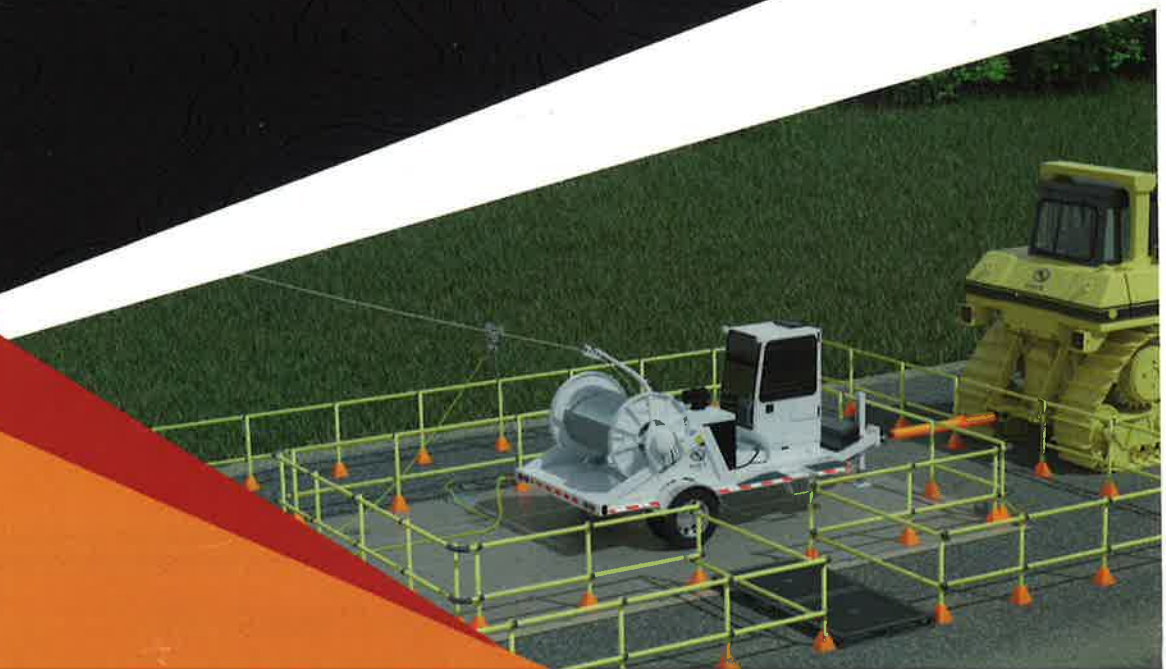
GROUNDING & BONDING

OVERHEAD GUIDEBOOK



QUANTA SERVICES

PRODUCED BY NLC CREATIVE

LINEMAN.EDU

DISTRIBUTED BY:

ALEXANDER publications

QUANTA SERVICES

FOR QUANTA COMPANIES:

To ***order more books***, scan the QR code or follow this link: uqr.to/gboverhead

1st Edition, 1st Printing, Oct. 2020

PURPOSE STATEMENT

This guidebook is intended as a resource for Quanta Services Inc. operating units that are required to perform grounding and bonding tasks. The designers realize that work done by crews can be dynamic and involve varying conditions and hazards that may not be fully captured in this guidebook. While this guidebook provides examples of typical grounding and bonding scenarios based on company and industry experience, it is necessary that supervision and crew members select the most appropriate methods, in compliance with applicable law, operating unit policies, and client requirements. The desired result is that the selected method for grounding and bonding safeguards workers and others from hazardous differences in electrical potential.

SAFETY NOTICE

REFER TO SAFETY, HEALTH, AND ENVIRONMENTAL PROGRAM MANUAL FOR SPECIFIC REQUIREMENTS

Workers performing grounding and bonding tasks must refer to the latest revision of Chapter 11 of the Quanta Services Inc. Safety, Health, and Environmental program manual as well as any other applicable specific grounding and bonding requirements. If a situation arises that requires a Quanta Services Inc. operating unit employee to perform any job task in conflict with an established safety policy and/or procedure, contact operating unit supervision before proceeding. Quanta Energized Services (QES) can be contacted to assist with the design, development, and review of any overhead distribution, subtransmission, and transmission grounding and bonding scenarios for worker protection. QES specializes in the design, development, and implementation of safe stringing procedures for work being performed in high induction environments.

