



Electric shock

A phenomenon in which electrical energy is applied to the human body and causes shock.



[Contact between both ends of live parts]



[Contact between live parts and ground]



[Contact with short-circuit parts]



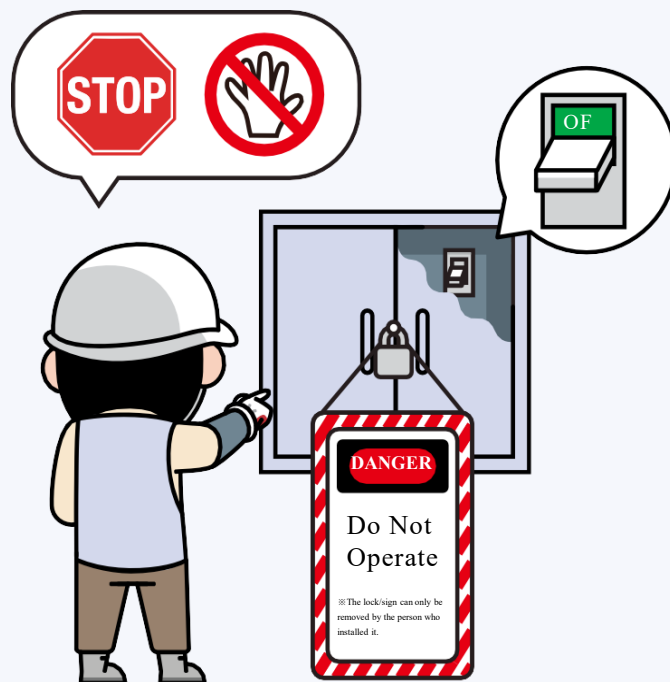
Major electric shock by work

Work	Situations
Electrical work by qualified personnel * Article 318 of the Rules on Occupational Safety and Health Standards	• Electrical shock due to power being supplied while connecting equipment and wires (wiring) • Electric shock due to a short circuit while working on live wires
Work using electromechanical equipment	• Electric shock due to contact with a damaged cable • Electric shock due to short circuit while using electrical machinery such as an electric drill • Electric shock due to contact with a welding rod holder during electric welding

Common Safety Rules to Prevent Electric Shock



- A qualified person must perform work (electrical work) such as installation, disassembly, maintenance, and inspection of electrical machines, devices, or electric circuits.
- When performing electrical work, the work order, such as turning off and on electricity, must follow the safety procedures written in the work plan, etc.
 - Before turning on electricity after work, ensure the safety of workers working on the relevant wires or equipment.
 - Turn off electricity during maintenance and inspection, and install locks and tags on switchboards, disconnectors, and disconnect devices to prevent other workers from arbitrarily turning on electricity during work.



- Do not touch or work on wires or equipment where you cannot tell whether electricity is turned on or off.
- Use electromechanical devices with normal insulation features.
- Do not insert or touch the plug of an electromechanical device into an outlet while your body or clothes are wet or moist.

Common Safety Rules to Prevent Electric Shock



- Do not leave wires in wet places, such as floors with stagnant water.
- Do not install or use electric wires or removable wires on passage floors.
 - Electric or removable wires can be an exception if appropriate measures are taken, such as protecting the insulating sheath with pipes or angles, etc.
- Use and work on electromechanical devices and electrical equipment that require grounding after properly grounding (connected to the green grounding wire).
 - Check whether the ground wire properly connects the electrical device to the ground or causes any interferences by being connected to other devices.
 - When using an outlet, check the condition of the outlet's grounding electrode, and when using a temporary outlet, check the connection between the outlet and the ground wire.



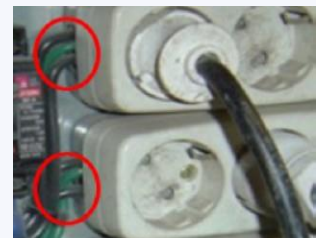
Grounding of a
device enclosure



Ground of a
switchboard door
(green wire)



Grounding electrodes
on an outlet



Grounding of
temporary outlets
(green wire)

Common Safety Rules to Prevent Electric Shock

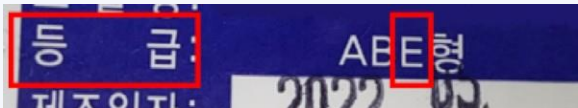
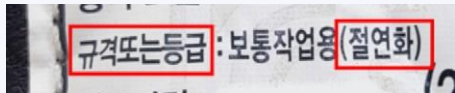


- Properly wear the insulating protective equipment the employer provides to prevent the risk of electric shock.

- Do not wear protective equipment that is damaged in appearance or has reduced electric shock prevention ability.

※ If the current protective equipment is damaged, acquire new protective equipment from the employer.

