

Grounding & Bonding



PARTNERSHIP

The First Rule To Live By:

**Never Second Guess Electrical Hazards!
If you are ever in doubt about a course
of action,**

STOP!

**Consult a Supervisor, Safety
Person and/or Journeyman**



Effects of Electrical Contact

- Shock Trauma
- Burns
- Loss of limbs
- Internal injuries
- Psychological Trauma
- Loss of livelihood



How a circuit can become unintentionally energized?



- Switching
- Induction
- Back-feed
- Lightning strikes
- Vehicle Accidents
- Equipment Failure



Key Safety Fundamental

To avoid hazardous differences in electrical potential:

- Insulate yourself from the hazard
- Isolate yourself from the hazard
- **Work in a Equal Potential zone**



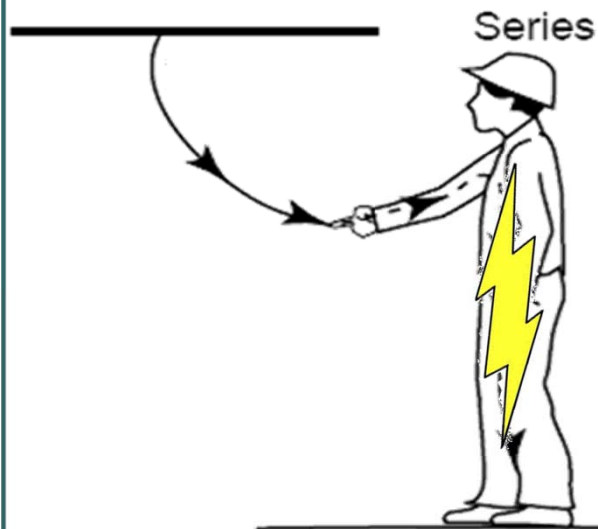
As an alternative but not required....

The employer can use an engineering analysis of the power system under fault conditions to determine whether hazardous step and touch voltages will develop



Safety Fundamental

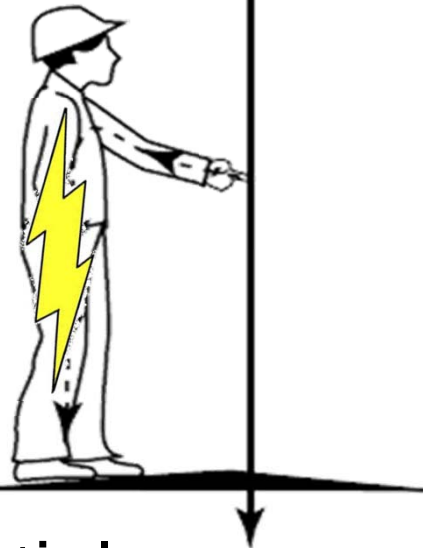
Voltage



Series



Parallel



Lower Potential

Installing and Removing Grounds



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Installing Grounds

- When attaching grounds
 - Attach ground end of the cable to a earth ground potential **first**
 - **Always** use a live line tool





Removing Grounds

- When removing grounds
 - The grounding device shall be removed from the normally energized conductor, line or equipment **first**
 - **Always** use a live line tool



Equipment Selection



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OSHA Standard

- 1926.962(c) Equipotential zone
 - Temporary protective grounds shall be placed at such locations and arranged in such a manner that the employer can demonstrate will prevent each employee from being exposed to hazardous differences in electric potential



Maximum Fault Current Capability for Grounding Cables



Cable Size	Clearing Time	RMS Amperes
#2	15 Cycles	17,000
	30 Cycles	13,000
1/0	15 Cycles	26,000
	30 Cycles	20,000
2/0	15 Cycles	33,000
	30 Cycles	26,000
4/0	15 Cycles	53,000
	30 Cycles	41,000

Applications





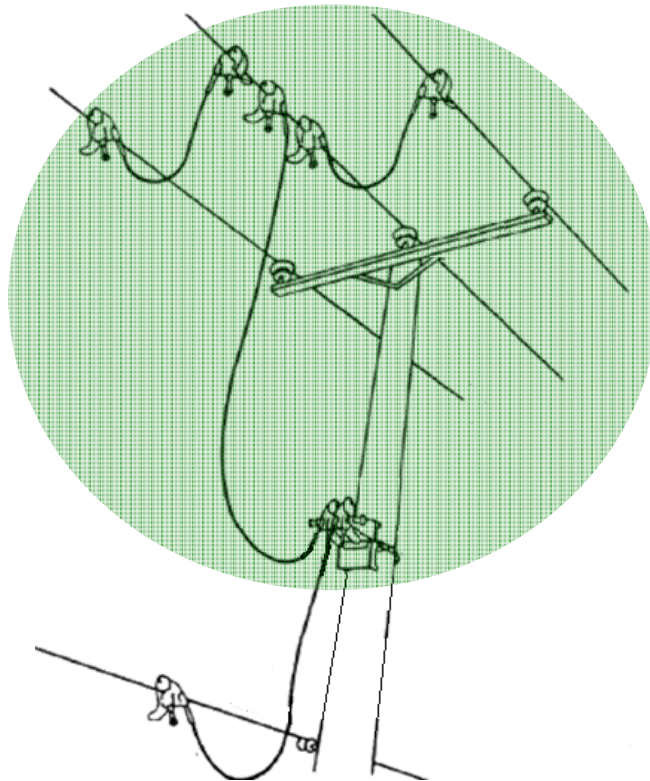
Safe Work Practices

- Job Briefing
 - Shall be held with all workers involved before beginning any job to discuss the potential hazards and what protective measures will be used for employee protection and safeguarding of the public and the customer



