

# SAFETY TRAINING GOUGE #8

## ELECTRICAL SAFETY

Published by the **Naval Safety and Environmental Training Center**  
[www.public.navy.mil/navsafecen/navsafenvtracen/](http://www.public.navy.mil/navsafecen/navsafenvtracen/)

### About This Series of Training Resources

If you're an afloat safety officer or division officer, you have a challenging, important role at your command. This series of pamphlets will help you meet your bi-monthly training requirements. Modify and use them at quarters or muster. You can also check the Naval Safety Center website at <http://www.public.navy.mil/navsafecen/Pages/safety-gouge/SafetyGouge.aspx> for the latest issues. We welcome feedback so we can continue to provide you with topics you need. Email LTJG Melissa Balint at [melissa.balint@navy.mil](mailto:melissa.balint@navy.mil). This issue was created by EMC (SW/AW) Elizabeth Chalmers ([elizabeth.chalmers@navy.mil](mailto:elizabeth.chalmers@navy.mil)).  
*This series is prepared by the Naval Safety and Environmental Training Center and the Naval Safety Center.*

### Why Worry About Electricity?

Electricity is an integral part of today's modern world, and sometimes it is easy to forget just how dangerous it can be. Given the correct circumstances, electricity can kill. It can also shock personnel, damage sensitive equipment, and ignite combustible materials.

This training module covers basic safety rules you should follow. This training is targeted for those who aren't qualified electricians, but whose may work near electrical systems.

During Indoc, all hands should receive training on basic electrical safety, the requirements for using personal protective equipment (PPE), and how to recognize symptoms of electrical shock, electrical shock trauma and emergency first-aid responder techniques. However, it's always good to have a brief refresher.



An electrician's mate, assigned to engineering department aboard an aircraft carrier, restores power from an electrical load center after a loss-of-power drill.

#### Inside this issue

Basics of electricity	2
Frequently asked questions	3
Do's and don'ts	4
Test your knowledge	5
Electrical hazards	6

#### Did You Know?

From 2009–2011, two Sailors and three Navy civilians died as the result of electrical shock. Nationwide, there are approximately 1,000 deaths each year and 30,000 work-related shocks each year.



## Basics of Electricity

- Electrical current will not flow unless it has a complete path (circuit) that returns to its source (battery, transformer).
- Current can flow through humans and other conductors, such as metals, earth and concrete.
- Current can harm a human when it flows through the body (electric shock).
- Insulators resist the flow of electricity. They are used to coat copper conducting wires and to make electrical work gloves. Insulators help to protect humans from contacting electricity that flows through conductors.

Electricity can damage your heart because it is in the path of the most common route that electricity will take through the body: hand-to-foot.

## How Can Electricity Harm You?

Electric shocks can produce three types of injuries.

1. Burns (arcs burn with heat and radiation)
2. Physical injuries (broken bones, falls, and muscle damage).
3. Nervous system effects (stop breathing, heart fibrillation or "twitching," no blood flow to the body).
4. The heart can be damaged because it is in the path of the most common route that electricity will take through the body: hand-to-foot.

## Electrical Terms

Ohm's Law: volts = amperes x ohms. Amperes are a measure of electric current intensity. Ohms are a measure of electric resistance. The power in standard American outlets runs at 60 hertz (a measure of frequency in cycles per second).

A normal outlet has 110 volts. A general button or something small on a panel might have .5 volts. A drill can have 18 volts. An overhead power line will have thousands.

The human body has a resistance between 300-1000 ohms; variables include whether you're male or female, wet or dry, tall or short.

An example of a minor electric shock would be 110 volts/500 ohms (which would equal .220 amp). With a shock like this, you can usually pull your hand

away. As long as the shock doesn't last very long, it won't do much damage or kill.

However, if you get high enough current running through your body, it can prevent you from letting go, so you are conducting the current longer which causes more damage.

Shock victims stop breathing at .300 to .750 amp (alternating current at 60Hz). Fibrillation occurs at .750 to 1 amp at 60Hz.

If you aren't creating a path from the voltage source to the ground, you will still get a shock and maybe a burn, depending on how high the voltage is.

