Electrical Safety

Toolbox Talk

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Establishing an Electrical Safety Program

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There are five objectives of an safety program:

1. Make personnel more aware of rules, responsibilities and procedures for working safely
2. Demonstrate compliance with the law
3. Document requirements and guidelines for providing a safe workplace free from unnecessary hazards
4. Document requirements and guidelines to personnel, who could be exposed to electrical hazards
5. Encourage, and make it easier for each employee to be responsible for his or her own electrical safety self-discipline.

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What are the most common electrical hazards today?

- **ARC FLASH:** a dangerous condition associated with the unexpected release of electric energy caused by an electric arc. As much as 80% of all electrical injuries are burns resulting from an arc-flash and ignition of flammable clothing. Arc temperature can reach 20,000°C - this is four time hotter than the surface of the sun

- **ARC BLAST:** This may result in a violent explosion of circuit components and thrown shrapnel. The blast can destroy structures, knock workers from ladders, or across the room

- **SHOCK HAZARD:** a dangerous condition associated with the possible release of energy caused by contract or approach to live parts.

Safety Basics

Electrical Hazards

Shock

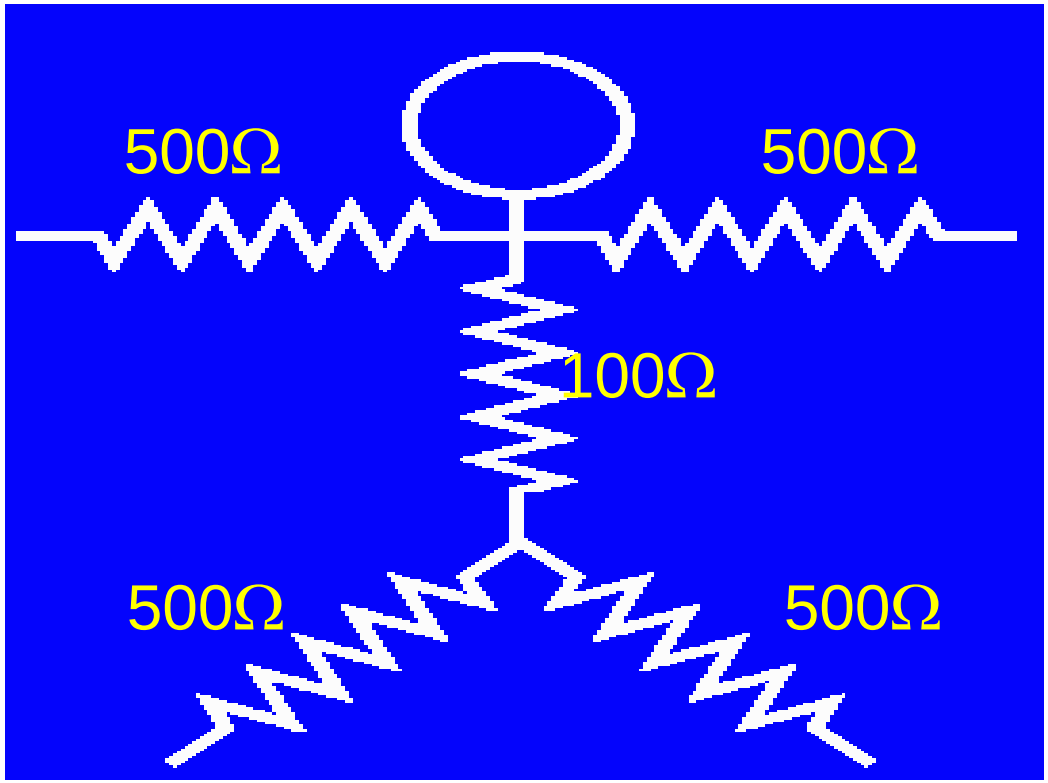
Human body resistance (hand to hand) across the body is not steady depending on a variety of parameters but statistically we could consider a value around 1000Ω in case of hand-to-hand current path

Ohms Law: I = E / R

Example: I = 380 volts / 1000 Ω
I = 0.38 amps (380 mA)

In general, any current above 30 mA is considered hazardous.

