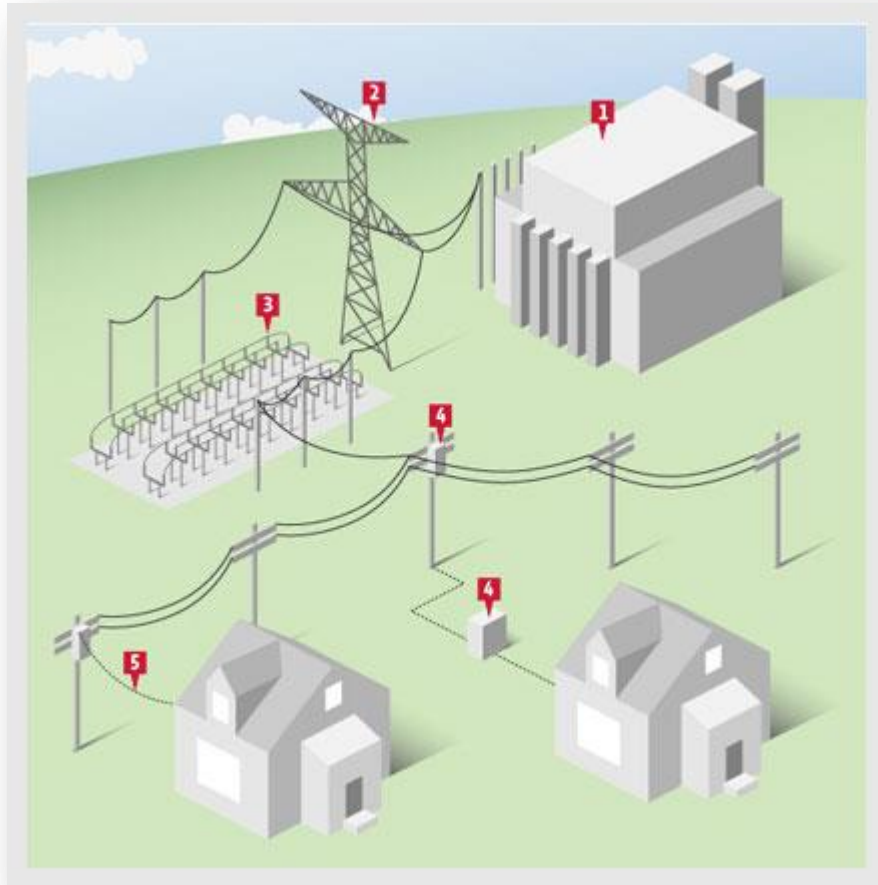


ELECTRICAL HAZARDS FACING FIREFIGHTERS



1. Generating Plant
2. Transmission Grid
3. Electric Substation
4. Distribution Grid / Pole & Pad Transformers
5. Customer Drops

ELECTRICAL HAZARDS FACING FIREFIGHTERS

Firefighters are often the first to respond to electrical emergencies, which usually consist of power lines that have fallen, arcing wires, or transformer explosion/fires. We must have an understanding of the hazards of electricity, the electrical distribution system, and how to mitigate the incident safely.

1) HAZARDS OF ELECTRIC

A. POTENTIAL

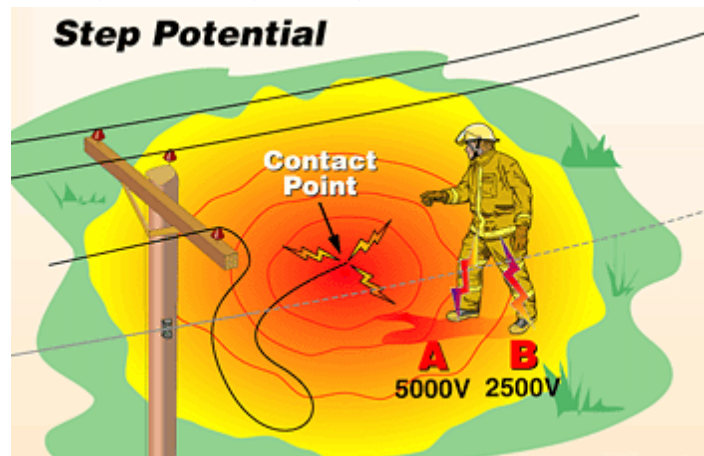
Potential is the voltage difference between the energized conductor and the ground or earth. If *anything* makes contact with a power line such as a tree, ladder, fence, etc., electricity will flow through the object to the ground. The human body is an excellent conductor because it is made up of 90 percent water. If a firefighter was to touch an object that has made contact with a wire or pick up a wire, the electricity will take the path of least resistance to the earth, which are the firefighters veins.

