.

Hot executor's signature (The hot work party) Signature of the fire guardian
signature of the person in charge of hot work O&M Licensee

Signature_____

12. Remarks

(1) Corresponding maintenance work ticket number (if none, fill in "none") _____

(2) something
else _____

Appendix P

(Informative appendix)

Delineation of fire management level

First-level dynamic range

Inside the walls of oil areas and oil depots; oil pipelines and equipment connected to the oil system, and fuel tanks (other parts are listed as secondary fire areas); dangerous goods warehouses, automobile gas stations, liquefied gas stations; transformers and other oil injection equipment , Battery room (lead-acid); other parts that need to be included in the first-level fire management.

Second-level dynamic range

Oil pipeline supports and other pipelines on the supports; sparks may splash and fall near flammable and explosive objects in hot spots; cable channels

(Shaft), tunnel, cable mezzanine; dispatch room, control room, communication room, electronic equipment room, computer room, archive room; other parts that need to be included in the secondary

fire management.

Appendix Q

(Informative appendix)

Emergency treatment

Q.1 General

Q.1.1 The basic principle of emergency rescue is to take active measures at the scene to protect the lives of the wounded, alleviate injuries, reduce pain, and promptly contact the medical emergency center (medical department) for treatment according to the needs of the injury. The key to successful first aid is quick action and correct operation. Any delays and operating errors will result in aggravation or death of the wounded.

Q.1.2 It is necessary to carefully observe the general condition of the wounded to prevent the injury from getting worse. When the injured are found to be unconscious, pupils dilated and unresponsive, breathing and heartbeat stop, they should be rescued on the spot immediately, using cardiopulmonary resuscitation to support breathing and circulation, and oxygen supply to important organs in the brain and heart. After the heart stops beating, it is only possible to save life quickly if every second counts.

Q.1.3 On-site staff should receive regular training, learn emergency first aid methods, be able to correctly release the power source, know cardiopulmonary resuscitation, can stop bleeding, can bandage, can fix, can transfer the wounded, can handle emergency trauma or poisoning, etc.

Q.1.4 The production site and places where people are often working should be equipped with first aid kits to store first aid supplies, and designated personnel should be frequently checked, supplemented or replaced.

Q.2 First aid for electric shock

Q.2.1 First aid for electric shock should be counted against every second. Once it is clear that the heartbeat and breathing have stopped, CPR should be used for rescue immediately on the spot, and continue to be carried out. At the same time, contact the medical emergency center (medical department) as soon as possible to seek medical personnel to take over the treatment. Before medical staff take over the treatment, they should not give up on-site rescue, let alone judge the casualty's death based on the absence of breathing or pulse, and give up rescue. Only a doctor has the right to make a diagnosis of the death of the wounded. When taking over with medical staff, they should be reminded that medical staff should not be interrupted during the transfer of electrocution to the hospital.

Q.2.2 Quickly leave the power supply.

Q.2.2.1 First aid for electric shock, first of all, the person who is shocked must be quickly removed from the power source, the sooner the better. Because the longer the current is applied, the more severe the damage.

Q.2.2.2 Disconnecting from the power supply means disconnecting all circuit breakers (switches), disconnectors (switches) or other circuit-breaking devices of the part of the live equipment contacted by the electric shocker; or trying to disconnect the electric shocker from the live equipment. In the process of disconnecting from the power source, rescue personnel should also pay attention to protecting their own safety. If an electric shock person is in a high place, corresponding measures should be taken to prevent the injured person from falling from a high place after leaving the power source to form a compound injury.

Q.2.2.3 Low-voltage electric shock can use the following methods to remove the electric shocker from the power source:

a) If there is a power switch or power socket near the electric shock site, you can immediately open the switch or pull out the plug to disconnect the power. However, it should be noted that a switch that only controls one wire, such as a pull-wire switch or a wall switch, may only cut off the neutral wire but not the phase wire of the power supply due to installation problems.

b) If there is no power switch or power socket (head) near the location of electric shock, use electrician's pliers with insulated handle or an ax with dry wooden handle to cut off the wire and disconnect the power.

- c) When the wire lays down on or under the body of an electric shocker, dry clothes, gloves, ropes, belts, wooden boards, wooden sticks and other insulators can be used as tools to pull the electric shocker or pick up the wire to cause the electric shocker Disconnect power.
- d) If the person's clothes are dry and not tangled up tightly, they can grab his clothes with one hand and pull them away from the power source. However, because the body of an electric shocker is live, the insulation of his shoes may also be damaged. The rescuer shall not touch the skin of the electric shocker or grasp his shoes.
- e) If an electric shock occurs on a low-voltage live overhead line or a power distribution stand, or an entry line, if the power supply can be cut off immediately, the power supply should be cut off immediately, and the rescuer should quickly climb the pole or climb to a reliable place and do Take safety measures to prevent electric shock and fall. Use wire cutters with insulating rubber handles, insulating objects or dry non-conductive objects to remove the electric shock from the power source.

Q.2.2.4 High voltage electric shock can use one of the following methods to remove the electric shocker from the power source:

- a) Immediately notify the relevant power supply unit or user of the power failure.
- b) Put on insulating gloves and insulating boots, and use insulating tools of corresponding voltage level to open the power switch or fuse in order.
- c) Throwing bare metal wires to short-circuit the line to ground, forcing the protection device to act and disconnect the power supply. Note that before throwing the metal wire, one end of the metal wire should be fixed and reliably grounded, and then the other end should be tied with a heavy object to throw it. Be careful not to touch the electric shocker or other people at the throwing end. In addition, after throwing the wire, the thrower should quickly leave the grounded wire 8m away or stand with legs together to prevent the stepping voltage from hurting people. When throwing a short-circuit wire, care should be taken to prevent the arc from hurting people or the wire breakage endangering the safety of people.

Q.2.2.5 Matters that rescuers should pay attention to after being disconnected from the power supply:

- a) The rescuer should not directly use his hands, other metal and damp objects as rescue tools, but should use appropriate insulating tools. It is best for the rescuer to use one hand to prevent himself from getting an electric shock.
- b) Prevent the electric shock person from possible fall injuries after leaving the power supply, especially when the electric shock person is in a high place, measures to prevent falling should be considered. Even if the shocked person is on a flat ground, pay attention to the direction in which the shocked person fell, and pay attention to prevent falling. Rescuers should also pay attention to their own fall and fall prevention measures during rescue.
- c) In the rescue process, especially when rescuing the wounded on a pole or at a high place, the rescuer should pay attention to the safe distance between himself and the rescued person and nearby live objects to prevent touching the live equipment again. Even if the power supply of electrical equipment and lines is disconnected, equipment that has not been connected to the grounding wire with safety measures shall be regarded as live equipment. Paramedics should carry necessary insulating tools and strong ropes when climbing.
- d) If the accident occurs at night, temporary lighting should be installed to facilitate rescue and avoid accidents, but the time for cutting off the power supply and first aid should not be delayed.

Q.2.2.6 First aid on the spot.

After the electric shocker is disconnected from the power source, the on-site ambulance personnel should quickly judge the shocked person's injury and rescue the patient symptomatically. At the same time try to contact the doctor of the medical emergency center (medical department) to take over the treatment at the scene. Different first aid methods should be adopted according to the different situations of the electric shock victims.

- a) The person who was shocked was conscious and conscious, with a beating heart, but was short of breath, pale, or had been in electrical shock but did not lose consciousness. Cardiopulmonary resuscitation cannot be used for rescue at this time. The person who has been shocked should be lifted to a place with fresh air and well-ventilated to lie down, rest quietly for 1 to 2 hours, and let him slowly return to normal. Pay attention to heat preservation

when it is cold, and observe the changes in breathing and pulse at any time. Conditions permit, send to the hospital for further examination.

b) The person who is electrocuted is unconscious, unconscious, has a heartbeat, but the breathing stops or is extremely weak, immediately raises the head and chin to open the airway and perform mouth-to-mouth artificial respiration. At this time, remember not to apply heart compressions to those who are electrocuted. If artificial respiration is not used for rescue in time, the electrocution will cause the heart to stop due to prolonged hypoxia.

c) If the person who is electrocuted loses consciousness, is judged to be unconscious, and the heartbeat stops, but has very weak breathing, he should immediately undergo cardiopulmonary resuscitation. It can't be considered that there is still weak breathing, just chest compressions, because this kind of weak breathing can no longer play the role of oxygen exchange that the human body needs. If artificial respiration is not timely, death will occur. If mouth-to-mouth artificial respiration and Chest compressions can be successful.