## General Electrical Safety

<b>Always</b> obey all warning signs, tags, and read operating instructions before using equipment.
<b>Never</b> work on energized equipment without CO's approval.
<b>Never</b> remove Danger or Caution tags, or energize equipment with tags until instructions read and thoroughly understood.
<b>Never</b> join more than two 25-foot extension cords together.
<b>Never</b> connect equipment cord to extension cord before inserting plug into receptacle.
<b>Never</b> pick up a tool by its cord.
<b>Never</b> allow a cord to be a tripping hazard or use if it is frayed.

## Frequently Asked Questions

**Q: What can you do to ensure that your work center is following safe electrical work practices?**

**A:** Plan your work and plan for safety with the following tips. Avoid wet working conditions and other dangers. Use and maintain tools. Avoid wearing items such as jewelry, watch bands, bracelets, rings, key chains, necklaces, etc. that might come into contact with exposed, energized parts. Wear PPE when required (for example, electrical gloves, leather shells).

**Q. What are the procedures for the safe handling of extension cords?**

**A:** According to NSTM 300 Rev 8, Cords must be meet 12 AWG/3 conductor criteria and be of the required length. Cords must have 3 prongs. Surge protectors must meet CID# AA-50622 per NSTM 300 REV 8. Do not use 2-prong, ungrounded extension cords on a ship. Do not run cords through walls, doors, under rugs, or across aisles. Do not repair cords—turn the damaged cord back to electrical tool issue. Make sure the total number of amps connected to the cord does not exceed the rating of the cord. Amperage (current) causes heat and determines a cord's gage by ability to dissipate heat. A 12AWG cord is good for 24 AMPS, but most receptacle current aboard ship do not exceed 20 AMPS.

## RESOURCES

Training presentations: <http://safetycenter.navy.mil/>; Go to Afloat, Surface Warfare, Electrical Safety, E-Training; Electrical Benches, Electrical Fundamentals, Electrical Tool Issue, Light & Starter Presentation, Tag-Out

“General Electrical Safety and Arc Flash Protection” [www.public.navy.mil/.../Elect/nstm300-rev8/NSTM\\_300\\_Rev.8\\_Part\\_II.pptx](http://www.public.navy.mil/.../Elect/nstm300-rev8/NSTM_300_Rev.8_Part_II.pptx)

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## Electrical Emergencies: How to Respond

Protect yourself. Don't touch the person who has been (or is being) shocked. The victim might be energized.

Get the victim away from the source of power. Shut off the power. This might be difficult because there might be secondary sources; if you are not sure, get help. You may be able to pull a fuse or circuit-breaker, or pull a plug if a powered machine is involved. Remove the victim from the power source with a non-conductive tool, such as a piece of rope or a wooden cane.

Move the victim to safety only when power is off and no neck or spine injuries are possible.

Check for pulse and breathing:

- If the person's heart has stopped, start CPR.
- If the person isn't breathing, begin mouth-to-mouth resuscitation.

Treat for shock:

- Keep the victim lying down.
- If unconscious, put the victim on his or her side to let fluids drain.
- Don't move the person if neck or spine injuries are possible.
- Cover the person to maintain heat.

Call Medical if the person:

- is obviously injured (loss of consciousness, significant trauma)
- has an altered mental status (confusion, slow/slurred speech)
- has other injury (laceration, burn)

Stay with the patient until help arrives.

Tell medical personnel about the patient's condition.

Report the accident to supervisor (even minor shocks and close calls must be reported).

Secure the area.



An aviation electrician's mate repairs the ramp of a C-2A Greyhound aboard a carrier at sea.

## Frequently Asked Questions, cont.

### Q: What are the rules for portable electrical tools?

**A:** If you keep portable tools in your workcenter even through your workcenter does not have an electrical/electronic rating, return those to tool issue because you are in violation of NSTM 300.

You must use the required personal protective equipment (PPE) that was issued with the tool.

Pay attention to the brief on routine safety tool precautions.

If you have not received training within the year, you are not authorized to use the portable

electrical tool until training is complete.

A routine safety check must be completed before tools are issued.