B. STEP POTENTIAL

Electricity seeks all paths to the ground, and when it reaches the ground, it spreads out like a ripple in a pool of water. Each ring, which radiates out will have a different voltage potential, with the highest voltage being in the center.

The closer the person moves towards the down wire, the higher the amount of voltage could be present between their feet. This would create the possibility that voltage levels 5 feet from the point of contact are higher than the levels present at 6 feet from the point of contact. If you step towards the wire, you now have a difference in voltage between your feet. The voltage could take the path from one foot, up the person's leg and

down the other leg, to the other foot. The difference could result in a serious injury or fatality. As the firefighter gets closer to the downed wire, the voltage becomes greater with every step. The difference in voltage between his two feet could travel up one leg and down the other leg causing serious injury or fatality.



2) ELECTRIC DISTRIBUTION COMPONENTS

There are two types of supports for electrical wires in the Commonwealth Edison system; wood poles and steel towers.

Wooden poles used to support electrical wires carry up to 345,000 volts. People should remain a minimum of 10 feet from any energized equipment on the wooden pole.

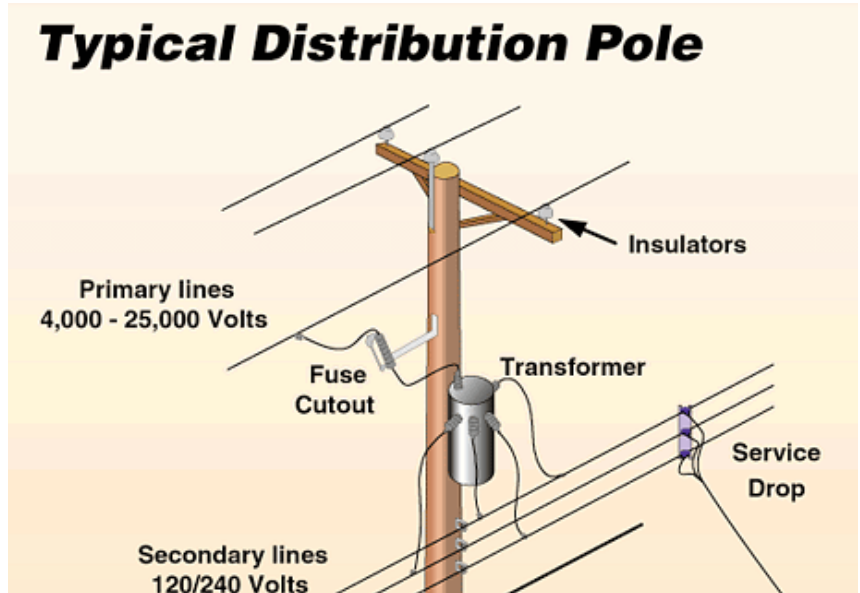


Steel towers used to support electrical wires carry up to 765,000 volts and require a clearance of 35 feet from any energized equipment on steel towers.



B. WIRES

Wires are different diameters depending on the voltage they are carrying. The larger the diameter, the more voltage the wire is carrying. The wires on poles are configured with the primary lines (4,000 to 25,000 volts) closest to the top of the pole. The primary lines are connected to the transformer, which steps down the voltage and sends it out to the secondary lines (120 /240 volts). Below the lower voltage wires are the television cable wires and phone wires. As firefighters we must observe basic rules:



- ❖ When positioning the aerial ladder or basket maintain a minimum distance of **10 feet** from any wire or electrical component.
- ❖ **The rubber coating on a wire is not an insulator**, it is a weather protector.

C. TRANSFORMERS

Transformers are used to step down the electricity from primary lines to secondary lines. Transformers are no longer filled with PCBs. They are now filled with a mineral oil. The oil is not flammable but can boil when heated and blow off a relief valve on the side of the transformer spilling the hot oil below.

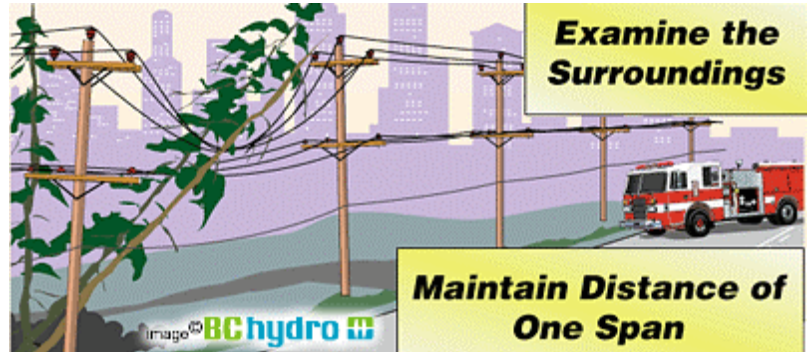


Typical pole mounted transformer relief valve.