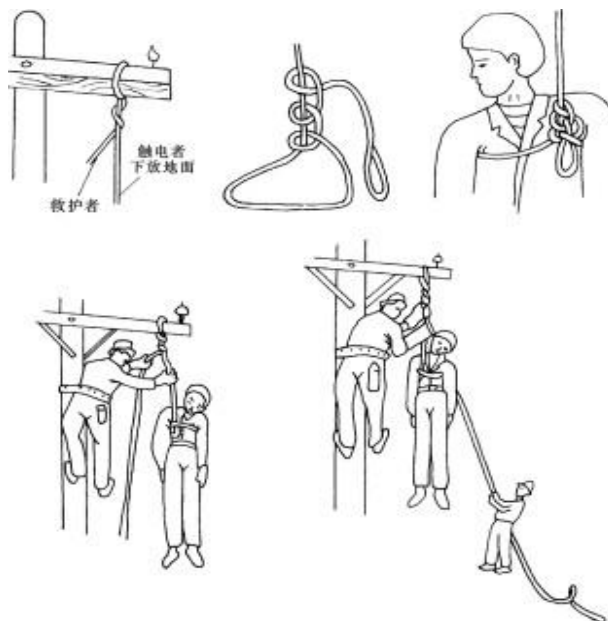
d) When the heartbeat or breathing of the electric shocker stops, CPR should be performed immediately without delay or interruption.

e) When the heartbeat and breathing of the electrocution person and the lightning-struck person have stopped, and other traumas are accompanied, the first aid of cardiopulmonary resuscitation should be performed quickly, and then the trauma should be treated.

f) It is found that someone is electrocuted on the tower or at a high place, and it is necessary to buy time to start rescue on the tower or at a high place as soon as possible. After the shocked person is disconnected from the power source, the injured person should be quickly supported on the safety belt of the rescuer (or lie flat in a suitable place), and then proceed according to the injured person's consciousness, breathing and carotid artery pulsation. (1) ~

(5)) First aid in different ways. It should be reminded that it is very important to rescue an electric shocked person from a high place and quickly determine whether consciousness and breathing exist. If breathing has stopped, immediately after opening the airway, blow mouth-to-mouth (nose) twice, and then test the carotid artery. If there is a pulsation, continue to blow once every 5s; if the carotid artery is not pulsating, you can hit the heart with a hollow

fist The anterior zone 2 times, prompting the heart to rebound. In order to make the rescue more effective, we should immediately try to rescue the wounded to the ground, and continue to persist in the rescue according to the cardiopulmonary resuscitation method. The specific operation method is



shown in Figure Q1.

Figure Q1 How to put down the electric shocked person on the tower or high place

1) Single rescue method. First install a rope on the pole, and fix one end of the rope on the pole. When fixing, the rope should be looped 2-3 times, and the other end of the rope should be placed under the armpit of the wounded person. The method of tying should first be padded under the armpit with a soft object.

And then use the rope to make a circle and tie 3 knots. The end of the rope should be inserted into the circle beside the arm of the wounded and pressed tightly. The length of the rope should be 1.2~ 1.5 times, finally loosen the casualty's foot buckle and seat belt, then untie the rope fixed on the pole, and slowly put the casualty down.

2) Two-person rescue method. This method is basically the same as the single-person rescue method, except that the other end of the rope is held by the personnel under the pole and slowly lowered. At this time, the rope should be longer and should be 2.2 to 2.5 times the pole height. The rescue personnel should coordinate and prevent the pole. The upper staff suddenly let go, and the lower staff was unprepared and an accident occurred.

g) When the clothes of the electric shocked person is ignited by the arc light, the fire source on their body should be extinguished quickly. The person who catches fire should not run. The method can use clothes, quilts, wet towels, etc. to put out the fire. If necessary, you can lie down and roll over. The fire is extinguished.

Q.2.3 What to do after the wounded is disconnected from the power source.

Q.2.3.1 Judgment of consciousness, call for help and position placement:

Q.2.3.1.11 The method of judging whether the wounded is unconscious:

- a) Lightly pat the injured person's shoulder and shout, "Hey! What's the matter with you?", as shown in Figure Q2.
- b) If you know, you can call their name directly. Consciously, immediately sent to the hospital.
- c) When the eyes are fixed, the pupils are dilated, and there is no response, immediately pinch the Renzhong and Hegu points with your fingernails for about 5 seconds.

Note: The above 3 steps should be completed within 10s, and should not be too long. If the injured have eye movement, limb movement and pain, they should stop pinching acupuncture points, and slap the shoulders without using too much force to prevent possible aggravation. Fractures and other injuries.

Q.2.3.1. 2 Call for help:

Once it is initially determined that the injured person has lost consciousness, he should immediately call people around to assist in the rescue, even if there is no one around, he should

Shouted "Come on! Help!", as shown in Figure Q3.

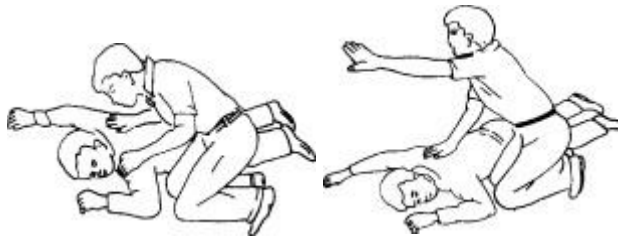


Figure Q2 Determine whether the wounded is conscious or not

Figure Q3 Call for help

Note: Be sure to call other people to help, because it is impossible for a person to perform CPR for a long time, and the movements are easy to change after fatigue. In addition to assisting in cardiopulmonary resuscitation, the person called should immediately call the ambulance station or call someone trained in ambulance to come and help.

Q.2.3.1. 3 Place the body position.

The correct rescue position is supine. The patient's head, neck, and torso were lying flat without distortion, and his hands were placed beside the torso on both sides.

If the injured person falls with his face down, he should be carefully turned while calling for help to make all parts of the injured person into a whole body. Particular attention should be

paid to protecting the neck. You can support the neck with one hand and the shoulder with the other. With the spine as the axis, the head, neck, and torso of the wounded can be steadily and straightly turned to supine. On a solid surface, the limbs are flat. , As shown in Figure Q4.



Figure Q4 Place the wounded

Note: The rescuer kneels on the side of the wounded shoulders and neck, raises his arms over his head, straightens his legs, and protects his neck. Untie the casualty's jacket and expose the chest (or just leave the underwear). Take care to keep it warm in cold weather.

Q.2.3.2 Open airway, judge breathing and artificial respiration.

Q.2.3.2.11 When it is found that the person's breathing is weak or stopped, the airway of the person who is shocked should be immediately cleared to promote the person's breathing or facilitate rescue.

Unobstructed airway mainly adopts the method of raising the head and chin. That is, place one hand on the forehead to raise the head, and place the index and middle fingers of the other hand on the mandible near the corner of the chin, and lift the chin, as shown in Figure Q5 and Figure Q6.

Note: It is strictly forbidden to use pillows and other objects under the casualty's head; do not press your fingers on the front of the casualty's neck and submental soft tissues to prevent compression of the airway.

Don't overstretch your neck when you lift it up. Those with dentures should take it out. Children's necks are easy to bend, and excessive neck-lifting can block the airway, so do not lift the neck too much. The head recline for adults should be 90°, the head recline for children should be 60°, and the head recline for infants should be 30°. The injured person with cervical spine injury should use double mandibular lift.



Figure Q5 Head lifted chin method



Figure Q6 Lifting the chin method

Check the wounded mouth and nasal cavity, and remove any foreign objects with fingers immediately.

Q.2.3.2.22 Determine breathing.

If an electric shock victim loses consciousness, he should look, listen, and try to determine whether the victim is breathing within 10 seconds after opening the airway, see Figure Q7.