DOWNLOAD CHAPTER 11

Scan the QR code or follow this link:
uqr.to/ch-11

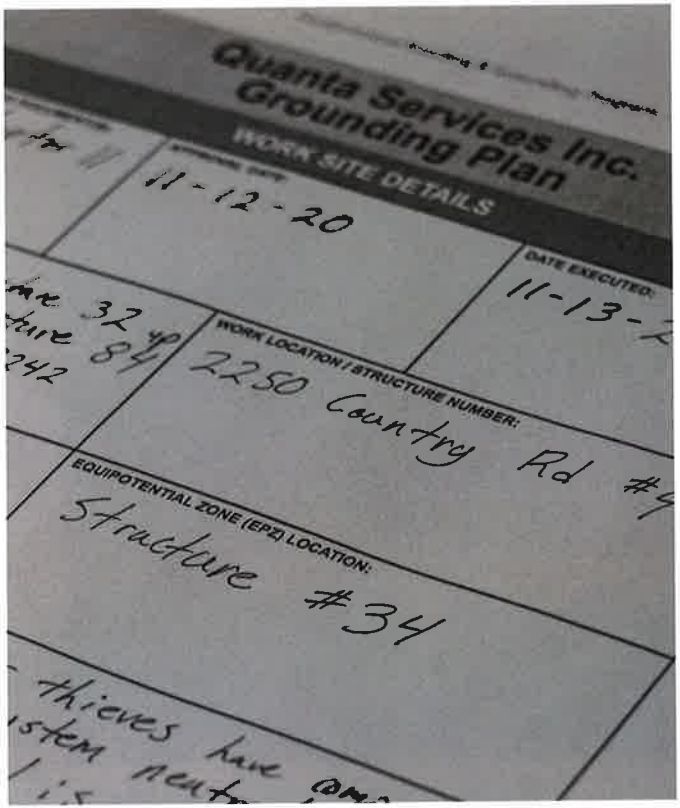
GROUNDING PLAN

The grounding plan is a detailed plan which addresses grounding and bonding for the specific project being performed. The components of a grounding plan may include the following:

- Creation of the equal potential zone (EPZ)
- Ground jumper size (ampacity)
- Ground and bond jumper placement & order of operations

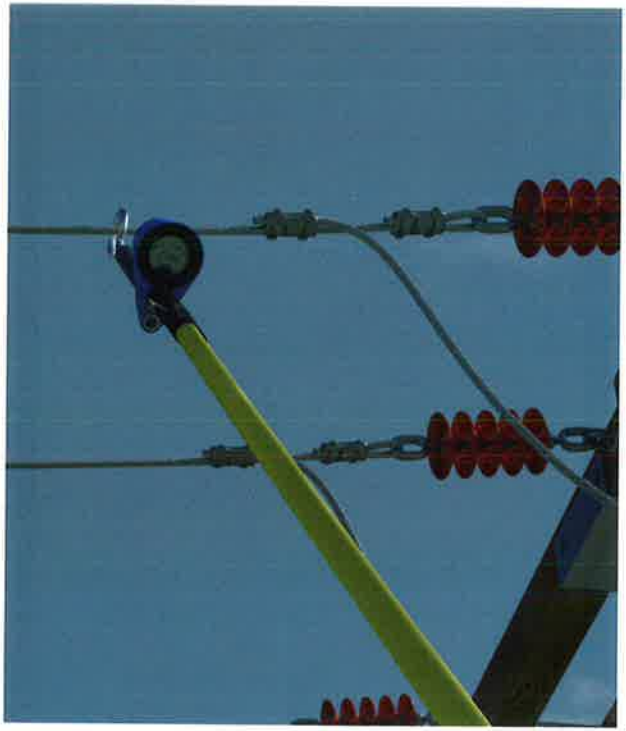
A GROUNDING PLAN FOR WORKER PROTECTION MUST BE DEVELOPED FOR EACH PROJECT BEING PERFORMED.