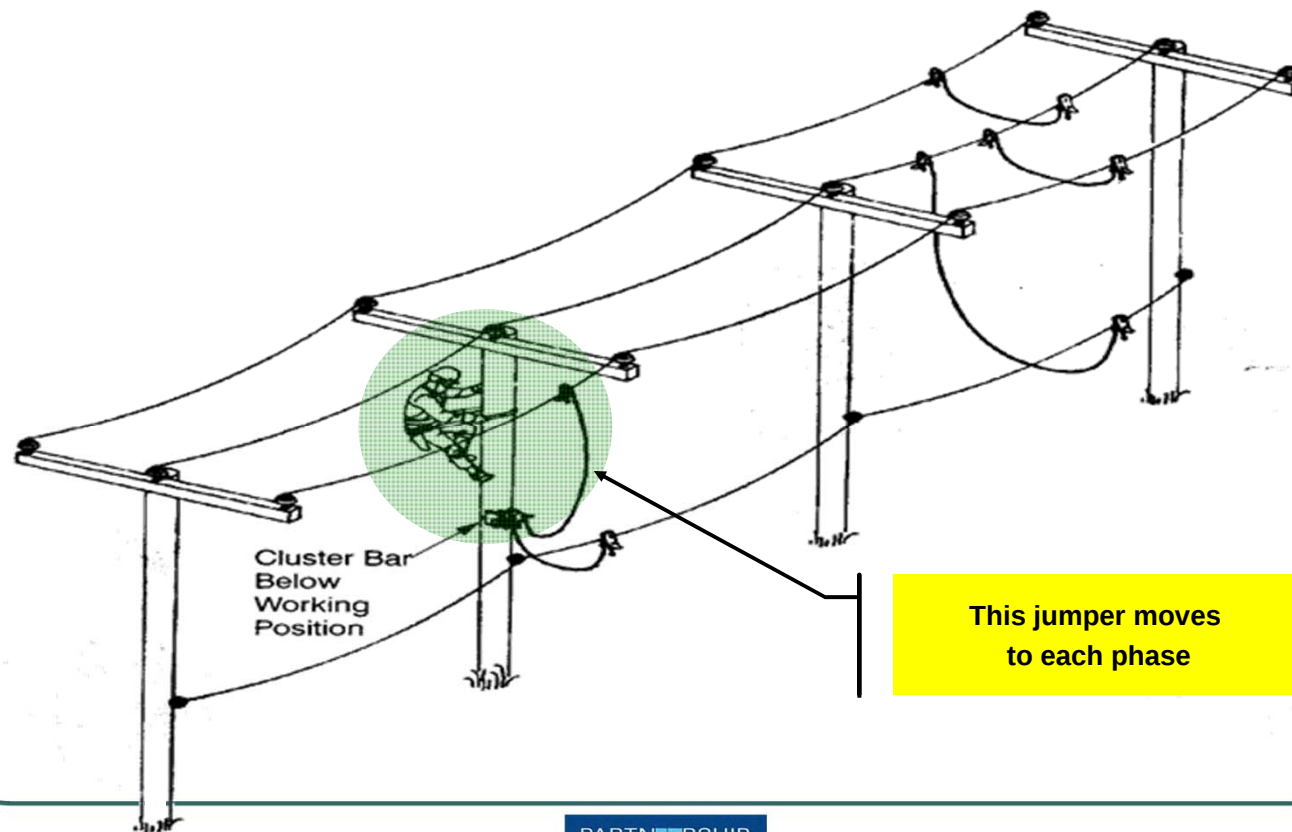


Distribution-Neutral on Pole

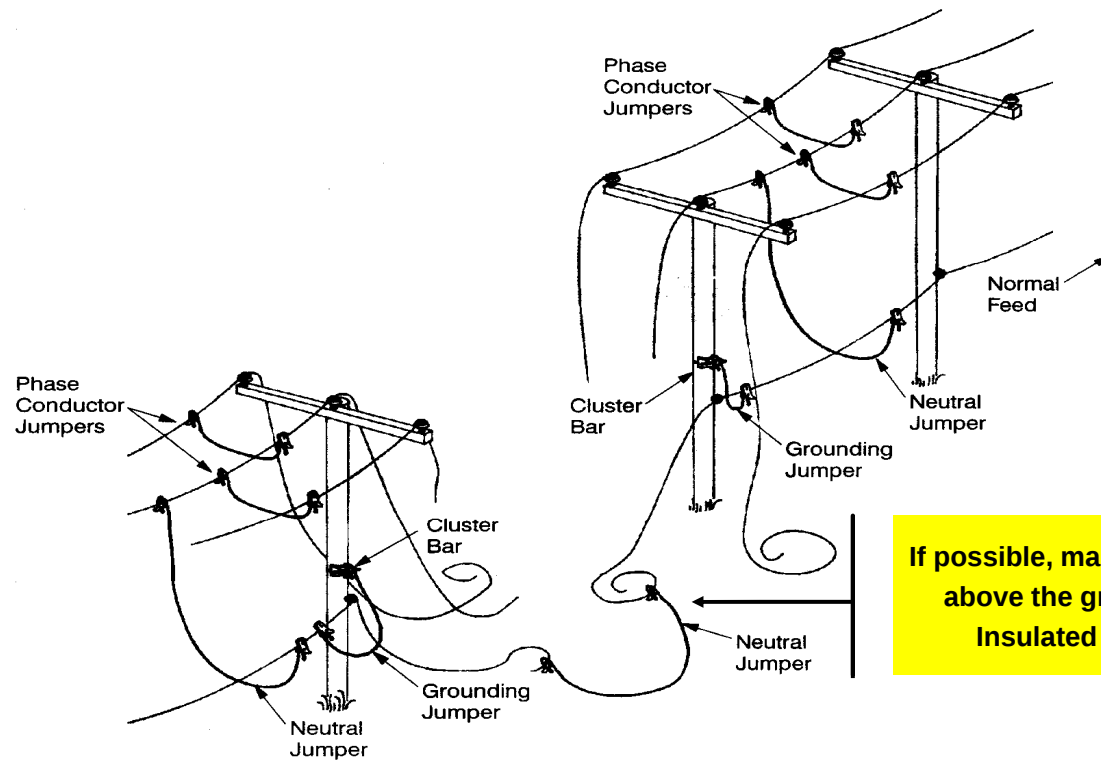




More Than One Span Away

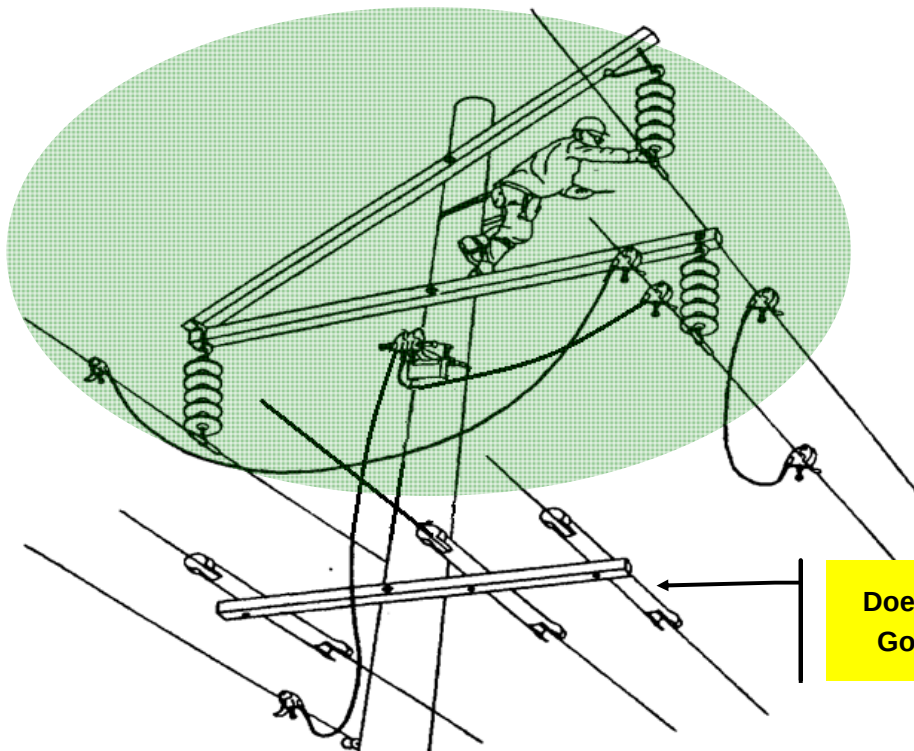


Primary Conductors Broken and on the Ground



If possible, make the splices above the ground in an Insulated Aerial lift