- a) Look: Look at the chest and abdomen walls of the wounded for breathing fluctuations.
- b) Listen: put your ears close to the wounded person's nose and mouth, and listen for the sound of exhalation.



Figure Q7 Seeing, listening, and testing the wounded breathing

- c) Test: Use facial sensation to test whether there is exhalation airflow in the nose and mouth.

If there are no such signs, it can be confirmed that there is no breathing. Once it is determined that there is no breathing, perform two artificial respirations immediately.

Q.2.3.2.33 Mouth-to-mouth (nose) breathing.

When it is judged that the wounded does not breathe, the mouth-to-mouth (nose) artificial respiration should be performed immediately. The specific methods are:

- a) Carry out in a position where breathing is maintained. Using the thumb and index finger of the hand pressed on the forehead, pinch the lower end of the wounded nostril (or wing of nose) to prevent air from escaping from the mouth through the nostril. Slightly opened mouth.
- b) Blow (he) breath into the wounded mouth each time for 1~1.5s, and carefully observe whether there are any undulations in the casualty's chest.
- c) After one blow, you should separate from the casualty's mouth, lift your head slightly, face the casualty's chest, and inhale fresh air for the next artificial respiration. At the same time, open the mouth of the wounded and relax the hands that pinch the nose so that the wounded can ventilate from the nostrils. When the wounded chest is observed to recover, airflow will be discharged from the wounded mouth, as shown in Figure Q9.



Figure Q8 Mouth-to-mouth inhalation



Figure Q9 Mouth-to-mouth exhalation

At the beginning of the rescue, two blows should be made to the wounded. If the chest is raised during the blow, artificial respiration is effective; if the blow does not fluctuate, the airway is not clear enough, or the nostril leaks, or the airway is insufficient, or the airway Obstruction should be corrected in time.

Note: ① Do not blow too much each time, about 600mL (6 ~ 7mL/kg), more than 1200mL will cause gastric dilation; ② Do not press the chest when blowing, as shown in Figure Q10; ③ Children wounded need different ages The blow volume is about 500 mL, and the best time is when the chest can be raised; ④ The first blow twice at the beginning of the rescue, each time is 1 ~ 1.5s; ⑤ For the wounded with pulse but not breathing, one blow every 5s Breath, blow 12 times per minute; ⑥ Mouth-to-nose artificial respiration is suitable for the

wounded with severe mandibular and lip trauma, closed teeth, mandibular fractures, etc. It is difficult to use mouth-to-mouth blowing method; ⑦ Infants, Pay attention to the first aid operation of young children. Because of the loose ligaments and muscles of infants and young children, the head should not be tilted too far to avoid airway pressure and airway patency. You can support the neck with one hand to keep the airway straight; The mouth and nose openings of infants are small, and the positions are very close. The rescuer can use mouth to stick to the mouth and nose openings of infants and infants to perform mouth-to-mouth and nose breathing.

Q.2.3.3 Determine whether the wounded has pulse and chest compressions.

Q.2.3.3.11 Judgment of pulse.

After checking the consciousness, breathing, and airway of the casualty, the casualty's pulse should be checked to determine the casualty's heartbeat. (Non-professional ambulance personnel may not perform pulse checking, and immediately perform cardiopulmonary resuscitation for the casual, unresponsive, and unconscious casualty.). The specific method is as follows:

- a) Perform in an open airway position (after the first artificial respiration).
- b) Place one hand on the forehead of the casualty, keep the head tilted back, and touch the carotid artery with the other hand on the side close to the rescuer.
- c) Touch the middle of the trachea with the tip of your index finger and middle finger. For men, touch the laryngeal knot first, and then slide 2 to 3 cm to both sides, and gently touch the carotid artery pulsation at the soft tissues next to the trachea, as shown in Figure Q11.



Figure Q10 Do not press the chest when blowing



Figure Q11 Touch the carotid pulse

Note: ① Do not touch the carotid artery with too much force, so as not to push the carotid artery and hinder access; ② Do not touch the carotid arteries on both sides at the same time, causing the blood supply to the head to be interrupted; ③ Do not compress the trachea, causing airway obstruction; ④ The inspection time should not exceed 10s; ⑤ Untouched pulsation: the heartbeat has stopped, or the touch position is wrong; touched pulsation: there is pulse, heartbeat, or touch feeling wrong (may feel the pulsation of your fingers as the pulse of the wounded); ⑥ The judgment should be comprehensively reviewed: if unconscious, no Breathing, dilated pupils, cyanotic or pale complexion, and not being able to touch the pulse, it can be judged that the heartbeat has stopped; ⑦ Infants and young children due to neck obesity, the carotid artery is difficult to reach, the brachial artery can be checked. The brachial artery is located at the midpoint between the inner armpit and the elbow joint. Use your index and middle fingers to gently press the inner side to feel the pulse.

Q.2.3.3.22 Chest compressions.

Before pressing the patient with a stopped heartbeat, first hold a hollow fist and hit the injured person's chest area at the middle and lower part of the sternum quickly and vertically for 1 to 2 times, each time for 1 to 2 seconds, with moderate strength. If it is invalid, the chest will be pressed immediately. Can't waste time.

a) Press the part. The junction of the middle 1/3 and the lower 1/3 of the sternum, as shown in Figure Q12.

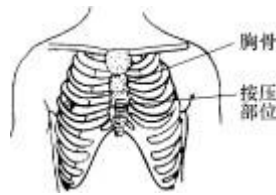


Figure Q12 Chest compression position

b) Position of the wounded. The wounded should lie on their back on a rigid bed or on the ground. If it is a box spring, a hard board should be placed on the injured person's back. The length and width of the rigid board should be large enough to ensure that the injured body will not move when the sternum is pressed. But do not delay the time to start pressing because of finding the pad.

c) A method to quickly determine the pressing position. The rapid determination of the pressing position can be divided into 5 steps, as shown in Figure Q13.

1) First touch the upper abdomen of the wounded, and slide the index finger and middle finger to the middle along the rib arch of the wounded, as shown in Figure Q13(a).

2) Look for the substernal notch at the intersection of the rib arches on both sides. Use the notch as a positioning mark. Do not position under the xiphoid process, as shown in the figure

As shown in Q13(b).

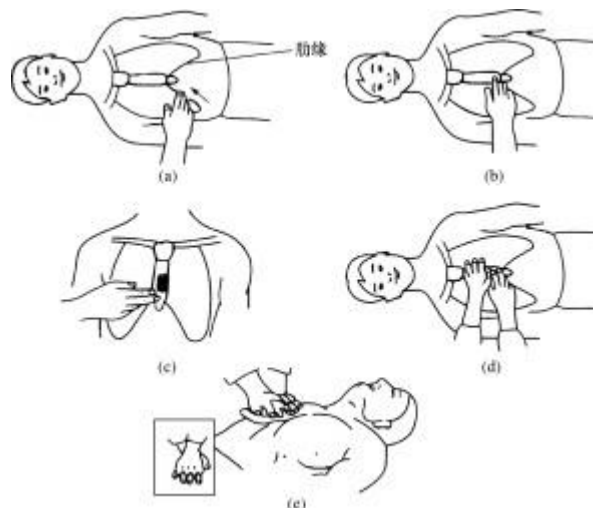


Figure Q13 Quickly determine the pressing position

(a) Two fingers move and slide along the costal arch; (b) Notch positioning mark; (c) Compression zone; (d) Palm base is placed in compression zone; (e) Overlap palm base

3) Then place the two transverse fingers of the index finger and the middle finger above the substernal notch. The middle of the sternum above the index finger is the compression area, as shown in Figure Q13(c).

4) Place the base of the palm of the other hand against the index finger and place it on the pressing area, as shown in Figure Q13(d).

5) Remove the positioning hand, overlap the base of the palm on the back of the other hand, and lift the fingers of both hands crosswise to separate the fingers from the chest wall, as shown in Figure Q13(e).

d) Pressing posture. The correct pressing posture is shown in Figure Q14. The rescuer's arms were stretched straight, his shoulders were centered above the wounded sternum, and he pressed down vertically with his own weight.

e) The pressing force method is shown in Figure R15.

- 1) Compression should be performed smoothly, rhythmically, and without interruption.
- 2) Don't press hard.
- 3) The time for pressing down and relaxing up should be equal, as shown in Figure Q15.