This guidebook illustrates many common overhead grounding and bonding scenarios but is not meant to replace sound judgment, reasoning, critical thinking, and industry-best practices for safeguarding workers from hazardous differences in electrical potential or other electrical hazards.



BEFORE WORK BEGINS

ALWAYS TEST



Test all conductors for absence of nominal voltage before applying grounds.

ALWAYS INSPECT

Inspect for missing, broken, or damaged grounds.

CONSIDERATIONS

EQUAL POTENTIAL WORK ZONE

In this guidebook EPZ stands for Equal Potential Work Zone.

REMOTE GROUNDING

Remote grounding means that master grounds are installed away from the work location.

TRUCK GROUNDS

Refer to jurisdictional requirements for when to utilize truck grounds.

POLE GROUND

On wooden poles, install a bonding jumper between the cluster bracket and the pole ground. In the absence of a ground wire, drive a staple or lag screw into the chain or in the base of the cluster bracket (if equipped) to accept one. This enhances the connection between the cluster bracket and the wooden pole.

TEMPORARY GROUND RODS

When using a temporary screw-in ground rod (TGR) or a driven ground rod, always install the rod as deep as soil conditions will permit in order to achieve maximum effectiveness as a ground source.

GROUNDING & BONDING

TABLE OF CONTENTS

GROUNDING & BONDING

STEEL STRUCTURE

SINGLE CONDUCTOR

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED

SS-1A

SS-1B

This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements. Avoid touch potential hazards by using a non-conductive access platform. Consider having an access/egress point to the platform.