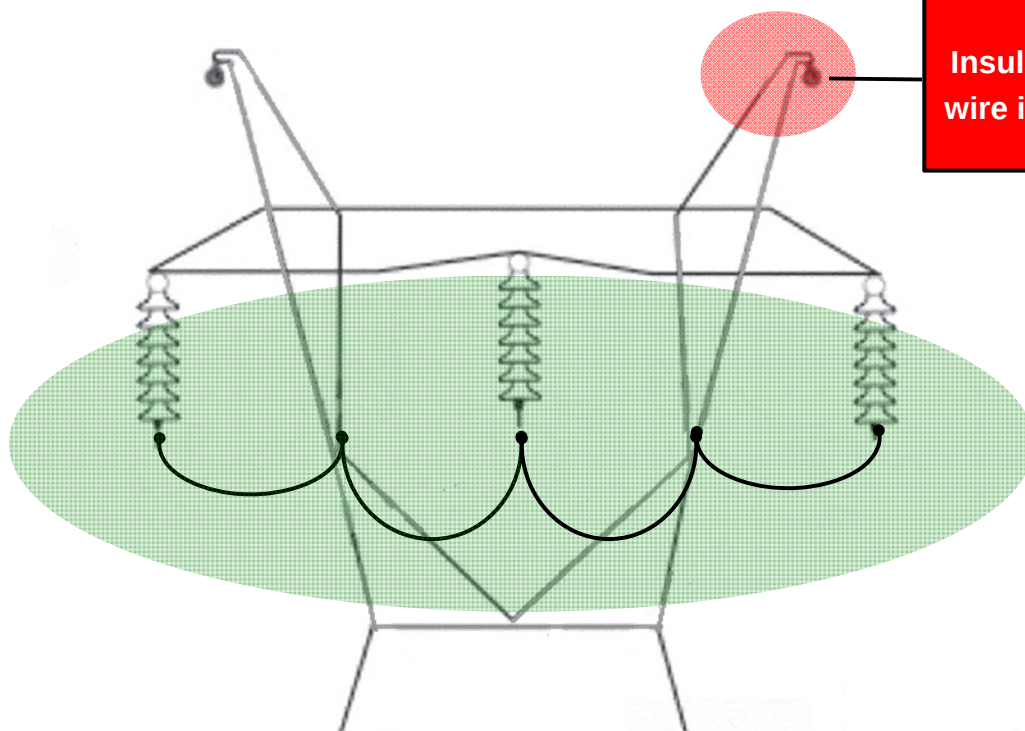
Transmission Lines with Distribution Underbuilt



Does not indicate
Good line cover



Grounding for Lattice Towers

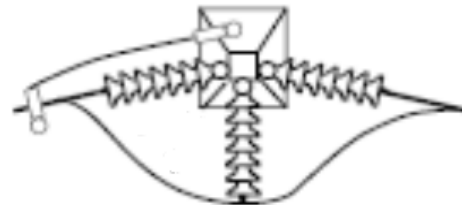


Insulated shield
wire is hazardous

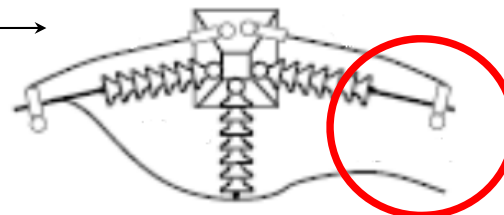
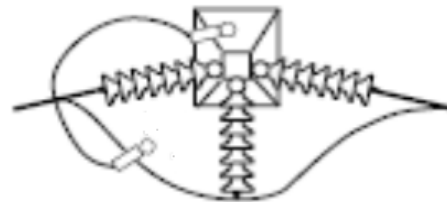