Press down to the lowest point, there should be a noticeable pause.



Figure Q14 Press the correct posture

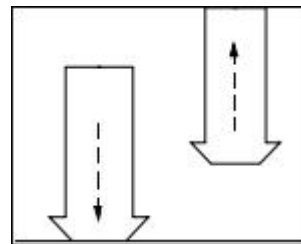


Figure Q15 Press force method

- 4) Vertically force downwards, do not swing from side to side.
- 5) Do not leave the base of the palm positioned at the position of the sternum when relaxing, but try to relax as much as possible so that the sternum does not suffer any pressure.
- f) Frequency of compressions. The compression frequency should be maintained at 100 times/min.
- g) The ratio of compression to artificial respiration. The ratio between compression and artificial respiration is usually 30:2 for adults and 15:2 for infants and children.
- h) Depth of compression. Generally, the adult wounded is 4 to 5 cm, the 5 to 13-year-old wounded is 3 cm, and the infant wounded is 2 cm.
- i) Common errors in chest compression.



Figure Q16 Double resuscitation method

- 1) In addition to pressing the base of the palm against the breastbone, the fingers are also pressed against the chest wall, which easily causes fractures (ribs or costal cartilage).
- 2) The positioning of the press is not correct, and the xiphoid process may be crushed by pressing downwards and the liver may rupture. It is easy to cause rib or costal cartilage fractures to both

sides, leading to pneumothorax and hemothorax.

- 3) The compression force is not vertical, resulting in invalid compression or fracture of the costal cartilage, especially swing compression is more prone to serious complications, as shown in Figure Q17(a).
- 4) The rescuer's elbows bend when pressing, so the force is not enough, and the pressing depth cannot reach 3.8~5cm, as shown in Figure Q17(b).
- 5) Press impact type, strong pressure, its effect is poor, and easily lead to fractures.
- 6) Raise your hand away from the sternum positioning point when you relax, causing the next compression position to be wrong and causing fractures.
- 7) The chest is not fully relaxed when relaxing, and the chest is still under pressure, making it difficult for blood to return to the heart.
- 8) The compression speed is accelerated or slowed down involuntarily, affecting the compression effect.
- 9) The palms of the hands are not overlapped, but crossed. As shown in Figure Q17(c), the common mistakes of chest compressions.

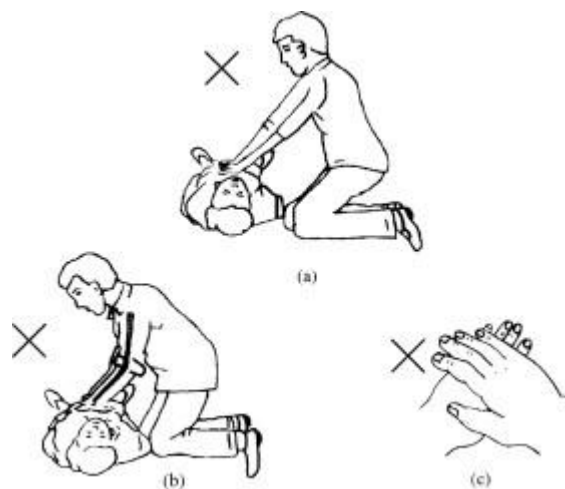


Figure Q17 Common errors of chest compression

(A) The pressing force is not vertical; (b) The pressing depth is not enough; (c) The palms of both hands are crossed

Q.2.4 Overview of cardiopulmonary resuscitation.

Q.2.4.1 The operation process has the following steps:

- a) First judge whether the fainted person is unconscious.
- b) If there is no response, call for help immediately, saying "Come on! Help!" etc.
- c) Quickly place the wounded in a supine position and place it on the ground or a hard board.
- d) Open the airway (① raise the head and lift the chin or jaw; ② remove foreign bodies in the mouth and nasal cavity).
- e) Determine whether the casualty is breathing (by seeing, hearing and feeling).
- f) If you are not breathing, blow two mouth to mouth immediately.
- g) Keeping the head tilted back, check the carotid artery for pulsation with the other hand.
- h) If there is a pulse, it indicates that the heart has not stopped beating. You can only do artificial respiration at 12 to 16 times per minute.
- i) If there is no pulse, immediately perform precordial percussion on the chest compression position under the correct positioning for 1 to 2 times.

- j) After tapping, judge whether there is a pulse again. If there is a pulse, it means that the heartbeat has recovered. You can only do artificial respiration.
- k) If there is no pulse, immediately perform chest compressions in the correct position.
- l) For every 30 compressions, you need to do 2 artificial respirations, and then reposition the chest, then do chest compressions, and repeat the procedure.

OK until the rescuer or professional medical staff arrive. The compression frequency is 100 times/min.

- m) Check the pulse, respiration, and pupil 2 minutes after the beginning, and every 4 to 5 minutes thereafter. The check should not exceed 5 seconds. It is best to be checked by the rescuer.
- n) If there is a stretcher to carry the wounded, cardiopulmonary resuscitation should be continued and the interruption time should not exceed 5 seconds.

Q.2.4.2 Time requirements for cardiopulmonary resuscitation operations: 0 ~

5s: Judgment consciousness.

5 ~ 10s: Call for help and position the wounded.

10-15s: Open the airway and observe whether breathing exists.

15-20s: mouth-to-mouth breath 2 times. 20 ~ 30s:

Judging the pulse.

30-50s: Perform chest compressions 30 times, and artificial respiration 2 times, then

continue to repeat. The above procedures should be completed within the 50s as much as possible, and the longest should not exceed 1min.

Q.2.4.3 Two-person resuscitation operation requirements:

- a) The two should coordinate and cooperate, and the blowing should be completed within the relaxation time of chest compression.
- b) The compression frequency is 100 times/min.
- c) The ratio of compression to breathing is 30:2, that is, after 30 heart compressions, perform 2 artificial respirations.
- d) In order to achieve a tacit understanding of cooperation, the person who presses can count the phrases "1, 2, 3, 4, ..., 29, blow". When the blower hears "29", be prepared. After hearing "blow", That is, blowing into the mouth of the wounded, the presser then repeated the mantra "1, 2, 3, 4,..., 29, blowing", and so on.
- e) In addition to unblocking the airway and blowing air, the artificial respirator should also touch the carotid artery and observe the pupil frequently, as shown in Figure Q18 Shown.

Q.2.4.4 Precautions for cardiopulmonary resuscitation:

- a) Blowing cannot be done while pressing down on the heart. The speed of counting formulas should be balanced to avoid variability.
- b) The operator should stand on the side of the person who is shocked, and stand on the shoulder of the person who is shocked for first aid. In case of first aid for two persons, the person who blows should stand on the head of the person who is shocked and those who press the heart should stand On the chest of the person who is shocked, on the side opposite to the person who blows.
- c) The artificial respirator and the heart presser can exchange positions and exchange operations, but the interruption time does not exceed 5 seconds.

d) After the second rescuer arrives at the scene, he should check the carotid artery pulsation first, and then start artificial respiration. If the heart compression is effective, the pulsation should be touched. If it is not, it should be observed whether the technical operation of the heart compression person is correct, and the compression depth should be increased and repositioned if necessary.

e) The operation can be rotated by the third rescuer and more rescuers to keep energetic and correct posture.

Q.2.5 Effective indicators, metastasis and termination of cardiopulmonary resuscitation.

Q.2.5.1 Effective indicators of cardiopulmonary resuscitation.

Whether the cardiopulmonary resuscitation operation is correct or not depends mainly on usual strict training and mastering the correct method. To judge whether resuscitation is effective in first aid, you can consider the following five aspects:

a) Pupils. When the resuscitation is effective, it can be seen that the pupils of the injured have changed from large to small. If the pupil changes from small to large, fixed, and the cornea is cloudy, the resuscitation is invalid.

b) Complexion (lips). Resuscitation is effective. It can be seen that the wounded complexion has changed from cyanotic to ruddy. If it turns pale, the resuscitation is invalid.