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Items	Description																								
Hard hat	• Wear a hard hat with voltage resistance. • Use grades with E.																								
Insulated shoes (safety shoes)	• ‘Insulated shoes’ must be shown in the specifications or grades.																								
Insulated gloves	• Use insulated gloves suitable for each work.	<table><tr><th colspan="2">Grade</th><th>00</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><th rowspan="2">Maximum operating voltage</th><th>AC (V, effective value)</th><td>500</td><td>1,000</td><td>7,500</td><td>17,000</td><td>26,500</td><td>36,000</td></tr><tr><th>DC (V)</th><td>750</td><td>1,500</td><td>11,250</td><td>25,500</td><td>39,750</td><td>54,000</td></tr></table>	Grade		00	0	1	2	3	4	Maximum operating voltage	AC (V, effective value)	500	1,000	7,500	17,000	26,500	36,000	DC (V)	750	1,500	11,250	25,500	39,750	54,000
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Electrical Work of a Qualified Person

Sequence of shutting off during electrical work on de-energized wires

※ Reference: Article 319 of the Rules on Occupational Safety and Health Standards (Electrical Work on De-energized Wires)

1. Check all power-related drawings and wiring diagrams supplied to electrical devices.
2. After turning off the power, open and check each disconnecter.
3. Attach locks and tags to shutoff devices and disconnectors.
4. Discharge the residual charge.
5. Use an electroscope to check whether the working equipment is energized.
6. If there is a possibility of voltage generation, ground using a short-circuit grounding device with sufficient capacity.

Precautions when turning on power after work

※ Reference: Article 319 of the Rules on Occupational Safety and Health Standards (Electrical Work on De-energized Wires)

1. Remove work tools, short-circuiting, grounding, and other electrical equipment, and check whether it can be safely energized.
2. Ensure all workers are away from electrical equipment where work has been completed.
3. The workers who installed the locks and tags must remove them when necessary.
4. After checking for abnormalities, turn on the power to electrical devices, etc.

Electrical Work of a Qualified Person

Handling energized wires and working nearby

※ Reference: Article 321 (Electrical Work Near Energized Wires), Article 322 (Work on Vehicles and Machinery Near Energized Wires)

- When powering off energized wires, follow the above Sequence of Shutting off during Electrical Work on De-energized Wires and Precautions when Turning on Power after Work.
- When protecting, shielding, and insulating energized wires, be careful not to allow them to come into direct or indirect contact with electric circuits.
- Workers handling energized wires shall be provided with insulating protective equipment appropriate for each work and wear them.
- When working with electricity near energized wires, install protective insulating gear appropriate for the voltage.

◆ Protective insulating gear: An insulating device mounted on the electric circuit to block contact between the operator and the circuit.

- For electrical work in high-voltage or special high-voltage converters, use the equipment and devices provided for live wire work.

Electrical Work of a Qualified Person

Handling energized wires and working nearby

※ Reference: Article 321 (Electrical Work Near Energized Wires), Article 322 (Work on Vehicles and Machinery Near Energized Wires)

- For installing or dismantling protective insulating gear, wear insulating protective equipment or use tools and devices provided for live wire work.
- When non-qualified workers work at elevated locations near energized wires, maintain a separation distance (no access) according to ground voltage to prevent the worker's body or long conductive objects from coming into contact with energized wires that are not protected by protective insulating gear, etc.

Ground voltage	50 kV or less	More than 50 kV
No access	300 cm or less	300 cm + additional 10 cm per 10kV

- When working on vehicles or machinery near energized wires, maintain a separation distance of at least 300 cm or according to ground voltage when the ground voltage exceeds 50 kV to prevent vehicles, etc., from coming into contact with live parts of energized wires.

Ground voltage	Standard	More than 50 kV
No access	At least 300 cm	300 cm + additional 10 cm per 10kV

- Avoid access to areas where fences or guards are posted to block access to uninsulated live parts or their vicinity.

Use of Electromechanical Devices

- **Use electromechanical devices with properly operating insulation features for your work.**
- **Before work, check whether the electromechanical device body is damaged, the cover is removed, the cable sheath or connection is damaged, etc., and do not use it if a short circuit is suspected.**
- **To prevent disconnection, connect the cable firmly to connections such as electromechanical devices, connectors, etc., or the distribution board.**
- **Use an AC arc welder with an automatic electric shock protector when used in the following locations.**
 1. **Places surrounded by conductive objects, such as inside the double hull of a ship, ballast tank, or boiler**
 2. **Places with a risk of falling or where workers may come into contact with highly conductive objects, such as steel structures**
 3. **Places where workers work with high conductivity while parts of their bodies may be wet due to water, sweat, etc.**

Use of Electromechanical Devices

- If the earth-fault circuit breaker operates automatically, do not reapply electricity until the safety of the electromechanical devices has been confirmed.
- Ground the enclosures of electromechanical devices, etc., and check the grounding condition.
 - Check the condition of the ground electrode for electrical appliances that are grounded through a plug without a separate connection to a grounding wire.
 - For temporary outlets, check the connection of the grounding wire connected to the outlet and whether the ground wire is connected correctly to the ground.
 - When electric welding, remove the coating film from the base metal and connect the base metal to the earth clamp.