Dead End Structures

If the continuity is maintained with the permanent jumper, one grounding jumper may suffice

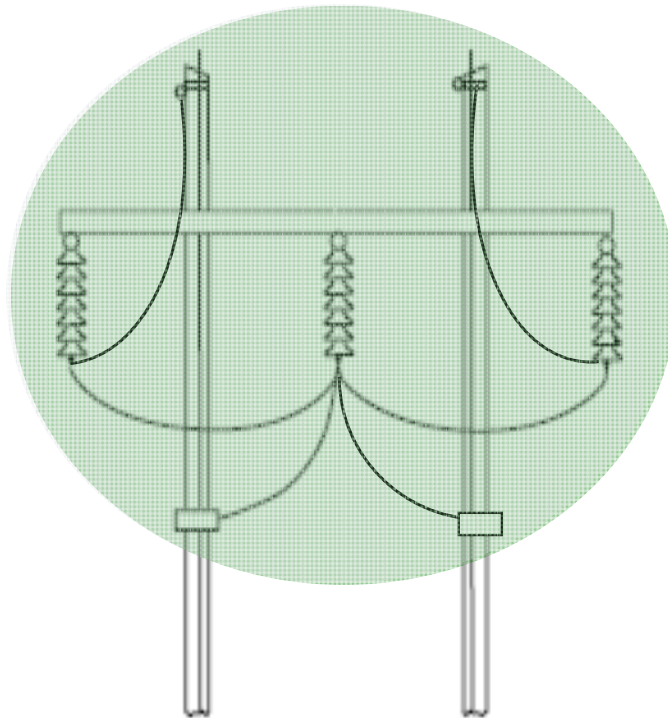


If the continuity is not maintained with the permanent jumper, two grounding jumpers are required



