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Presents

Why Use A Grounding Cluster
One Good Reason

• Cluster makes electrical contact around entire pole
Objective

• Create Equal Potential Zone in Work Area

EPZ - An area where each & everything I can touch is at the same potential for all conditions
Objective

- Creating EPZ
  - Step one – Short Circuit & ground
Objective

• Creating – EPZ
  – Step two – Install Grd Cluster

Actual installation procedure may vary with company
Objective

- Creating – EPZ
  - Step three – Install Grd Cluster Jumper (personal jumper)

Now the entire structure becomes energized for transient conditions
Objective - EPZ

- All connections are critical
  - Ground to Phase
  - Phase to Phase
  - Jumper - Conductor/Cluster
  - Cluster to Pole/Ground

Poor connections force more current thru worker
Objective - EPZ

- These connections can be improved by cleaning and using inhibitors
  - Ground to Phase
  - Phase to Phase
  - Phase to Phase
  - Jumper - Conductor/Cluster

Connection to the pole cannot!
Maybe drive all the staples back in?
Objective - EPZ

- Worker Protection depends on the quality of these connections

**Connection Integrity!**
**How Good must a connection be?**
Defining The Problem

• Humans are injured at approximately 50 milliamps
• Fault currents exceed 200,000,000 milliamps
• At 40,000 amps we must protect workers from 99.999875% of the available fault current!
What We Believe

Current takes the path of least resistance.

True  False

Current takes every path, not just the path of least resistance, would you like proof?
A more accurate statement is “Most current takes the path of least resistance”. And it only takes 0.000125% of 40,000a to injure a person.

What will 120 ma do to a worker?
Connection Integrity

• For worker’s protection, jumper resistance must be much much less than worker’s resistance
  – Most current flows through the jumper
  – Very small current flows through the body.
    • $R_{\text{Jumper}} \ll R_{\text{Human}}$
    • $I_{\text{Jumper}} \gg I_{\text{Human}}$
As jumper resistance increases, more current is forced through the body.

When conditions are:
- \( R_{\text{Jumper}} = 0.00125\,\Omega \)
- \( R_{\text{Human}} = 1000\,\Omega \)
- Worker should survive

For \( I_\ell \leq 40\,\text{kA} \)

“jumper resistance” actually parallel impedance
Connection Integrity

• If connections are dirty, over paint, galvanizing or loose, resistance increases!
• Remember a life may depend on low resistance connections.
GROUND SET RESISTANCE

- Fifteen points where resistance can be introduced in grounding circuit.
- High resistance at any point can result in failed grounds and serious injury.

(See Page 69 in your textbook)
• THE CALCULATION
  - $R_{\text{Jumper}} = \frac{50v}{39,999.95a}$
  - $R_{\text{Jumper}} = 0.00125\Omega$
  - $R_{\text{Average}} = \frac{0.00125\Omega}{15}$
  - $R_{\text{Average}} = 0.00008333\Omega$

  ❖ 83.3 micro-ohms
  ❖ Wow, do you clean ground set connections?
  ❖ And why risk a poor connection to the pole?
So Why Risk a Poor Pole Connection

• Pole Grounds are smaller and only contact pole in one quarter

And how good is that connection?
Wood Pole as a Conductor

- Non Homogenous
  - Checking
  - Splitting
- Rotten
  - Internal decay

Yeah, today they are in the pole yard!
But last week somebody worked them!
• Creosote Impregnation

• Need pictures of pole cut showing variation of depth of creosote
• Creosote retention

• Need picture of old wood showing deterioration of creosote retention
- Penta treated vs Creosote Treatment
- How does the conductivity vary with type of treatment
Conduction Paths in Wood

- Wood deterioration
  - Shelling
  - Split Poles (Checking)

What about this path for conduction?
An Exercise

- Typical set of protective grounds or jumper.
- Imagine a resistor everywhere resistance can enter the circuit.

- How many do you count?
- And remember this is only one ground set!
- A worker can be in parallel with three sets!
Conduction Paths in Wood

- Wood deterioration
  - Split Poles (Checking)
  - Shelling

How homogenous is wood?
Conduction Paths in Wood

- Wood is Not Homogenous
  - Knots

- How do knots affect conductivity?
Work Situations

• Pole Change outs
  – Broken Poles
  – Changes in height

❖ How do workers bond (create EPZ) for pole change out or replacement?
Pole Ground – Pole Connection

- How do workers bond (create EPZ) for pole change out?
- Use two grounding clusters and bond them together
Ground Wire to Pole Connection

- **New Installation**
- **Old Installation**

How Good for How Long
Ground Wire – Pole Connection
How Good?

• After Years of Service
  – Line built 1980 (?)

• After How Many Faults
  – Every fault tries to pull staples
Will Pole Ground Work?

- Bonding connection should be continuous the length of the pole.
Will Pole Ground Work?

• Is this a good connection?
• Does it bond the ground to the pole?
Will Pole Ground Work?

- How effectively does this connection bond the pole to ground potential?
Will Pole Ground Work?

- Some really need immediate attention!
- It was repaired once before!
Will Pole Ground Work?

- Some Pole Grounds are an immediate hazard!
Will Pole Ground Work?

• Do you want to depend on connections like these?
• A life may depend on these connections!
Will Pole Ground Work?

- Visually inspect & tighten the neutral connection.
- Will they re-staple?
Pole Grounds vs. Grounding Cluster

- Previous photos taken in the 600 & 700 blocks of Custer Road, Richardson, Texas on April 5, 2001.
- All are less than two blocks from the front door of 777 Custer Road and all are in the same pole line!
- Of 11 poles inspected, one, maybe two could be considered in good condition!

What method will you give me?
Grounding Clusters Protect Better Than Pole Grounds

• Use it every time & use it correctly!

For additional information on grounding and grounding clusters - Contact Associated Training Corp.

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Grounding Clusters Protect Better Than Pole Grounds

Additional information shows and we recommend repairing the pole ground; restoring pole grounds to original condition as much as practical and using a grounding cluster provides an improved connection.  September 1, 2006

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