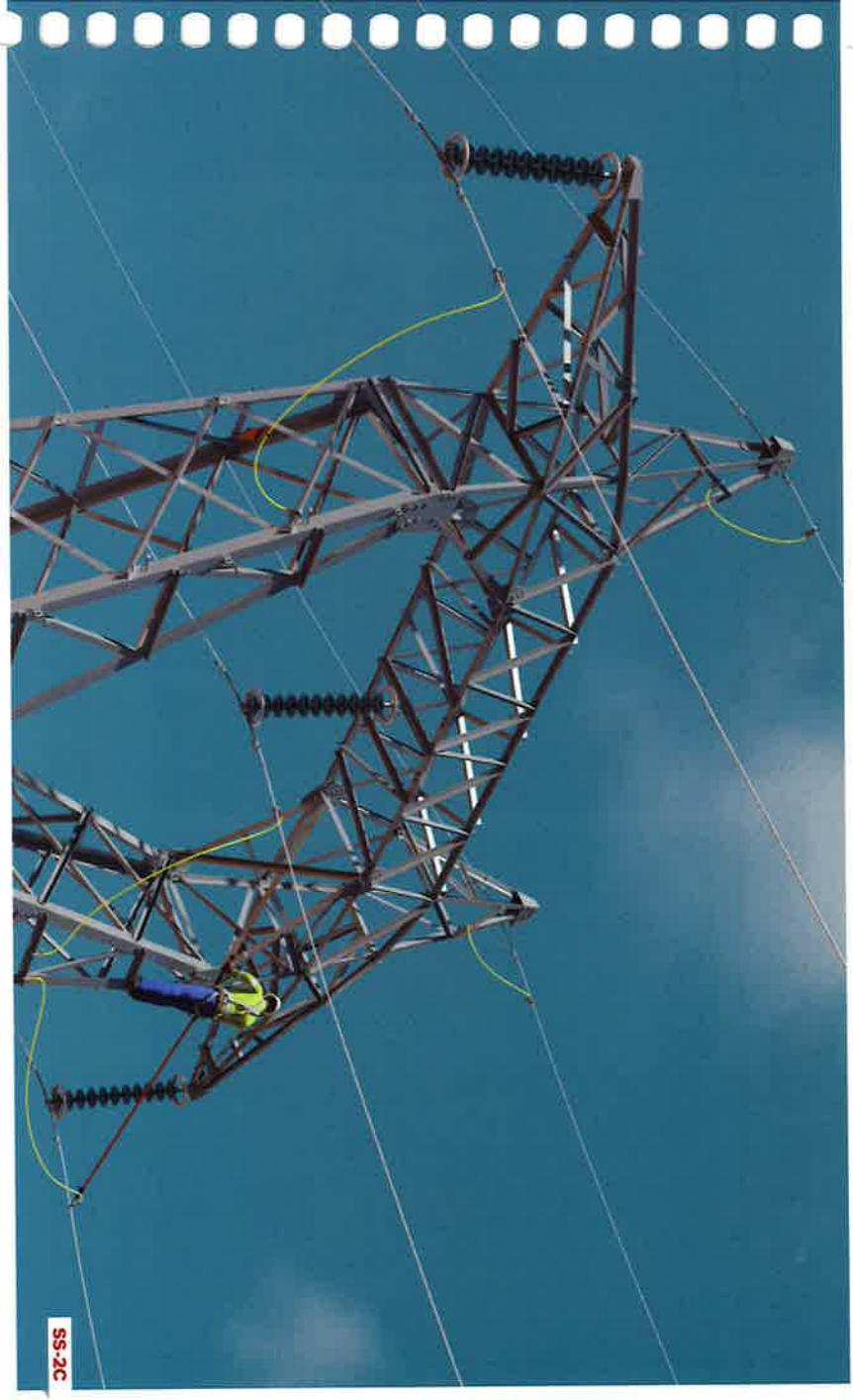

SS-1C

ALTERNATE SINGLE CONDUCTOR

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED

This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements. Avoid touch potential hazards by using a non-conductive access platform. Consider having an access/egress point to the platform.

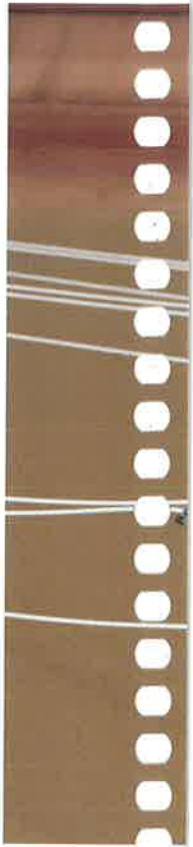

SS-2C

BUNDLE CONDUCTOR

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED

This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. When grounding bundle conductors, each conductor in the bundle must be grounded. Hardware, such as yoke plates, shall not be used as a point of attachment for ground conductors. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements. Avoid touch potential hazards by using a non-conductive access platform. Consider having an access/egress point to the platform.