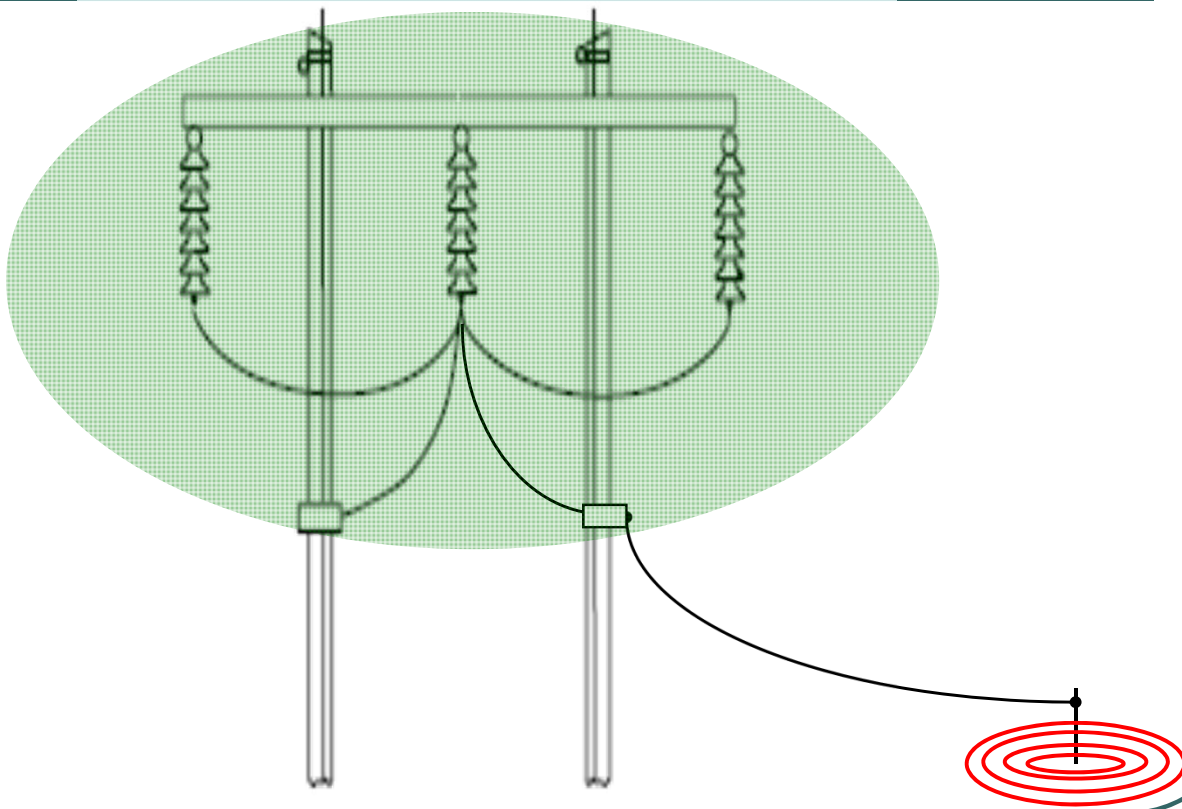


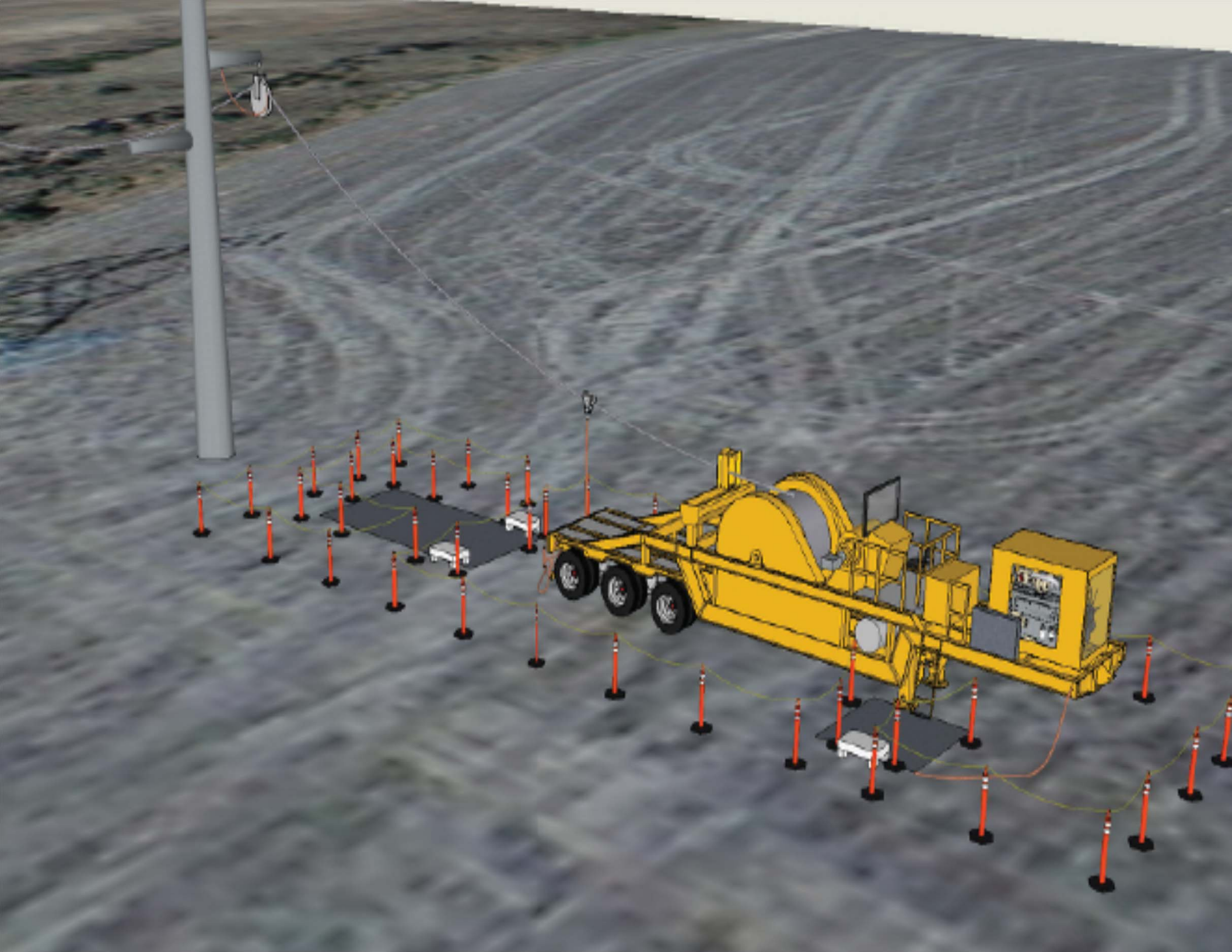
With Shield Wire

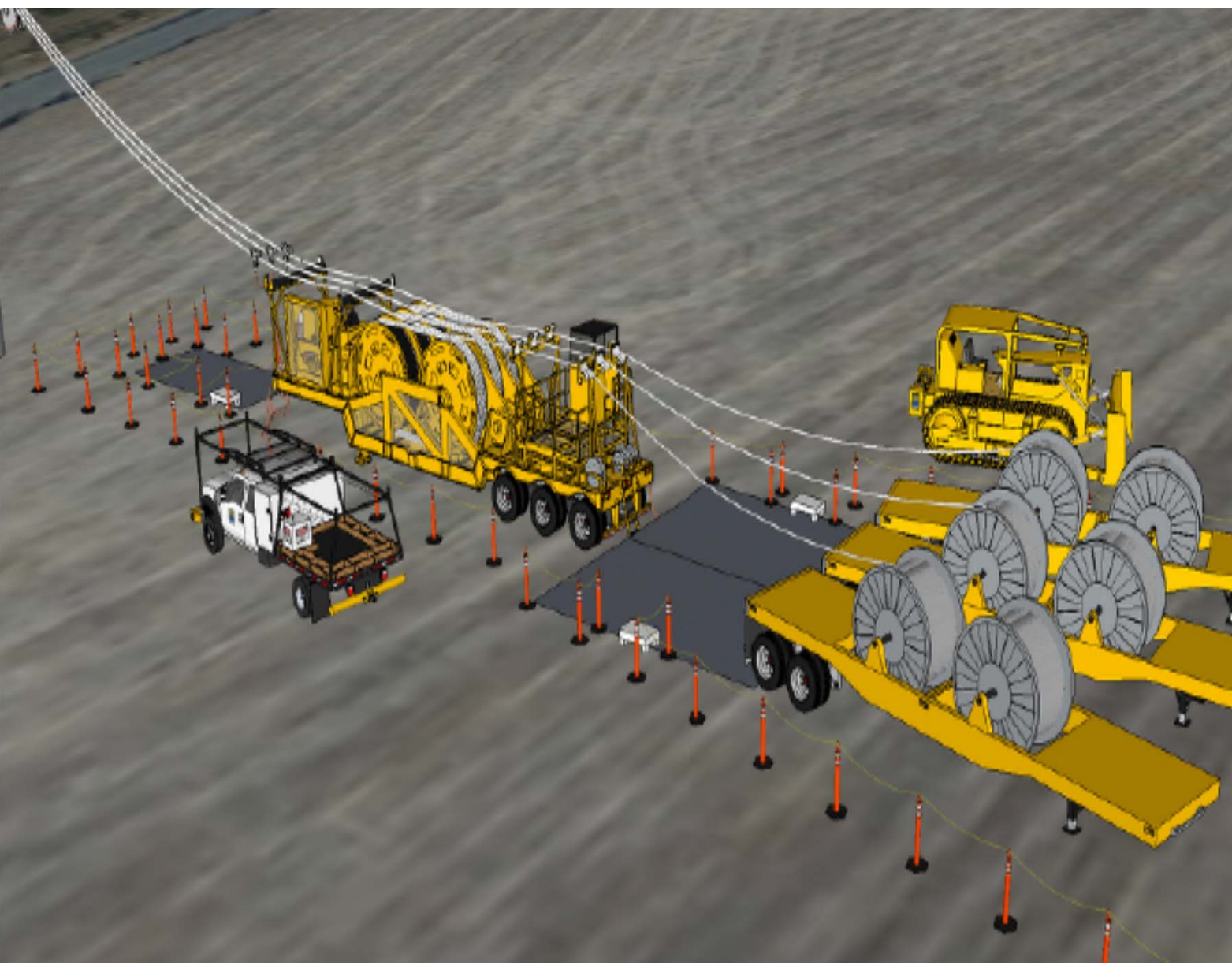




No Shield Wire

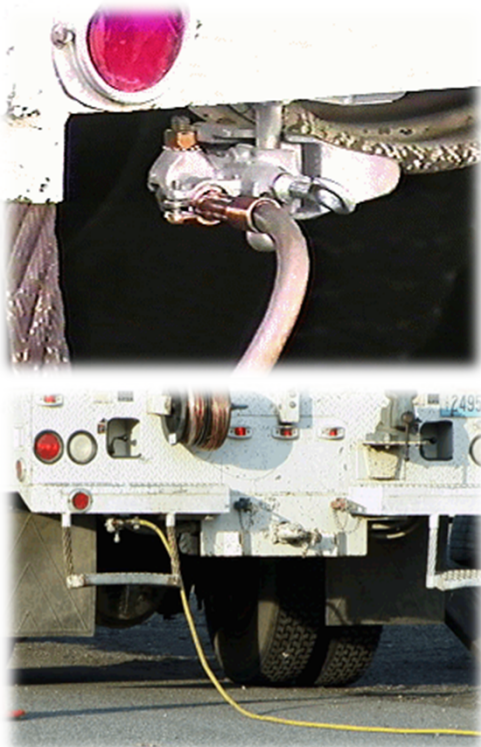








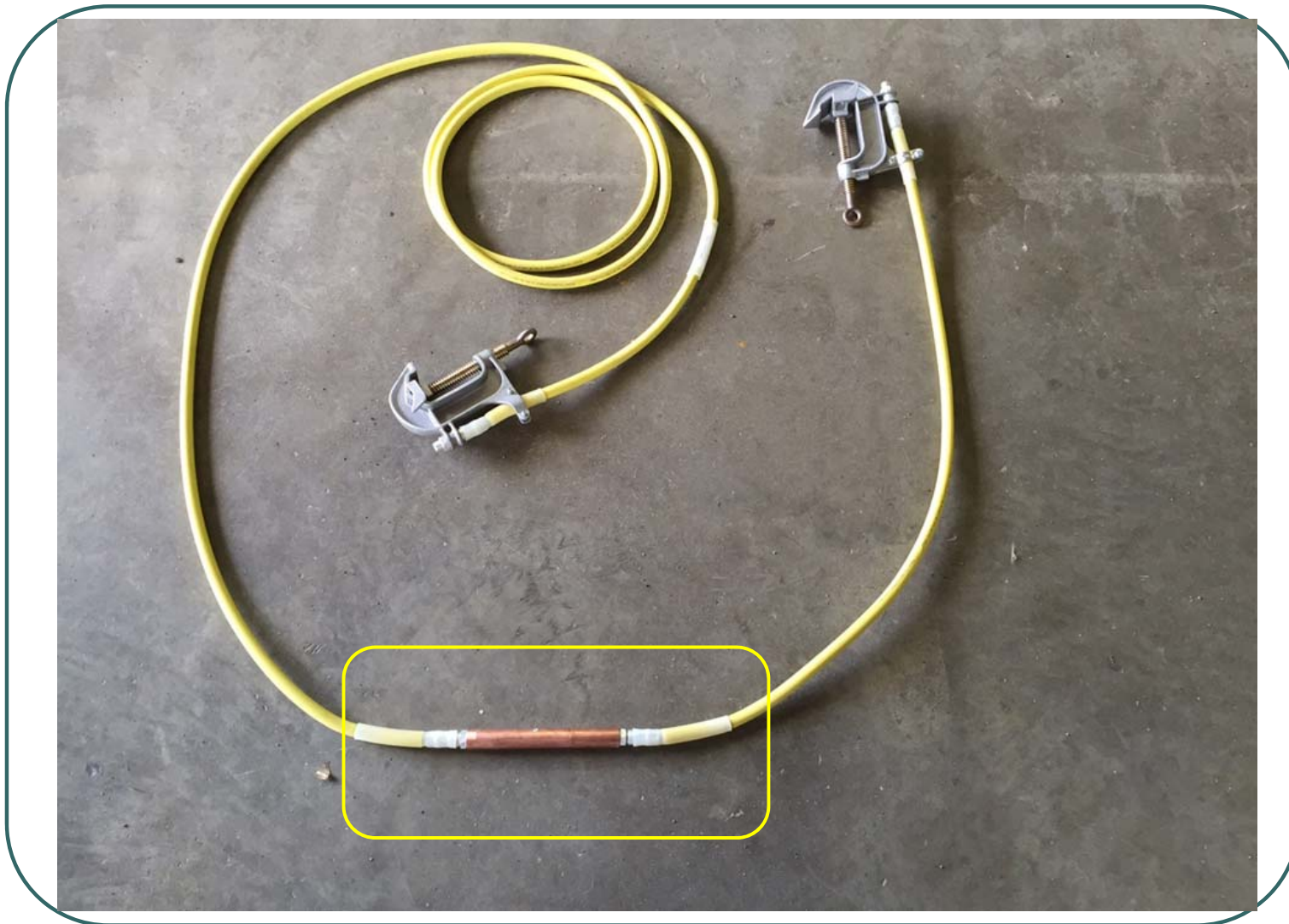
Equipment Grounding



- Equipment
 - Approved connection point capable of handling the anticipated fault current
- Ground Source
 - To system neutral (or)
 - A pole ground (or)
 - To a grounded structure (or)
 - To a Temporary Ground Rod
 - *driven or screw type*