Unsafe tools shall be marked "OOC" and rendered incapable of energizing. These tools shall be locked in a designated OOC locker unless they are being repaired.

PMS must be accomplished on electrical safety gloves prior to issue.

Extension cords must be visually inspected when issued.

Reference:

OPNAVINST 5100.19E para B0707(b -d; f; NSTM 300; MIP 3000 series)

## Test your electrical safety knowledge

### 1 Safety-related work practices involve:

- The use of ground fault circuit interrupters
- Verifying power is off before doing repairs
- Keeping proper distance from overhead power lines
- All of the above

### 2 Conductive articles of jewelry and clothing may be worn around exposed energized parts.

- True
- False

## Are You Inspection Ready?

Use this inspection checklist:

[http://www.public.navy.mil/fltfor/insurv/Getting\\_Inspected/Pages/Deck\\_Pages/NAVOSH\\_EP.aspx](http://www.public.navy.mil/fltfor/insurv/Getting_Inspected/Pages/Deck_Pages/NAVOSH_EP.aspx)



### Things To Check in Your Work Centers

Do you have any “personal items?” These items are discouraged for use and can only be used aboard ship if Navy procured, approved by the Electrical Officer under NSTM 300 mobile equipment guidelines and safety checked under PMS.

- Fans
- Portable extension cords
- High-intensity lamps
- Reading lamps
- Electric blankets
- Heating pads
- Tools except hobby tools
- Heat/sun lamps
- Hot plates and griddles
- Electric clocks
- Microwave ovens
- Portable extension lights
- Electric heaters
- Portable refrigerators and air conditioners
- Immersion-type water heaters.

Have all unauthorized power strips been removed? Authorized power strips are EFI, Electronics Corporation models MPS-453EFI-120A and MPS-6, Brooks Power System model Z6 (62P), International Power Technologies (IPT) model Navy Controller V, and HFS, Inc.

Have all dead-ended cables been properly identified and isolated? (NSTM 300-4.6.7.1f and 300-4.6.9)

Have unauthorized personal electrical/electronic items been removed? (OPNAVINST 5100.19E para B0702(e)(3); NSTM 300-2.7.3.6)

Are multiple surge suppressors being fed from a single isolated circuit? Or, are surge suppressors “daisy-chained” together? (NSTM 300-2.7.3.59(a))



An electrician's mate and an engineman troubleshoot a recycling trash compactor aboard an amphibious assault ship.

## Items To Check, cont.

Has all electrical and electronic equipment been safety-checked in accordance with the current PMS? Portable equipment requires a quarterly safety check (2-Prong Q-1R and 3 Prong Q-2R). All mobile equipment (not hardwired, can be moved, but normally is stationary while in operation) requires a one-time situational check (2 Prong R-6 and 3 Prong R-5). Surge suppressor periodicity is A-4R. Battery charger (with plug-in cords) periodicity is Q-1R/Q-2R. Ref: OPNAVINST 5100.19E para B0702(e)(2) and NSTM 300-2.7.3.6.1, 300-2.7.5.2.1 and PMS MIP 3000.

Has all personal electric/electronic equipment been checked in accordance with NSTM 300-2.7.3.6.4 – 300.2.7.3.6.9?

Has all personal, mobile and portable equipment been tagged with color-coded tape or approved NSN supplied tags? (NSTM 300-2.7.3.6.2)



An electronics technician aboard an aircraft carrier fills out a safety-harness check-out form in the ship's electrical tool-issue room.

## Personal Protective Equipment (PPE)

Are you using the correct electrical safety glove for the task? Are the gloves in good condition? Have they been checked, prior to use, to ensure that they aren't damaged and haven't deteriorated?

Are safety gloves only being used for electrical work and not for chemical handling or cleaning?

Are leather over-gloves issued to protect rubber gloves from damage during use?

Are safety goggles and/or face shields available for use? Are they clean? In good working condition? Are you using the correct gloves/face shield for the type of hazard? (Ref: OPNAVINST 5100.19E para B0506(a – c), B0706 (a & b), C0903 (a)(3); NSTM 300 and MIP 300 series).