Body parts resistance



APPROACH DISTANCES FOR QUALIFIED EMPLOYEES – ALTERNATING CURRENT

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Voltage range (phase to phase)	Minimum approach distance
300V and less	Avoid Contact
Over 300V, not over 750V	(30.5 cm)
Over 750V, not over 2kV	(46 cm)
Over 2kV, not over 15kV	(61 cm)
Over 15kV, not over 37kV	(91 cm)
Over 37kV, not over 87.5kV	(107 cm)
Over 87.5kV, not over 121kV	(122 cm)
Over 121kV, not over 140kV	(137 cm)

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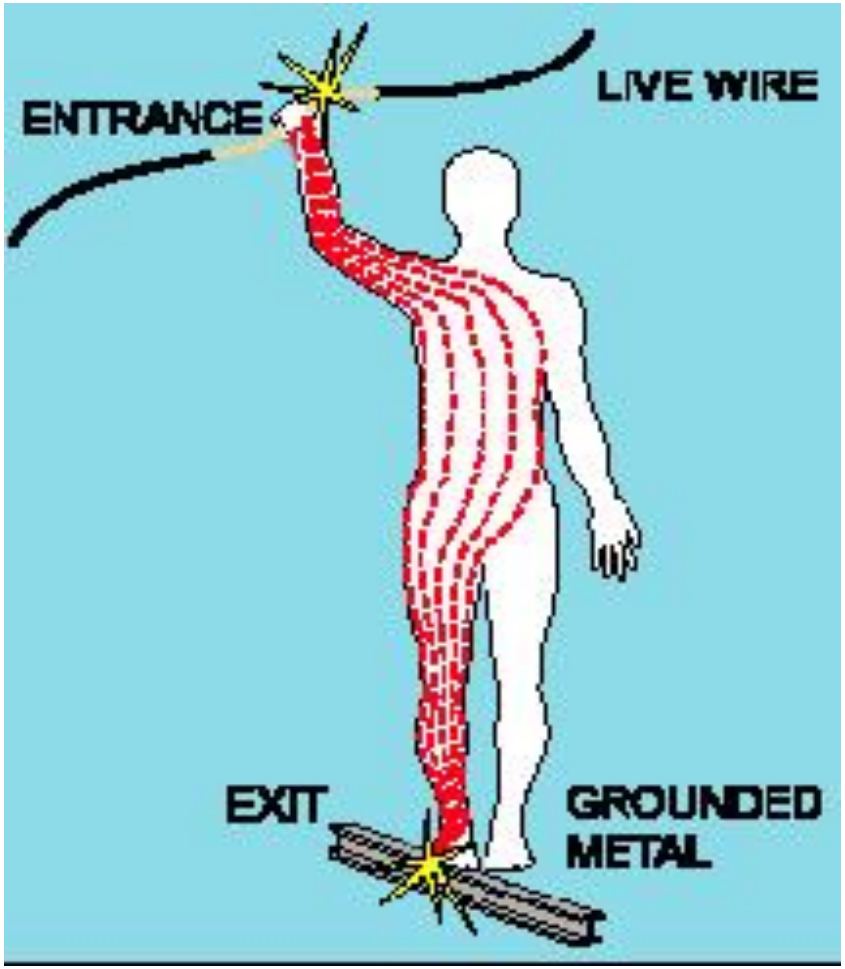
Human Body Resistance



SKIN

outer layer of skin “horny layer” provides resistance to electricity but varies from individual to individual

HEART

controlled by internal electrical impulses and disturbed by outside electrical impulses causing fibrillation and halting of pumping action. Death can quickly occur.