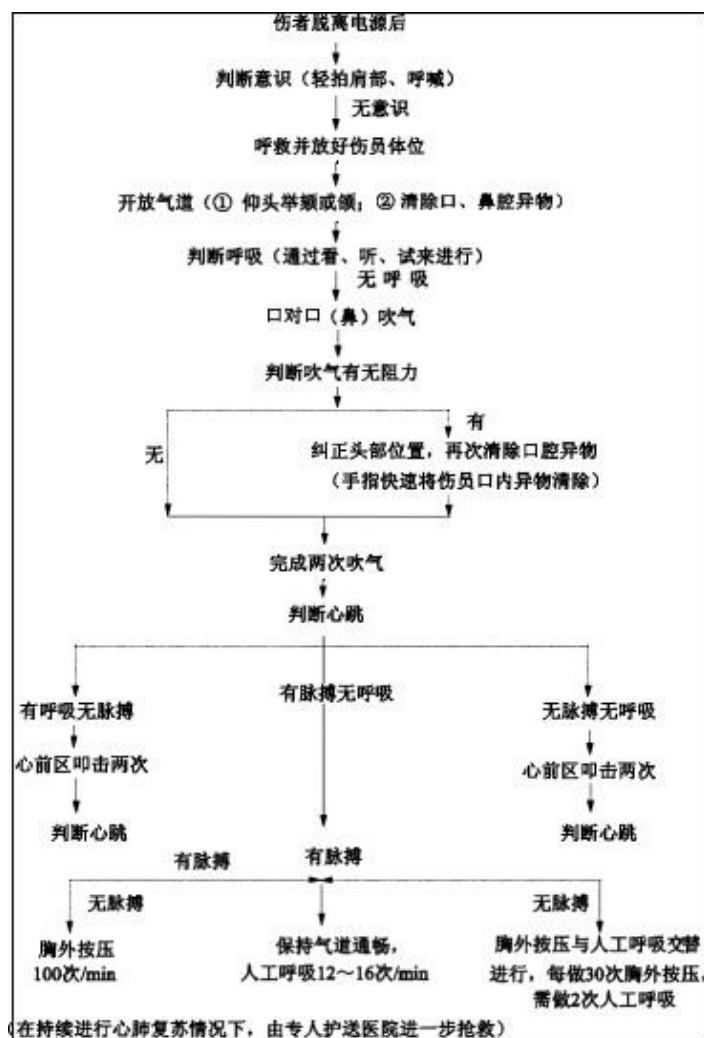


Figure Q18 The rescue procedure of on-site cardiopulmonary resuscitation

- c) Carotid artery pulsation. When the pressing is effective, you can feel a pulsation every time you press, if you stop pressing, the pulsation will disappear. Cardiac compressions should be continued; if the pulse is still beating after the compressions
- d) Consciousness. Resuscitation is effective. It can be seen that the injured have eye movements, eyelashes and light reflections appear, and even hands and feet begin to twitch, and muscle tension increases.
- e) Spontaneous breathing occurs. The spontaneous breathing of the wounded does not mean that artificial respiration can be stopped. If spontaneous breathing is weak, you should still insist on mouth-to-mouth breathing.

Q.2.5.2 Transfer and termination.

Q.2.5.2.11 Transfer. During on-site rescue, you should strive for rescue time. Do not move the wounded for convenience or comfort, thereby delaying the on-site rescue time.

On-site cardiopulmonary resuscitation should be carried out continuously, rescuers should not be changed frequently, and should be continued even on the way to the hospital. nose Catheter oxygen should never replace cardiopulmonary resuscitation. If it is necessary to move the wounded from the scene to the room, the interruption of the operation shall not exceed 7s; the interruption of operations such as narrow passages, up and down floors, and delivery to an ambulance shall not exceed 30s.

When sending the wounded whose heartbeat and breathing have recovered to the hospital by an ambulance, a hard board of appropriate length and width should be placed on the wounded back to prepare for cardiopulmonary resuscitation at any time. Cardiopulmonary resuscitation should be continued before the injured are sent to the hospital and the professionals have not yet taken over.

Q.2.5.2.22 Termination. When to terminate cardiopulmonary resuscitation is a medical, social, and moral issue. In any case, the termination of cardiopulmonary resuscitation is determined by the doctor or the chief physician of the rescue team composed of doctors. Otherwise, the rescue must not be given up. The heartbeat and breathing of the wounded from high-voltage or ultra-high voltage electric shock should not be given up at will.

Q.2.5.3 Cardiac monitoring of the injured by electric shock.

Those who have been injured by electric shock and successfully rescued by cardiopulmonary resuscitation should be fully rested, and they should undergo cardiac monitoring for no less than 48 hours under the guidance of medical personnel. Because of the hyperkalemia caused by the direct influence of voltage, current, frequency and tissue damage, as well as the myocardial damage and arrhythmia caused by hypoxia and other factors in the process of being shocked by the wounded, after CPR, the heartbeat After recovery, some wounded may also have "secondary cardiac arrest", so cardiac monitoring should be performed to treat the wounded with arrhythmia and hyperkalemia in time.

For the various operations described in detail above, the rescue steps that should be carried out by on-site cardiopulmonary resuscitation can be summarized as shown in Figure R18.

Q.2.6 Precautions during the rescue process

Q.2.6.1 Re-judgment during the rescue process:

- a) After pressing and blowing for 2 minutes (equivalent to 5 30:2 pressure and blowing cycles in a single rescue), apply the method of watching, listening, and

testing in 5 ~ 10s Complete the re-judgment of whether the wounded breathing and heartbeat have recovered within time.

b) If it is determined that the carotid artery has pulsated but is not breathing, pause the chest compressions and perform 2 more mouth-to-mouth artificial respirations, followed by blowing once every 5 seconds (ie 12 times per minute). If the pulse and breathing have not recovered, continue to adhere to the cardiopulmonary resuscitation method.

c) During the rescue process, the judgment shall be repeated every few minutes, and the judgment time shall not exceed 5-10s each time. Before the medical staff take over the rescue, the rescue personnel on the scene shall not give up the rescue on the spot.

Q.2.6.2 On-site electric shock rescue should be cautious about the use of epinephrine and other drugs. If there is no necessary diagnostic equipment condition and sufficient assurance, it shall not be used indiscriminately. When rescuing an electric shocked person in the hospital, the medical staff shall make a diagnosis by medical equipment and decide whether to adopt it according to the diagnosis result.

Q.3 Trauma first aid

Q.3.1 Basic requirements for trauma first aid.

Q.3.1.1 In principle, first aid for trauma is to rescue, fix, and transport, and take measures to prevent aggravation of injury or pollution. Those who need to be sent to the hospital for treatment should immediately take measures to protect the wounded and send them to the hospital for treatment. The conditions for successful first aid are: fast action and correct operation. Any delay or misoperation can aggravate the injury and cause death.

Q.3.1.2 Before rescue, let the wounded lie down quietly, judge the general condition and the degree of injury, such as whether there is bleeding, fracture, shock, etc.

Q.3.1.3 Take immediate hemostasis measures for external bleeding to prevent excessive blood loss and shock. Appearance is not injured, but in a state of shock, unconscious or unconscious, the possibility of injury to the chest, abdomen, internal organs or brain should be considered.

Q.3.1.4 To prevent wound infection, it should be covered with a clean cloth. Ambulance personnel are not allowed to directly touch the wound with their hands, let alone stuffing anything into the wound or administering medicine casually.

Q.3.1.5 When carrying, the wounded should lie flat on the stretcher, with the waist tied on the stretcher to prevent falling. The head of the wounded was behind when transporting on level ground, and the head was on when going upstairs, downstairs, or downhill. The wounded should be closely observed during transport to prevent sudden changes in the injury. The method of transporting the wounded is shown in Figure Q19.