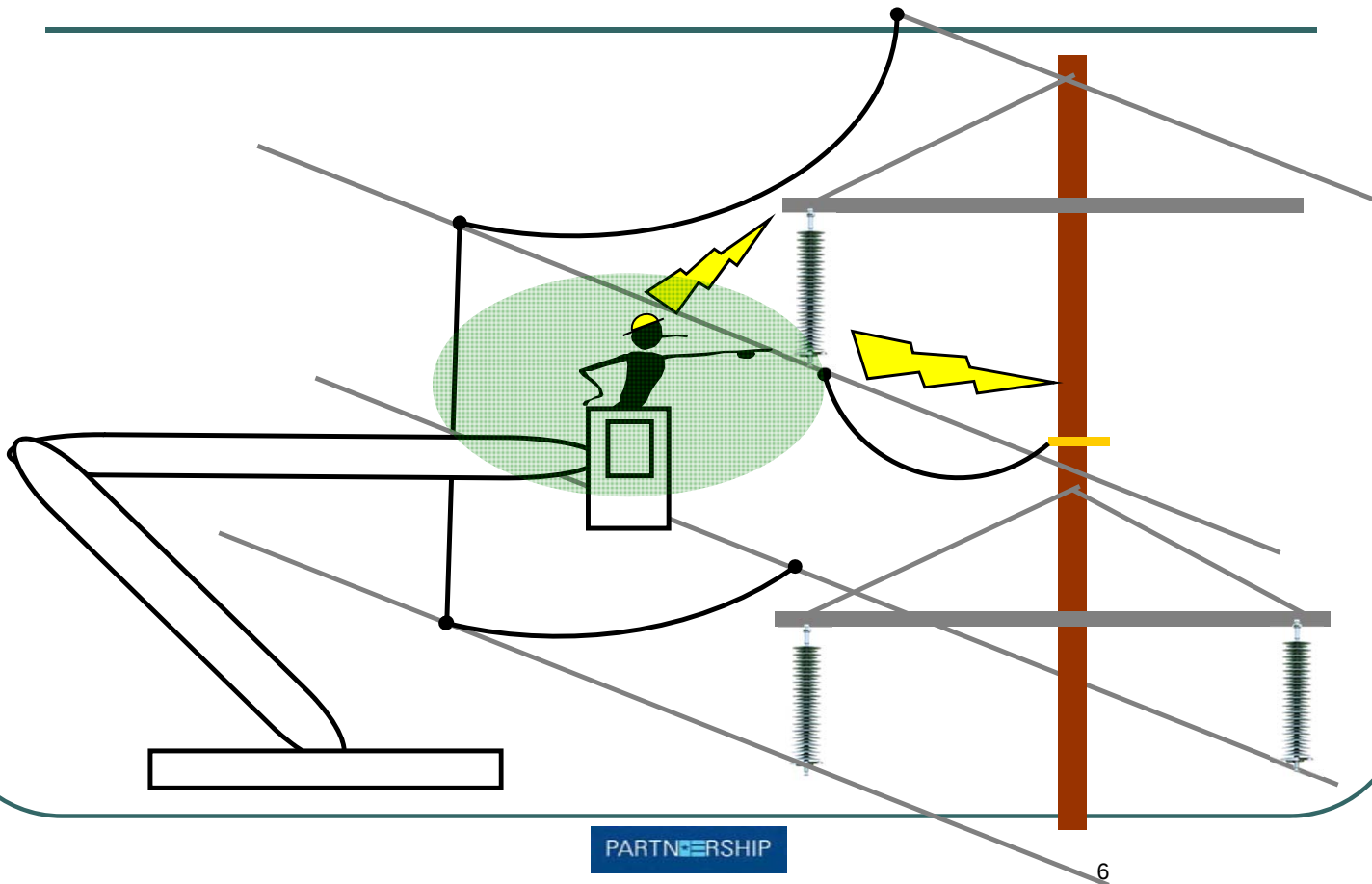
Bonding Non-Insulated Aerial Lift







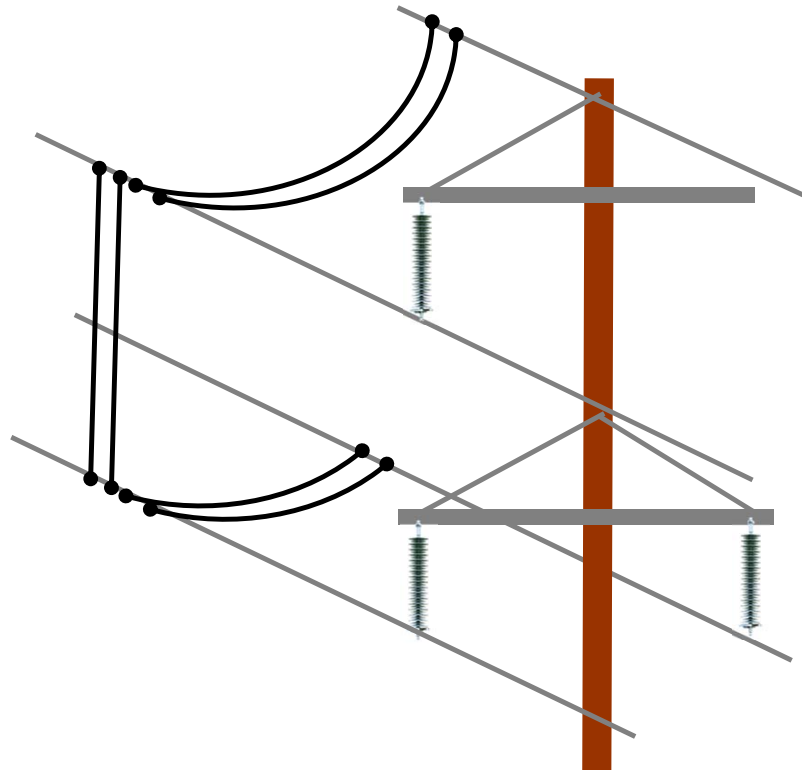
Insulated Aerial Lift





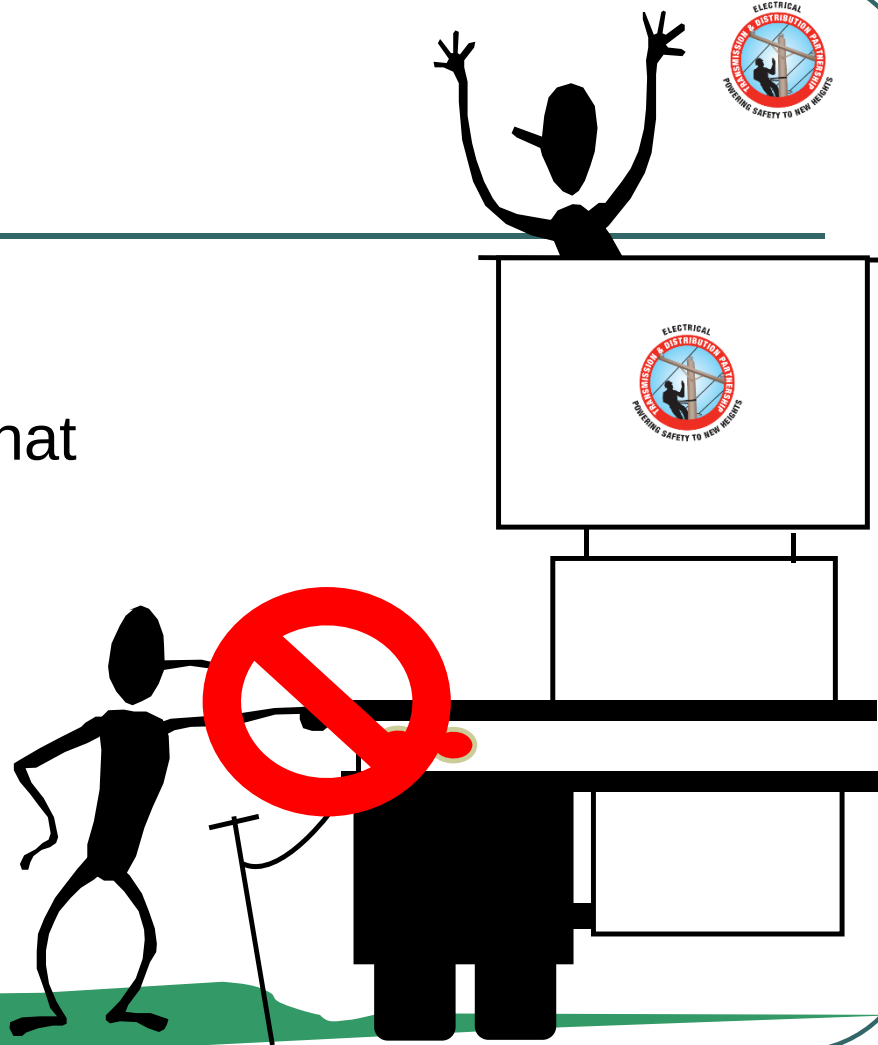
Parallel Ground Sets

- Determine the current carrying capacity of a single ground
- Multiply by 2
 - Reduce by 10% if restrained
 - Reduce by 20% if unrestrained