MUSCLE

also controlled by electrical impulses shock can result in loss of muscular control and lack of ability to release an electrical conductor

Possible Consequences

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Mechanical Injuries

- Unexpected motion
- Improper Lockout / Tagout procedures

Other Injuries:

- **Loss of hearing** - from the pressure wave caused by the arc blast
- **Blindness** - from flying pieces or molten metal during a blast

- **Broken bones** - from falls, death of tissue and muscle contraction

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Malpractices

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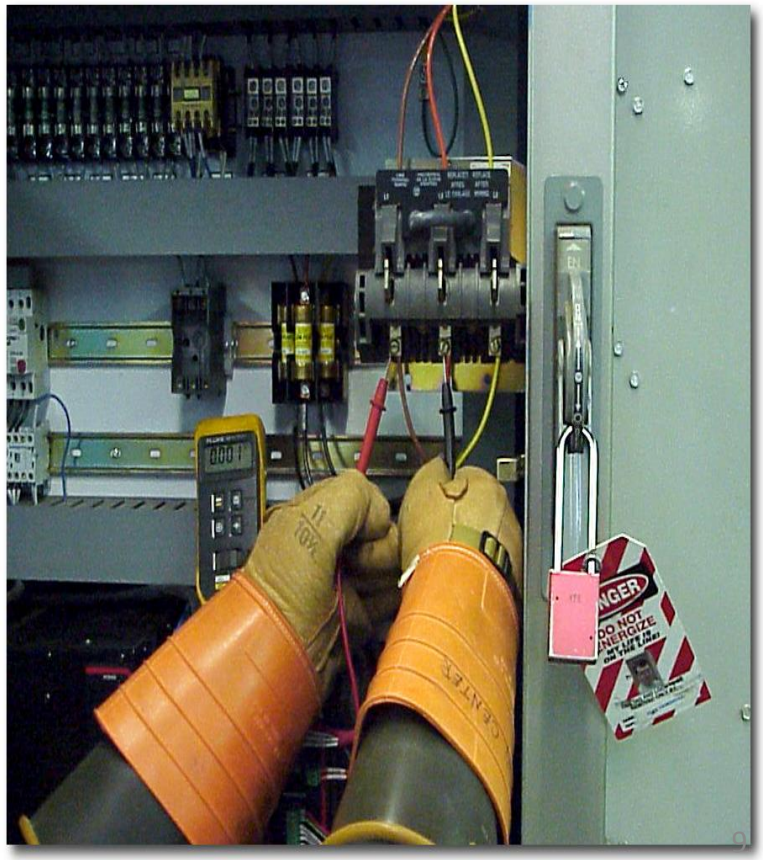
This is EXACTLY the WRONG way to do it!!!!

This is how it should be done



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Death may occur from effects of current on the body

- Contraction of the chest muscles
- Paralysis of nerve center
- Ventricular fibrillation
- Suspension of heart rhythm
- Hemorrhages and destruction of tissue, nerves and muscles

Emergency Response for Electric Shock

1. Look first - do not touch!
2. Turn off the source of electricity.
3. If you can't turn off the power, separate the victim from the power source using a dry object made of non-conducting material.
4. If the victim is outdoors and touching a high voltage power line - stay clear and dial 112 or your emergency number.
5. Act fast - speed is essential - delegate someone to call 112 or your emergency number.

Emergency Response for Electric Shock

6. Keep the victim lying down and make sure you are both in a safe area.
7. If the victim is not breathing, apply rescue breathing. If the victim is not breathing and has no pulse, begin CPR.
8. Cover the victim with a blanket to maintain body heat and wait for emergency medical personnel to arrive.
9. Note as many details about the accident as possible to send with the victim to the hospital.

Emergency Response for Flame Burns

1. If the victim's clothing is on fire - remind him/her to drop and roll or tackle the victim to smother the flames.
2. Check the victim for shock and follow the steps previously discussed for treating shock.
3. No signs of shock - begin treating the burned area.
4. Delegate someone to call 112 or your emergency number.
5. Cool the burn with water or saline solution.