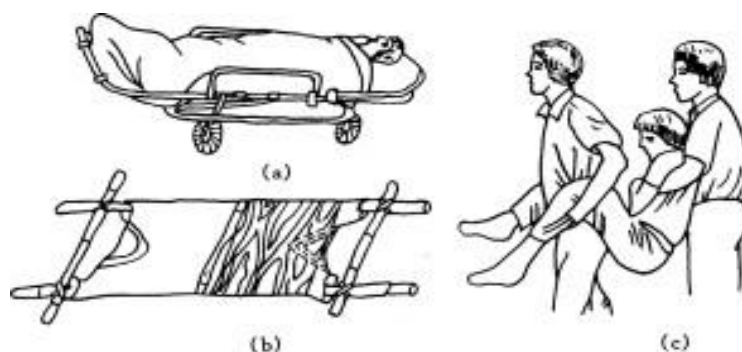


Figure Q19 Transporting the wounded

(A) Normal stretcher; (b) Temporary stretcher and plank; (c) Mishandling

Q.3.1.6 If the injured person is suspected of spinal injury (falling from a height), the spine should not be twisted or bent when placing the body and carrying it. The injured person should be laid on a hard flat plate and try to use sandbags (Or other substitutes) Place the head and both sides of the torso to properly fix them, so as not to cause paraplegia.

Q.3.2 Hemostasis.

Q.3.2.1 Wound oozing: Cover the wound with several layers of sterile gauze that is slightly larger than the wound, and then bandage it. If there is still more bleeding after bandaging, a bandage can be applied to stop the bleeding.

Q.3.2.2 When the bleeding from the wound is jet-like or bright red blood is gushing out, immediately press the upper part of the bleeding point (near the heart) with clean fingers to interrupt the blood flow, and raise or raise the bleeding limb to reduce the amount of bleeding .

Q.3.2.3 When using a tourniquet or a cloth tape with better elasticity to stop bleeding (see Figure Q20), you should first use a soft cloth or the wounded person's sleeve to put several layers under the tourniquet, and then tie the tourniquet tightly. The pulsation of the acral arteries just disappeared. The upper limbs are relaxed every 60 minutes and the lower limbs are relaxed every 80 minutes, and each time is relaxed for 1 to 2 minutes. The beginning of the tightening and each time of relaxation should be marked in writing next to the tourniquet. The tightening time should not exceed 4h. Do not use a tourniquet on the middle 1/3 of the upper arm and under the socket to avoid nerve damage. If you observe that there is no major bleeding when you relax, you can stop using it.

Q.3.2.4 It is strictly forbidden to use wires, iron wires, string, etc. as tourniquets.

Q.3.2.5 Falling from a high place, bumping, squeezing may cause rupture and bleeding of the chest and abdomen. The injured person has no bleeding but often appears pale, weak pulse, shortness of breath, cold sweat, cold limbs, irritability, and even confusion. They should lie down quickly and raise their lower limbs (see Figure Q21), and maintain Warm, rushed to the hospital for treatment. If the hospitalization takes a long time, a small amount of sugar and salt water can be given to the wounded.



Figure Q20 Tourniquet

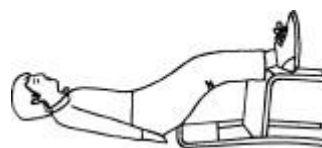


Figure Q21 Elevating lower limbs

Q.3.3 First aid for fractures.

Q.3.3.1 For limb fractures, the upper and lower joints of the broken bone can be fixed with splints, wooden sticks, bamboo poles, etc., as shown in Figure Q22. The wounded body can also be used for fixation to avoid movement of the fracture site to reduce pain and prevent deterioration of the injury. .

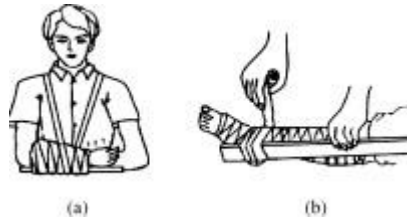


Figure Q22 Fracture fixation method

(A) Upper limb fracture fixation; (b) Lower limb fracture fixation

For open fractures and severe bleeding, stop the bleeding first, then fix it, cover the wound with a clean cloth, and then rush to the hospital for treatment. Never push the exposed broken bone back into the wound.

Q.3.3.2 If there is a suspected cervical spine injury, after placing the injured person on his back, place both sides of the head with sand bags (or other substitutes) (see Figure Q23) to immobilize the neck. When mouth-to-mouth breathing should be performed, only chin-lifting can be used to make the airway unobstructed, and the head cannot be moved back or turned to avoid paraplegia or death.

Q.3.3.3 For lumbar spine fractures, the casualty should lie supine on a flat hardboard, and the lumbar torso and both lower limbs should be fixed together to prevent paralysis (See Figure Q24). When moving, several people should cooperate, keep stable and not twisted.



Figure Q23 Cervical spine fracture fixation



Figure Q24 Lumbar spine fracture fixation

Q.3.4 Craniocerebral trauma.

Q.3.4.1 The wounded should be placed in a supine position to keep the airway unobstructed. If vomiting occurs, the head and body should be supported so that the head and body should be turned sideways to prevent suffocation caused by vomit.

Q.3.4.2 When there is liquid from the ears and nose, do not block it with cotton, but only gently wipe it off to reduce intracranial pressure. Do not blow your nose forcefully, drain the nasal fluid, or suck the fluid into the nose again.

Q.3.4.3 In case of traumatic brain injury, the condition may be complicated and changeable, so it is forbidden to give food and drink, and to be sent to hospital for treatment.

Q.3.5 First aid for burns.

Q.3.5.1 Electric burns, flame burns, or high temperature gas or water burns should be kept clean. The wounded clothes and socks were cut with scissors and removed. All wounds are covered with clean cloth to prevent contamination. When limbs are burned, first rinse with clean cold water, then cover with clean cloth or sterile gauze and send to the hospital.

Q.3.5.2 For strong acid or alkali burns, you should quickly remove the stained clothing, and immediately rinse with plenty of clean water on site, and then use appropriate drugs to neutralize; the rinse time is not less than 10 minutes; for strong acid burns 5 % Sodium bicarbonate (baking soda) solution for neutralization; for strong alkali burns, use 0.5% to 5% acetic acid solution or 5% ammonium chloride or 10% structure rafter acid solution.

Q.3.5.3 Without the consent of the medical staff, it is not suitable to apply anything or medicine to the burned area.

Q.3.5.4 On the way to the hospital, a small amount of oral sugar and salt water can be given to the wounded several times.

Q.3.6 First aid for frostbite.

Q.3.6.1 Frostbite makes the muscles stiff, and in severe cases it reaches deep to the bones. During the ambulance and transportation, the movement should be gentle. Do not force the limbs to bend to avoid aggravating the injury. Use a stretcher to lie down and lift the injured into a warm room. Cure.

Q.3.6.2 Cut off the wet clothes on the wounded and cover them with dry and soft clothes. Do not heat or rub snow.

Q.3.6.3 The breathing and heartbeat of people suffering from frostbite are sometimes very weak, so they should not be mistaken for death and should be rescued.

Q.3.7 First aid for animal bites.

Q.3.7.1 After being bitten by a poisonous snake, do not panic, run, or drink, so as not to accelerate the spread of snake venom in the human body.

Q.3.7.1.11 Bites are mostly on the extremities. You should quickly squeeze the venom from the upper end of the wound to the bottom, and then tie it tightly with a cloth tape above the wound (near the heart end) to fix the injured limb and avoid movement to reduce the venom. absorb.

Q.3.7.1.22 If you have snake medicine, you can take it first before sending to the hospital for treatment.

Q.3.7.2 Dog bites:

Q.3.7.2.11 After a dog bite, immediately wash the wound with thick soapy water or clean water for at least 15 minutes, and squeeze the saliva out of the residual wound from top to bottom, and then apply iodine to the wound.

Q.3.7.2.22 When there is a small amount of bleeding, do not rush to stop the bleeding, and do not bandage or suture the wound.

Q.3.7.2.33 Try to find out whether the dog is a "mad dog", which will greatly help the hospital to formulate a treatment plan.

Q.3.8 First aid for drowning.

Q.3.8.1 If someone is found drowning, try to rescue him from the water quickly. Those who have stopped breathing and heartbeat should use cardiopulmonary resuscitation. Those who have been trained in water rescue can be rescued in the water.

Q.3.8.2 When mouth-to-mouth artificial respiration is difficult due to foreign body obstruction and cannot be removed with your fingers, you can put your hands on top of the umbilical line slightly above the midline (away from the xiphoid process) and quickly press upwards several times to make the foreign body withdraw, but does not use too much force.