Poor connection of the welding rod holder and damaged cable

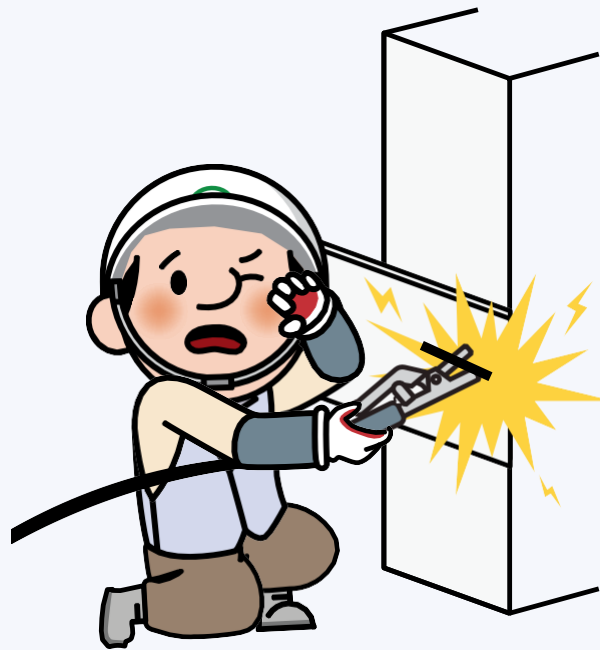


Remove the coating film of the base material before connecting the base material to the earth clamp.

Use of Electromechanical Devices

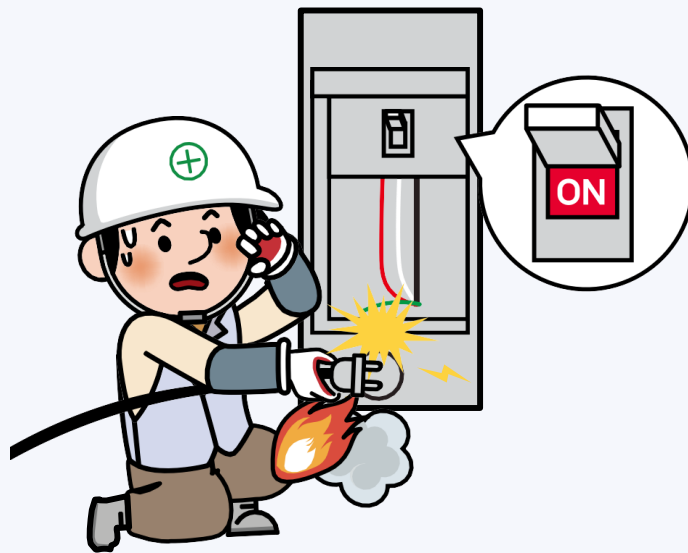
- For electric welding, wear protective equipment, such as welding safety gloves, to prevent the hands or body from touching the welding rod holder and the rod.
- Be careful not to allow the electromechanical devices you use to come into contact with exposed live parts.
- Disconnect the outlet from electricity before inserting or removing the cable plug of an electromechanical device from an outlet.
- Turn off the power when transporting electromechanical devices and suspending or ending work.
 - When suspending or ending work, disconnect the power and remove the welding rod from the electric welder holder.

- ① While working with an AC arc welder, a worker suffered an electric shock when part of his body came into contact with a welder holder whose insulation was broken.



Causes	• Electrical shock due to contact with the welder holder or welding rod
Preventive measures	• Replace the damaged welder holder with a new one. • Use appropriate safety gloves to prevent the worker's body from touching welding rods, etc.

- ② When connecting (wiring) the electric equipment power cable to the circuit breaker inside the 440 V panel (for welding machines), a worker suffered burns when his clothes caught fire due to sparks generated when the power cable plug of another electrical appliance (welding machine), interfering with work, was pulled out of the outlet.



Causes

- Since two outlets are connected to the power breaker, workers may be confused about which outlet has been powered off.
- The welder's power cable was unplugged from an energized outlet.

Preventive measures

- To prevent workers from misunderstanding whether an outlet's power is cut off, connect breakers and outlets one to one or clearly indicate which outlet is connected to each breaker.
- When plugging or unplugging, ensure the corresponding power outlet is turned off.