

Appalachian Power Company Policy / Procedure No. 22:
Working on De-Energized and Grounded Lines

1) Statement of policy:

To protect workers performing work on de-energized and grounded lines from potentially hazard touch potentials, workers shall work within an equipotential zone when working on those lines from a pole or an aerial device (bucket). Workers working from a pole shall also wear insulating rubber overshoes.

The equipotential zone may be established using either an existing or newly installed pole ground or a partially installed pole ground. In the absence of an equipotential zone, workers working aloft on de-energized and grounded conductors must wear a minimum of Class 2 rubber gloves and those working from the pole shall also wear rubber overshoes.

Workers on the ground handling de-energized and grounded conductors or anything (such as a service drop or guy wire) bonded to those conductors shall wear a minimum of Class 2 rubber gloves and insulating rubber overshoes or boots.

A minimum #1/0 copper conductor shall be used for any protective grounding conductor anywhere on Appalachian Power's distribution system.

2) Discussion:

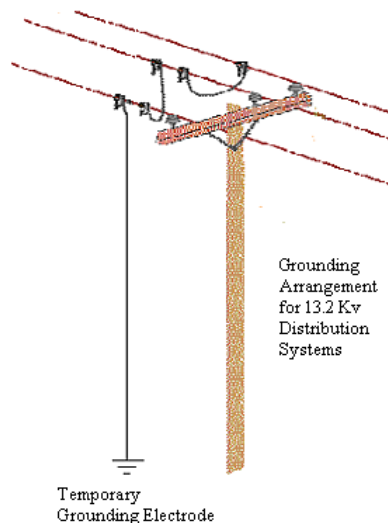
Field tests have shown that hazardous voltages are present on de-energized and grounded conductors when those conductors are accidentally re-energized. Essentially, the protective ground's function is to limit the voltage on the conductors and to conduct fault current well to assure the fastest possible interruption time. When a de-energized and grounded conductor is accidentally re-energized, a voltage to ground that is nearly equal to half the nominal line to neutral voltage is present on the primary and neutral conductors and anything bonded to the neutral during the period of energization.

To protect workers under this condition, additional measures must be taken to prevent injury from these voltages. An equipotential zone created by ensuring that an existing, partial or newly installed pole ground is in contact with the pole and properly bonded to the neutral has been shown to provide effective protection for workers working on grounded conductors or equipment that have become re-energized. Because this hazard is made more acute for the worker working on the pole due to the distance between the worker's lowest point of contact with the pole (the worker's feet) and the worker's hands, an additional level of protection is mandated, the wearing of rubber overshoes. These overshoes protect against any voltage gradients that may be present on the pole during a re-energization event especially near the bottom of the equipotential zone and at ground level.

If proper grounding and bonding sequences are followed while performing this work and connections made with a hot line tool as prescribed, workers working aloft may work on de-energized and grounded conductors and equipment without wearing any IPE (workers working from the pole must wear rubber overshoes). Workers choosing not to establish an equipotential zone must wear a minimum of class 2 gloves when working on de-energized and grounded conductors (those working from the pole must also wear rubber overshoes).

Because an effective equipotential zone cannot be established for workers working on the ground, those individuals must wear both rubber overshoes and a minimum of class 2 rubber gloves when in contact with any conductor or equipment bonded to the primary or the neutral.

On poles without a system neutral (such as 13.2Kv distribution systems), **workers must always wear insulating gloves and rubber overshoes**. A temporary grounding electrode shall be installed at the grounding location and connected to the ground set.



3) Definitions:

Equipotential Zone – An area on a pole that is effectively bonded to the neutral so that a worker performing work within the zone will not experience a difference in potential across the worker’s body if the line being worked on is energized while they are in contact with it.