Q.3.8.3 The main cause of drowning death is suffocation and hypoxia. Since fresh water can be quickly absorbed through the circulation in the human body, and the trachea can hold very little water, it is not necessary to "pour water" to delay the rescue time when rescuing a drowning person, nor just "pour water" without CPR Method for rescue.

Q.3.9 First aid for heat stroke.

Q.3.9.1 Scorching sun directly on the head, high ambient temperature, too little water or excessive sweating can cause heat stroke. The symptoms are generally nausea, vomiting, chest tightness, dizziness, drowsiness, collapse, and convulsions in severe cases. Even coma.

Q.3.9.2 The patient should be immediately transferred from the high temperature or sun environment to a cool and ventilated place to rest. Wipe the body with cold water, cover the body with a wet towel, blow with a fan, or put an ice pack on the head to cool down, and give the patient oral salt water in time. Severe cases are sent to hospital for treatment.

Q.3.10 First aid for hazardous gas poisoning.

Q.3.10.1 At the beginning of gas poisoning, there are symptoms such as tearing, eye pain, coughing, and dry pharynx, which should be vigilant. When heavier, he will have headache, shortness of breath, chest tightness, and dizziness. In severe cases, it can cause convulsions and coma.

Q.3.10.2 When it is suspected that there may be harmful gases, people should be evacuated from the scene and transferred to a well-ventilated place to rest. Rescue personnel should wear gas masks when entering the danger zone.

Q.3.10.3 Patients who have been unconscious should keep their airways unobstructed and give oxygen inhalation when possible. Those who have stopped breathing and heartbeat should be rescued by cardiopulmonary resuscitation and contact the hospital for treatment.

Q.3.10.4 Quickly find out the names of harmful gases for early symptomatic treatment in hospitals.

Electric power safety work rules

Editing instructions

Table of contents

The "Electric Power Safety Work Regulations and Substation Part" is formulated to strengthen the management of electric power production sites, regulate the behavior of various workers, and ensure the safety of personal, power grid and equipment. The preparation work description is as follows:

1. Compilation background

The "State Grid Corporation Electric Power Safety Work Regulations (Electrical Parts of Substations and Power Plants)" (the 2005 version of "Safety Regulations"), which was revised and published in 2005, has been implemented well after nearly four years of practice. However, with the rapid development of power grid production technology, especially the construction and operation of cross-regional $\pm 500\text{kV}$ DC projects, 750kV AC transmission projects, $\pm 800\text{kV}$ UHVDC projects, and 1000kV UHV AC test demonstration projects, the 2005 edition of the "Safety Regulations" The content can no longer meet the actual needs of electrical safety work. To this end, the State Grid Corporation of China organized comprehensive revisions on the basis of the 2005 version of the "Safety Regulations" to form the 2009 version of the "Safety Regulations". In order to advance The State Grid Corporation of China has further promoted the standardization of the regulations of the State Grid Corporation of China. After minor amendments to the 2009 version of the "Safety Regulations", it was revised in May 2012 to form the corporate standard version of the "Transformation Part of the Electric Power Safety Work Regulations" for review. In June 2012, it passed the review of the State Grid Corporation's expert review meeting, and in August 2012, the enterprise standard version of the "Power Safety Work Regulations and Substation Part" (draft for approval) was reported. In order to adapt to the new situation of the company's "three sets and five major" system construction and unattended substations, some provisions were revised and supplemented in June 2013, and the enterprise standard version of the "electrical safety work regulations" (submission for approval) was completed. .

2. The main principles and ideas of compiling

2.1 Standardize various electric power operation procedures and personnel's code of conduct in the company's system, effectively reducing the occurrence of personal injury and death accidents in power production and grid and equipment accidents.

2.2 Put forward management regulations and technical measures and requirements for preventing personal injuries and equipment accidents.

3. Relationship with other standards

This part complies with the requirements of the "Electrical Part of Power Plants and Substations" (GB 26860-2011) of the "Electrical Safety Work Regulations", and provides detailed safety work regulations based on the actual work of the State Grid Corporation.

4. The main work process

On March 6, 2008, the Safety Supervision Department of State Grid Corporation of China issued the "Letter on Entrusting Supplementary Amendment to the Safety Regulations" (a letter from the safety supervision

[2008] No. 12). It is clear that the East China Company is fully responsible for the revision work, the Northwest Company supplemented the drafting of the 750kV AC part, the State Grid Operation Company supplemented the drafting of the HVDC part, and the State Grid Wuhan Higher Institute supplemented the drafting of the 1000kV AC part.

On April 15, 2008, the State Grid Corporation of China issued the "Letter on the Establishment of the Organization for Revision of the "State Grid Corporation's Electric

Power Safety Work Regulations” (An Jian Yi Han [2008] No. 21), and established a leading group and work group.

From May 13th to 17th, 2008, the "Transformation" research team (Shanghai, Jiangsu United) went to Shandong Electric Power Company, Beijing Electric Power Company and Liaoning Electric Power Company to conduct investigations.

On June 13, 2008, the “Safety Regulations” Substation Part Discussion was held in Shanghai Electric Power Company.

From July 3 to 4, 2008, a conference on substation and line drafting was held in Xuancheng, Anhui.

On July 18, 2008, a joint meeting of the leading group and working group was held in Shanghai.

Members of the revision leading group and working group attended the meeting. At the meeting, East China Power Grid Corporation, Northwest Power Grid Corporation, State Grid Operation Company and State Grid Corporation Wuhan High Voltage The experimental institute separately reported the preliminary work of each professional team, as well as the revision of the original regulations, the revision of the relevant parts of the HVDC, 750kV and UHV 1000kV. The meeting decided: to do a good job in the collection and analysis of test data, strengthen the connection with the Electric Power Research Institute, and do a good job in theoretical analysis; do a good job in the follow-up work on the revision of relevant regulations, this revision of power distribution is not independent, but it should be independent The preliminary work of the book revision, UHV, interpretation and other follow-up work should be studied; on the general part (lifting, transportation, high altitude operation, general safety measures, etc.), in principle, the relevant content in the power part of the "Safety Regulations" will be streamlined come.

At the end of July 2008, the first draft of the substation part of "Safety Regulation" was completed

On August 12-16, 2008, a meeting of all staff was held in Xining, Qinghai. The meeting discussed the first draft revisions of the two regulations recently completed by the working group, revised and improved the 2005 version of the regulations, and added $\pm 500\text{kV}$ DC transmission The content of part, 750kV AC part and 1000kV AC part were discussed and confirmed.

On October 30, 2008, the second meeting of the revision working group of the State Grid Corporation's Electric Power Safety Work Regulations was held in Wuhan, Hubei. Since the first meeting of the revision working group (the Qinghai meeting), all relevant units and work The amendments proposed by the group members and the issues that need to be discussed at the meeting were discussed.

On November 28, 2008, the State Grid Corporation's Construction and Transportation Department and the Safety Supervision Department organized a special discussion on the safety distance of the 1000kV UHV AC test demonstration project.

At the end of 2008, the "Safety Regulations" (Transformation Part) (Draft for Solicitation of Comments) solicited opinions on the national network.

On February 17, 2009, a discussion meeting on the revision of the "State Grid Corporation's Electric Power Safety Work Regulations (Transformation Part)" draft was held in Shanghai. On March 26, 2009, State Grid Corporation organized an expert review meeting of "State Grid Corporation's Electric Power Safety Work Regulations (Transformation Part) (Line Part)".

On April 15, 2009, all members of the writing team held a post-review revision opinion discussion meeting in Shanghai, and carefully discussed and adopted the opinions and suggestions put forward at the expert review meeting.

On May 8, 2009, the "State Grid Corporation Electric Power Safety Work Regulations (Transformation Part)" (draft for approval) was submitted to the State Grid Corporation of China.

On July 6, 2009, the "State Grid Corporation Electric Power Safety Work Regulations (Transformation Part)" was issued.

On August 1, 2009, the "State Grid Corporation Electric Power Safety Work Regulations (Transformation Part)" was implemented.

From January 2012 to May 2012, the "Electric Power Safety Work Regulations and Substation Part" were compiled and compiled in accordance with the State Grid Corporation's corporate standards. Based on the implementation of the "Safety Regulations" (part of power transformation) in August 2009, some content revisions and improvements have been made.

