

Personal Protective Equipment (PPE): Electrical Protection

IMPORTANT: ONLY qualified people should work with or around uncontrolled electricity. Taking this course DOES NOT qualify anyone to work on or near the dangerous voltages of exposed energized electrical conductors. Only electrical workers who have received extensive specialized electrical safety training and specific electrical qualification from their employer may follow the electrical precautions discussed in this course.

Hazards

The more current a person is exposed to, the more serious the injuries. Some injuries can cause death.

- 1 - 3 Milliamperes: Perception threshold for most people
- 3 - 9 Milliamperes: Painful sensations
- 9 - 25 Milliamperes: Muscular contractions (can't let go)
- 25 - 60 Milliamperes: Lungs stop, can't breathe (may be fatal)
- 50+ Milliamperes: Irregular heartbeat (likely fatal)
- 4 Amps: Heart stops (CPR may restart)
- 5 Amps: Severe burns (fatal shock to vital organs)

Use electrical protection when working with **sources of electricity**, such as utility lines, electrical systems, circuits or equipment. Electrical protection is insulated (not conductive) and electrically rated to limit or halt the electrical current that reaches your body. We use electrical protection to **supplement** other precautions, or controls, such as de-energizing equipment, verifying de-energization, and locking and tagging electrical equipment during maintenance. Electrical protection is vital because it is the last barrier between you and electricity when other controls fail.

Protection that is specifically designed for electrical hazards must have **labels** and **markings** that indicate its protective qualities and limitations. Electrical protection should meet applicable **regulatory standards** specific to your location, such as NFPA 70E in the United States. Hazard assessments should specify what controls you must use for electrical tasks, including the types and ratings of electrical protection.

Electrical PPE is worn by workers to protect themselves from electrical hazards. It may include:

- Hard hats and helmets that conduct electricity away from the wearer
- Balaclavas or head socks that help protect the head during arc-flashes
- Hearing protection for loud arc-flash noise
- Safety glasses and goggles that do not conduct electricity
- Face shields to help protect the face from molten metals and arcing energy
- Clothing, suits and undergarments made of materials that will not ignite, melt or adhere to skin
- Gloves and sleeves to resist current to the hands and arms
- Shoes with non-metallic safety toe caps

Electrical PPE may be worn alone or with other PPE, depending on the hazard assessment.

Insulating protective equipment (IPE) includes barriers that the worker uses to prevent contact with energized conductors. It may include barriers to prevent contact with energized conductors, insulating blankets, insulated switchboard mats, and tools and tool covers that the worker uses but does not wear.

Use and Care

Electrical protection should **supplement** other controls. Your employer should have a written program that explains how to manage electrical protection effectively, including when and how to use, care for, inspect and maintain electrical PPE. You should receive training about the specific electrical PPE that is required for your job.

Defective or damaged electrical protection can fail and cause voltage breakthroughs that may injure the wearer. **Inspect**, test, clean and care for electrical protection per the manufacturer, relevant regulatory agencies and company guidelines. This includes inspecting the protection before and after each use. For example, in the United States, NFPA 70E requires that a qualified laboratory test electrical gloves every 6 months as well as when there are concerns about the insulating value, after repairs and after anyone uses the gloves without leather protectors.

Electrical protection must be free of **defects** such as holes, tears, punctures, cuts and embedded objects. It must also be free of signs of wear including cracks, discoloration and texture changes such as swelling, softening, hardening, stickiness or stretching. Electrical gloves, sleeves and blankets must be seamless. Make sure electrical protection is dry before using it.

Follow the manufacturer's instructions to perform **air or water testing** on electrical gloves to check for tiny, invisible holes that can compromise their ability to protect the wearer from electrical current.

1. Fill gloves with air or submerge them in clean water.
2. Look, listen and feel for leakage, which may produce a hissing sound in air or bubbles in water.
3. Repeat the test with the gloves inside out.

Gloves must be completely dry before you use them after water testing.

If you find any **defects or damage** during electrical PPE **inspection**, follow your company's procedures to report the issue, remove the electrical protection from service, and replace the electrical protection. It's best to destroy defective PPE that is specifically designed for electrical hazards so that no one else will use it for any task.

Remove jewelry and other metal such as belts, buttons and zippers that may be exposed before donning electrical PPE. Metal items may conduct electricity, cause burns if they are exposed to an arc-flash, and cut or tear protective material. Wear cotton or natural fiber garments because some synthetics can melt to the person in an arc-blast event even when worn under proper PPE. Any protective clothing should cover the intended area of protection.

Store electrical protection where it is protected from light, temperature extremes, excessive humidity, ozone, and chemicals or substances that could damage it. Do NOT fold electrical gloves. Store them in the separate, dedicated bag provided by the manufacturer.