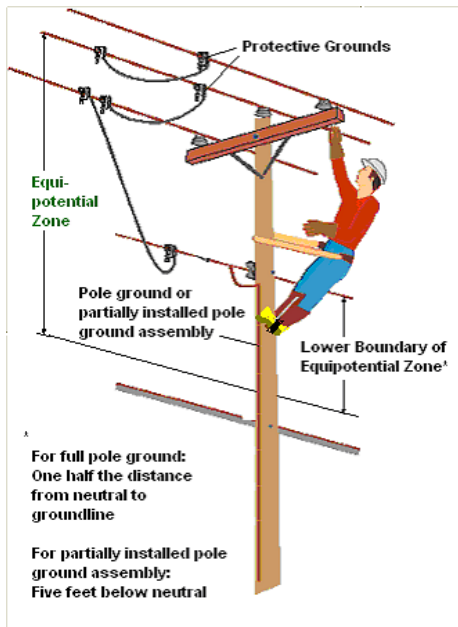
Existing Pole Ground as Equipotential Zone – An existing pole ground may be used to establish an equipotential zone if the worker assures that there are at least six nails and clips or staples in the ten feet of the ground assembly closest to the neutral. The worker shall also reset each nail or staple with a hammer to assure proper contact with the pole and check the mechanical integrity of the connection with the neutral. This type of zone is effective from the top of the pole to a point halfway between the neutral and the ground.

Partial Pole Ground as Equipotential Zone – Where a pole ground does not exist on a pole where de-energized and grounded work is being performed, a partial ground consisting of a ten foot piece of copper ground wire, at least six staples and a hot line clamp. After installing the wire with equally spaced staples, the ground wire shall be connected to the neutral with the hot line clamp using a hot stick. After work is

completed, the clamp should be removed and the attachment lead coiled up in place for the next time it is needed. This type of zone is effective from the top of the pole to the midpoint of the partial pole ground.

4) Attachments:

The illustration below shows the proper application of and effective protection offered by an equipotential zone:



5) OSHA / Safety Manual References:

AEP Jobsite Grounding Policy issued October 26, 2006

Safety Manual:

E 1.02 All circuits and equipment shall be considered energized at full voltage until de-energized, tested and grounded...

E 2.03 Workers shall wear Personal Insulating Protective Equipment (PIPE), in accordance with Electrical Table 2.01, while working from an insulated aerial lift device during the time from when the bucket leaves the cradle until it returns to the fully cradled position

Exceptions to 2.03:

- When equipment is de-energized, tested and properly grounded. (See grounding policy)
- PIPE is not required if the scope of the work involves only...

E 2.04 When workers are climbing poles with equipment energized at any voltage, a minimum of class 0 Personal Insulating Protective Equipment (PIPE) shall be worn from ground to ground...

Exceptions to 2.04

- When equipment is de-energized, tested and properly grounded (see grounding policy).
- On new construction (never connected or energized and no possibility for energization or induced voltage) work.
- When the scope of the work involves only Transmission voltages over 34.5kv.

OSHA

1910.269(n) "Grounding for the protection of employees."

1910.269(n)(2) "General." For the employee to work lines or equipment as de-energized, the lines or equipment shall be de-energized under the provisions of paragraph (m) of this section and shall be grounded as specified in paragraphs (n)(3) through (n)(9) of this section. However, if the employer can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards than working without grounds, the lines and equipment may be treated as de-energized provided all of the following conditions are met.

1910.269(n)(2)(i): The lines and equipment have been de-energized under the provisions of paragraph (m) of this section.

1910.269(n)(2)(ii): There is no possibility of contact with another energized source.

1910.269(n)(2)(iii): The hazard of induced voltage is not present.

1910.269(n)(3): "Equipotential zone." Temporary protective grounds shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to hazardous differences in electrical potential.

1910.269(n)(4): "Protective grounding equipment."

1910.269(n)(4)(i): Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault. This equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.

1910.269(n)(4)(ii): Protective grounds shall have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment.

6) Date Adopted: February 14, 2007