D. SPANS

A span is the distance from one pole to the next. The average span from pole to pole in the city is between 100 and 150 feet. Always isolate the area at least 1 span from the down wire.



E. VAULTS AND SUBSTATIONS

Commonwealth Edison has substations and vaults. Personnel should not enter the substation or vault without a Commonwealth Edison representative. Commonwealth Edison has been removing PCB transformers and equipment from their system for the past 20 years. However, you may still find some doors on vaults or gates to substations marked with a PCB identification tape. This tape is 2 inches by 18 inches and checkered with black and yellow vinyl tape. It is located at 18 inches and 60 inches from the ground. On any incident involving this marking notify the incident commander immediately so that the hazardous material team can be notified.



F. UNDERGROUND ELECTRICAL SYSTEMS

Along with overhead wires, Commonwealth Edison has wires that run underground. Underground electrical systems consist of cables, transformers and switchgear. They are located in manholes, vaults, and in cable tunnels. Firefighters should **NEVER** enter an underground vault or service cover. All Commonwealth Edison underground



III. HANDLING ELECTRICAL EMERGENCIES

A. DOWNED ELECTRICAL WIRES

When live electrical wires are knocked to the ground because of a wind storm, lightning, fire, or other reasons, the fire department's main function is to remove civilians from the area surrounding the wires and call the power company to remedy the situation.

All downed lines are considered energized. Many times the energized downed wire will lay quiet and motionless. However, remember that the threat of wire movement is always a possibility. The following is recommended for a downed wire:

- 1) Never position equipment or personnel under the object that has been compromised. Isolate the area at **least one span** from any downed wire.
- 2) Request Commonwealth Edison through the dispatch center indicating that there a wire downed.
- 3) If there are no injuries or fire, request police officers to remain on the scene to secure the area and wait for Commonwealth Edison.

B. TRANSFORMERS AND POLES ON FIRE

When called because a pole or transformer is on fire, the following guidelines are recommended:

- 1) Isolate the area at least one span from the transformer pole. Be aware, if the transformer is on fire or exposed to heat the blow off valve on the transformer may release hot oils and the transformer may come down.
- 2) Request Commonwealth Edison through the dispatch center indicating the type of equipment on fire.
- 3) Do not apply water to the pole or transformer on fire. It is best to let it burn.
- 4) Cover exposures (Garages, houses etc.) with a fog nozzle set at least at 30-degree fog pattern.
 - ❖ **Remember; do not apply the water to the pole or electrical equipment.**
- 5) Extinguish the burning pole or equipment only after it has been de-energized by Commonwealth Edison crew and they have given permission.
 - ❖ **Remember electricity can travel from both so ComEd may have to shut down both ends of the pole on fire.**

C. POWER STATION OR SUBSTATION FIRE

Substations are used to step down voltage. If there is a fire in a substation, the following is recommended:

- 1) Request Commonwealth Edison at the sight through the dispatch center.
- 2) Do not enter the substation until arrival of Commonwealth Edison representative.
- 3) Do not apply water to the substation. Cover exposures (Garages, houses etc.) with a fog nozzle set at least at 30-degree fog pattern. Remember do not apply the water to the substation or any electrical equipment.

D. ENERGIZED APPARATUS

In the event the apparatus makes contact with energized wires, fire personnel should remain in the vehicle until Commonwealth Edison shuts down power to the wires involved. If the apparatus must be dismantled, **DO NOT** step off the apparatus, **JUMP** away from the vehicle so that no part of the firefighter touches the vehicle and the ground at the same time. Land with both feet together, then **SHUFFLE STEP** out of the hazardous area by taking very small steps and keeping your feet in contact with each other and the ground constantly. A second option is to jump clear of the apparatus landing with feet together and hop away from the charged apparatus.

E. UNDERGROUND VAULTS

Underground vaults or substations are used in areas where overhead wires would be impractical. They are usually found in high-populated areas. Underground vaults or substations have the following additional hazards that firefighters should be aware of:

Explosive gases may gather in underground enclosures as a result of leaks or spills from gas mains, tanks, sewers, or other sources. These gases can ignite by an accidental spark.

Toxic gases may be generated in the vaults by burning oil or insulation from the wires and transformers.

High water may be found in some vaults. Some tunnels are located below water level and are serviced by pumps, which keeps the seepage from rising above safe levels. Failure of the pumps could result in dangerous high water levels. The firefighter attempting to cope with a fire or explosion in a manhole should use the following procedures:

- 1) Isolate the public from the area at a safe distance from the manhole, making certain to stop traffic.
- 2) Request Commonwealth Edison through the dispatcher indicating the situation and location of the manhole cover.
- 3) Do not remove the manhole cover or blanket the holes of the cover with anything.
- 4) Do not apply water or dry chemical through the cover. Isolate the area and wait for Commonwealth Edison crew to arrive.