Barricade

- Grounding a vehicle will not protect workers that may contact the vehicle if the vehicle becomes energized



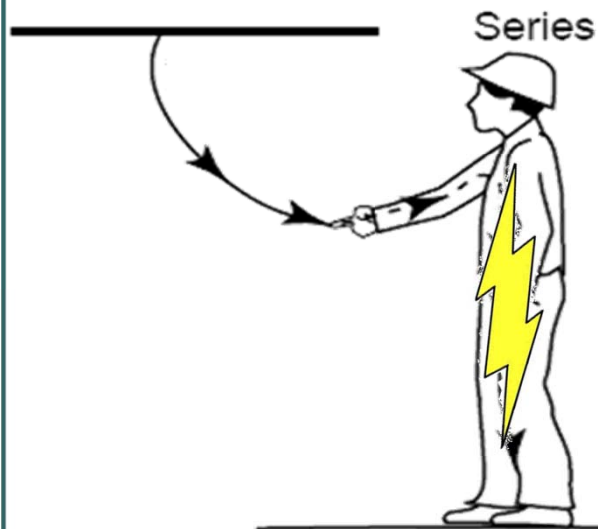
Recap



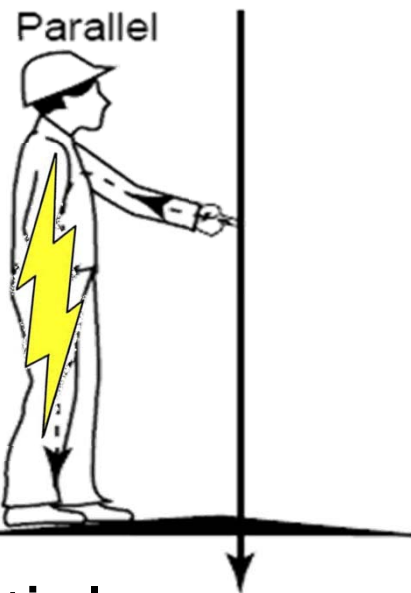


Safety Fundamental

Voltage



Voltage



Lower Potential

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