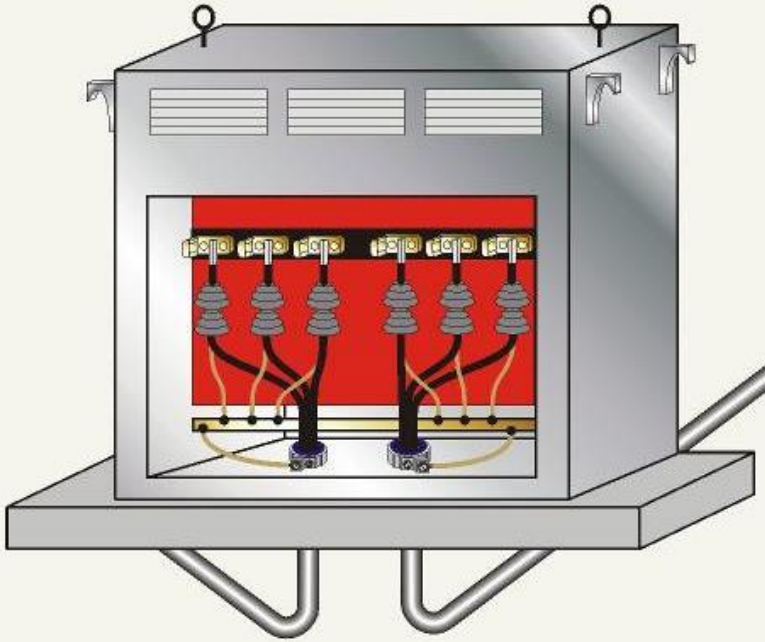
Emergency Response for Arc Burns

Follow the same procedures for flame burns except cool the burns via safety shower because these burns usually involve large areas of the body.

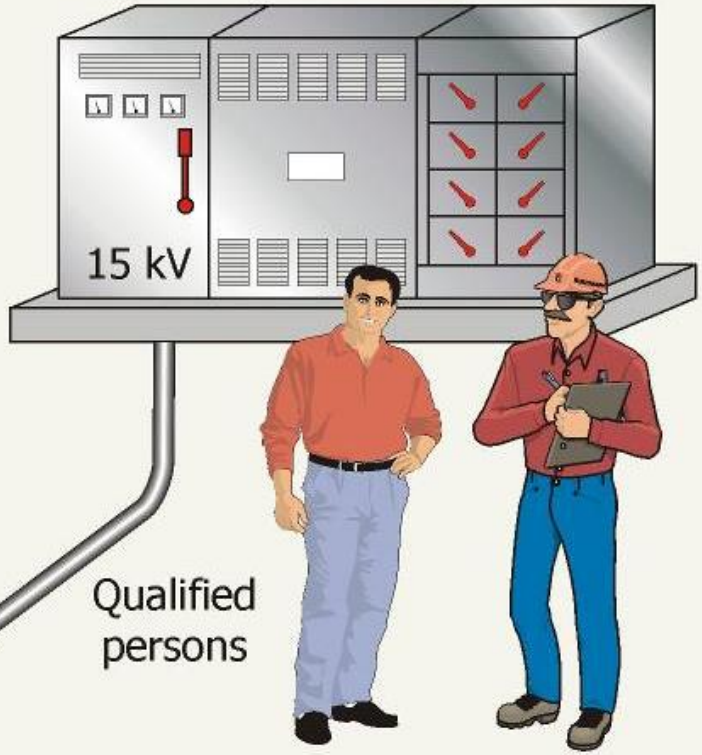
Qualified Person

One who has the skills and knowledge related to the construction and operation of the equipment and has received safety training on the hazards involved

Typical MV switching cabinet



Typical unit substation



Has the skills and knowledge
Has received the safety training
on hazards involved

Basic Electrical Safety Principles

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What can you do in your workplace?

1. Administrative Controls – Do not work on or near energized circuits, equipment and parts

2. Engineering Controls – Engineer out the hazard, or reduce to a safe level

3. Work on the energized circuits, equipment and parts using Safe Work Practices, including the appropriate PPE.

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Basic Electrical Safety Principles

4. When testing an electrical cabinet or a switch breaker, you must wear UV filtering goggles because an unexpected electrical arc flash in the vicinity of the face of the worker ,may damage the eyes due to the heavy content of ultra-violet rays.

BIBLIOGRAPHY

- *Effects of Current to the Human Body , HUBBELL Power Systems*
- *Various commercial brochures*
- *IEC TS 60479-1 electric shock graph*

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ANY QUESTIONS?

THANK YOU!!

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