In May 2012, completed the corporate standard version of the "Power Safety Work Regulations and Substation Part" submitted for review.

In June 2012, the corporate standard version of the "Electric Power Safety Work Regulations and Substation Part" (draft submitted for review) passed expert review.

In August 2012, the corporate standard version of the "Power Security Work Regulations and Substation Part" (draft for approval) was reported.

In June 2013, some of the provisions were revised and supplemented, and the enterprise standard version of the "Electrical Safety Work Regulations and Power Transformation Part" (draft for approval) was completed.

5. Standard structure and content

This part is compiled according to the requirements of DL/T 800-2001 "Electric Power Enterprise Standard Compilation Rules". The main structure and content of this part are as follows:

5.1 Table of contents;

5.2 Foreword;

5.3 The standard text consists of 18 chapters: scope, normative references, terms and definitions, general principles, basic requirements for high-voltage equipment work, organizational measures to ensure safety, technical measures to ensure safety, and safety measures for substations and power plants during line operation, Live work, overhaul and maintenance of generators, synchronizing cameras and high-voltage motors, work on sulfur hexafluoride (SF₆) electrical equipment, work on low-voltage power distribution devices and low-voltage wires during power outages, secondary systems On-board work, electrical tests, power cable work, general safety measures, lifting and transportation, and high-altitude operations;

5.4 The standard has 4 normative appendices: nameplate style, insulation safety equipment test items, cycle and requirements, climbing equipment test standard table, common lifting equipment inspection and test cycle and requirements;

5.5 The standard has 13 informative appendices: substation (power plant) switching operation ticket format, substation (power plant) first work ticket format, power cable first work ticket format, and substation (power plant) second work Ticket format, power cable second work ticket format, substation (power plant) live work ticket format, substation (power plant) accident emergency repair form, secondary work safety measure ticket format, substation level one hot work ticket format, Substation level two hot work ticket format, electrical test standard table of overhead insulated bucket car for live work, delineation of hot fire management level, emergency rescue method.

6. Provisions

Clause 6.1 uses "shall" clauses to indicate compulsory execution, and "should" or "may" clauses are recommended.

6.2 This part is formed by slightly modifying the 2009 version of the "Safety Regulations". In actual implementation, this part shall prevail. Among them, the hot work ticket system of power plants shall implement the State Grid Corporation's electric safety work regulations

[thermal (water) power plant (power part)] hot work ticket system. Each unit can formulate supplementary clauses and implementation rules of this part according to the site conditions, and implement them after approval by the leader (chief engineer) in charge of production.

6.3 Explanation of the definition of high and low pressure in 3.1-3.2. Originally, the definition of high and low voltage at the national legal level was only the "Interpretation of the Supreme People's Court on Several Issues Concerning the Trial of Cases of Compensation for Personal Injury by Electrocutation" [Adopted at the 1137th meeting of the Judicial Committee of the Supreme People's Court on November 13, 2000 Law Interpretation [2001] No. 3]. Its first article clarifies that the "high voltage" stipulated in the General Principles of Civil Law 123 includes high voltage electricity of 1 kilovolt (kV) and above; voltage below 1 kilovolt (kV) is non-high voltage electricity. "Therefore, the 2009 version of the "Safety Regulations" adopted this definition.

Currently, GB 26860-2011 "Electrical Safety Work Regulations" (electrical part of power plants and substations) defines high and low voltage as follows:

Low voltage, LV

Voltage levels of 1000V and below in AC systems used for power distribution. [GB/T 2900.50—2008, 601-01-26 in definition 2.1]

High voltage, HV

① Usually refers to a voltage level exceeding low voltage.

② Under certain circumstances, it refers to the voltage level of power transmission in the power system.

[GB/T 2900.50—2008, 601-01-27 in definition 2.1]

6.4 The scope of application of this Part in accordance with "9 Live Work" "9.1.1 This Part is applicable to AC 10~

1000kV, DC $\pm 500 \sim \pm 800$ kV (750kV is at an altitude of 2000m and below) high-voltage overhead power lines, substation (power plant) electrical equipment, using equipotential, intermediate potential, and ground potential methods for live work." The content of 9.13 Low-voltage Live Work" is moved to 12.4, and the title of this section is revised to "Low-voltage non-stop work".

6.5 In order to guarantee the requirements of the on-site safety production and inspection work of the ± 400 kV Chaila DC transmission system, on the basis of experimental research, the State Grid Corporation of China organized and formulated the " ± 400 kV Chaila DC Transmission System Production and Operation Safety Distance Regulations (Trial)." Power Transmission [2012] No. 16). Based on this, this section supplements the safety distance of the ± 400 kV DC transmission system, the safety distance of live working, and the minimum combined gap. This safety distance is only applicable to the ± 400 kV Chaila DC transmission system.

6.6 This part supplements the safety distance of ± 660 kV DC transmission system and the safety of live operation based on the acceptance opinions of the project " ± 660 kV double-circuit DC line live operation and test research" (contract number: SGKJ SKF [2008] No. 657) Data such as distance and minimum combined gap.

6.7 According to DL/T 966—2005 "Technical Guidelines for Live Working on Transmission Lines", the safety distance between the human body and the 330kV live body during live work in Table 4 is changed from 2.2m to 2.6m, and the 500kV equipotential in Table 8 The minimum combined gap during operation was changed from 4.0m to 3.9m.

6.8 Table 4 According to DL/T 1060-2007 "Technical Guidelines for Live Working on 750kV AC Transmission Lines", it is clear that the corresponding data for 750kV is the straight-line tower side phase or mid-phase value in the safety distance between the person and the live

body during live working. According to DL/T 392-2010 "Technical Guidelines for Live Working on 1000KV AC Transmission Lines", the 1000kV value in the table does not include the human body space, which should not be less than 0.5m during operation.

6.9 According to DL/T 1060-2007 "Technical Guidelines for Live Working on 750kV AC Transmission Lines", DL/T 392-2010 "Technical Guidelines for Live Working on 1000KV AC Transmission Lines", and "Safety Distance for Production and Operation of ± 400 kV CziradC Transmission System" Regulations (Trial)" (Sheng Transmission [2012] No. 16), "Technical Guidelines for Live Working on ± 660 kV DC Transmission Lines (Draft for Solicitation of Comments)", Q/GDW 302—2009

In the "Technical Guidelines for Live Working on ± 800 kV DC Transmission Lines", the data in Table 5, Table 6, Table 7, Table 8, and Table 9 have been supplemented and modified accordingly, and relevant instructions have been supplemented.

6.10 This part is based on DL/T 976-2005 "Preventive Test Regulations for Live Working Tools, Devices and Equipment", DL/T 878-2004 "Test Guidelines for Insulating Tools for Live Working" and related AC (direct) current transmission lines In the operating technical guidelines, 9.13.3.7 "Mechanical Test Standards for Live Working Tools" is revised to "Mechanical Preventive Test Standards for Live Working Tools". The content is as follows: Static load test: It is qualified if the tool has no deformation or damage under 1.2 times the rated working load for 1 min. Dynamic load test: Operate 3 times under 1.0 times of the rated working load, and the tool is qualified if it is flexible, portable, and without jamming.

6.11 In accordance with GB/T 3608-2008 "Classification of Work at Heights", the "high winds of level 6 and above" in Article 18.1.16 is changed to "high winds of level 5 and above". "High winds of level 6 and above" is the relevant content of the 2009 version of "Safety Regulations" quoted from GB/T 3608-1993 "Classification of Work at Height".

6.12 According to GB 2894-2008 "Guidelines for Safety Signs and Their Use", the words of the prohibited signs in Appendix I are changed from "black words" to "white words on a red background". Prohibited signs with the words "black" can continue to be used, but when purchasing new signs, consider replacing them in batches according to the new standard.

6.13 In order to adapt to the new situation of the company's "three sets and five major" system construction and unattended substations, this section refers to the "State Grid Corporation of China on the issuance of the "State Grid Corporation of Electric Power Safety Work Regulations (Transformation Part), (Line Part)" revision and supplement The "Notice of Regulations" (State Grid Safety [2013] No. 945) has revised and supplemented some provisions of the 2009 version of the "Safety Regulations".

6.14 In this section, "cable dual name" is revised to "cable name".