

# Safe Work Practices

<p>Title:</p> <h2>Equipotential Grounding</h2>	Reference:	Revision:
	SWP-5.03	
	Page:	1 of 5
	Date:	3/28/2017
Revised:		

  

**1.0 GENERAL**

1.1 The purpose of this document is to outline the principles of equipotential grounding procedure to provide the maximum protection to an employee working on a de-energized line or equipment.

**2.0 SCOPE**

2.1 The procedures outlined in this document were developed to ensure a safe working environment for personnel working on de-energized lines. The procedures shall be used on all circuits nominally rated at 750V to 46KV.

2.2 It must be emphasized that the equipotential zone principle provides maximum protection for the worker under any condition that would produce a potential rise to ground in the work area. The worker is fully protected by being within the equipotential zone.

**3.0 PROCEDURE FOR INSTALLING GROUNDS**

3.1 One of the following procedures shall be used on each structure where the work requires an employee to make contact with the conductors.

**3.2 Preparation for Installing Grounds**

3.2.1 Prior to their use, all approved ground sets shall be checked to ensure that:

- a) the proper set is being used (2/0 in the SOR, 1/0 in the NOR)
- b) cables shall be visibly inspected to ensure they are in good condition, no breaks, wear spots, kinks
- c) terminal connections are tight and non-corroded
- d) eye screws turn freely
- e) clamp heads are brushed

3.2.2 Having identified the line, established a visual opening(s) and obtained red tag clearance from the proper controlling authority, the line shall be de-energized and isolated.

3.2.3 The circuit to be worked shall then be tested for potential with a Salisbury or Bierer voltage detector to confirm the line is de-energized.

3.2.3 Having confirmed the line to be worked has been de-energized and isolated, the conductor shall be cleaned at the proposed point of attachment of the grounds by using an approved wire brush attached to a hot stick.

### **3.3 Installation Practices and Techniques**

3.3.1 Grounding shall be installed as close to the work site as possible, but far enough away so that contact with the employee is avoided.

3.3.2 Work involving single point grounding shall extend no more than one mile away from the grounding location.

3.3.3 Cluster bars shall be installed at a location close to but below the worker's feet, even while working from an insulated bucket.

3.3.4 Ground clamps shall not be installed over an armor rod.

3.3.5 Pole down grounds shall not be used as a point of grounding.

3.3.6 Ground clamps shall be properly tightened.

3.3.7 The ground potential end of grounding conductors may be applied and removed by hand. Ground potential connections shall always be applied first and removed last.

3.3.8 The energized end of grounding conductors shall only be applied and removed with hot line tools.

3.3.9 Rubber gloves shall be worn while placing personal protective grounds with hot-line tools.

3.3.10 Ground conductors shall be as short as possible to complete the work. In no case shall ground connectors be coiled.

### **Equal Potential Grounding – Single Point**

3.4.1 Single point grounding shall not be used for the maintenance or repair of broken conductors or buss.

3.4.2 Work involving single point grounding shall extend no more than one mile from the grounding location.

3.4.3 Cluster bars shall be installed at a location close to but below the location of the worker's feet, even while working from a bucket.

3.4.4 If working from a bucket where an employee can't touch a pole or crossarm, a cluster bar is not required.

- 3.4.5 The order of single point grounding connection for poles equipped with neutrals is as follows:
- a) The cluster bar shall be connected to an existing neutral, ground rod, or anchor rod.
  - b) The cluster bar or neutral shall be connected to the closest phase of the conductor or equipment.
  - c) The grounded phase shall be connected to the remaining ungrounded phases in sequence.

- 3.4.6 The order of single point grounding connection for poles without neutrals is as follows:
- a) The cluster bar shall be connected between an existing or temporary ground rod or anchor rod.
  - b) The cluster bar shall be connected to the closest phase of the conductor or equipment.
  - c) The grounded phase shall be connected to the remaining ungrounded phases in sequence.

3.4.7 On multi-pole structures, a cluster bar connected to the grounded circuit shall be installed below the work area on each pole on which employees will be working.

- 3.4.8 When working from a box girder these steps shall be followed:
- a) Inspect the tower down ground to ensure integrity and connection to ground grid.
  - b) Ground connections shall be made to the down ground at a point below the work area.
  - c) Connections shall then be made to the first phase and then the remaining ungrounded phases in sequence.

#### **Equal Potential Grounding - Bracket Grounding**

- 3.4.9 Bracket grounding will be required any time repairs must be made to down or broken conductors or when conductors or buss are to be cut, spliced, or opened up in any manner.
- 3.4.10 On overhead lines, a bracket ground shall be installed on the nearest pole to either side of the work area. In no case shall the distance between grounds exceed one mile.
- 3.4.11 If working from a bucket where an employee cannot touch a pole or crossarm, a cluster bar is not required.
- 3.4.12 The order of bracket ground connections for poles equipped with neutrals is as follows:
- a) The first connection shall be between the neutral, ground rod or anchor rod and the closest phase to be grounded.

- b) The grounded phase shall be connected to the remaining ungrounded phases in sequence.
- c) Cluster bars shall then be installed on each pole below the work area by connecting them to the neutral or phase.

3.4.13 The order of bracket ground connection for poles without neutrals is as follows:

- a) The first connection shall be between an existing or temporary ground rod or anchor rod and the closest phase to be grounded.
- b) The grounded phase shall be connected to the remaining ungrounded phases in sequence.
- c) Cluster bars shall then be installed on each pole below the work area by connecting them to a grounded phase.

3.4.14 On multi-pole structures, a cluster bar connected to the grounded phase shall be installed below the work area on each pole on which employees will be working.

3.4.15 Employees handling conductors on the ground shall wear rubber gloves. Since the lines have been grounded by the bracket method, rubber gloves will be considered secondary protection. The rubber gloves will serve as insulation from the difference in potential between the worker on the ground and the conductor.

#### **Equal Potential Grounding – Static Wire**

3.4.16 On overhead transmission lines, the static wire (where available) shall be considered an established ground and shall be used as such.

3.4.17 On wood structures, ground connections shall be made directly upon the static wire and not on pole grounds.

3.4.18 When more than one static wire is present on a structure at least two cluster bars shall be used.

3.4.19 The order of grounding connections for a pole or structure where only one static wire is present is as follows:

- a) Install a cluster bar below the work area
- b) Connect the cluster bar to a ground rod or anchor rod.
- c) Connect the cluster bar to the closest ungrounded phase.
- d) The grounded phase shall then be connected to the remaining ungrounded phases and static wire in sequence.

3.4.20 The order of grounding connections for a pole or structure where two static wires are present is as follows:

- a) Install a cluster bar below the work area

- b) Connect the cluster bar to a ground rod or anchor rod.
- c) Connect the cluster bar to the closest ungrounded phase.
- d) The grounded phase shall then be connected to the remaining ungrounded phases and static wire in sequence.

3.4.21 On metal structures grounding lugs may be used in place of the static wire.

Developed by: EPZ Team:  
Neil Lyons, Scott Richards, Brian Gould

Approved by: SWP Approval Committee:  
Bradley Flannery, Scott Richards  
Stan Hartin, Brian Gould