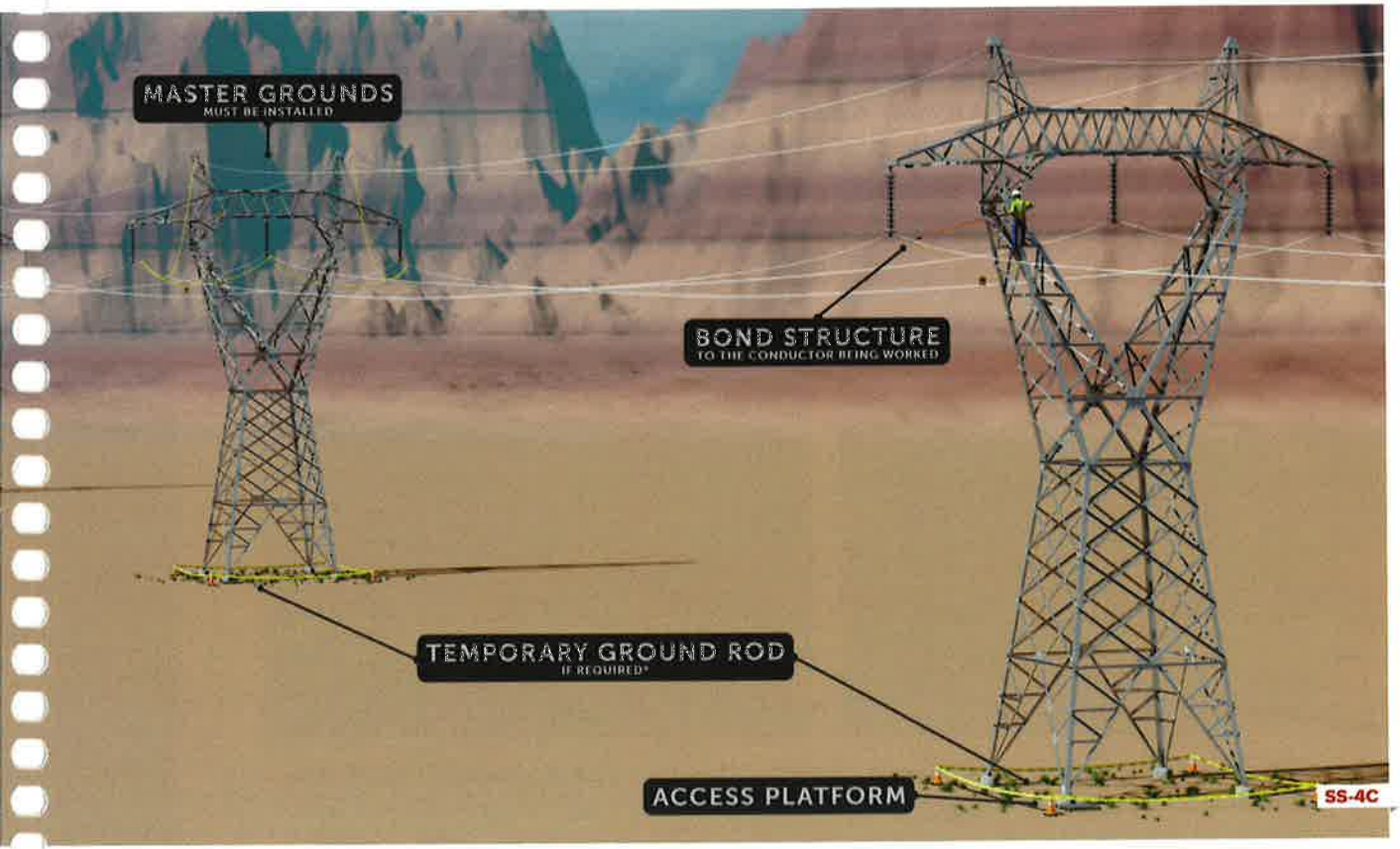



SS-3C

EPZ ON THE
CONDUCTOR BEING WORKED

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED

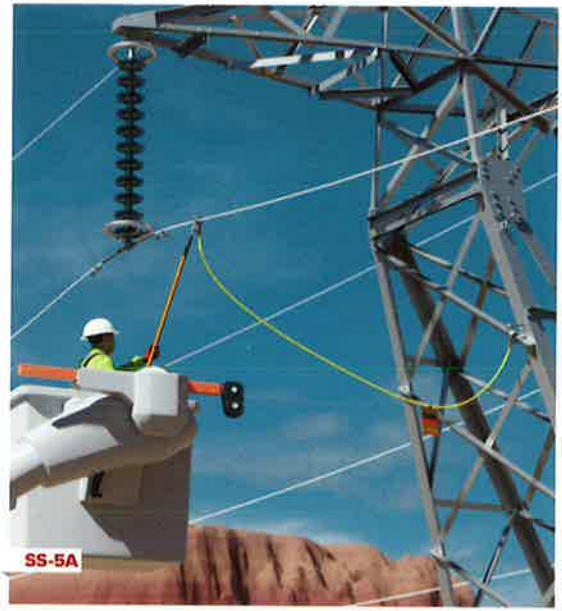
Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements. Avoid touch potential hazards by using a non-conductive access platform. Consider having an access/egress point to the platform.


MASTER GROUNDS
MUST BE INSTALLED
BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
TEMPORARY GROUND ROD
IF REQUIRED*
ACCESS PLATFORM
SS-4C

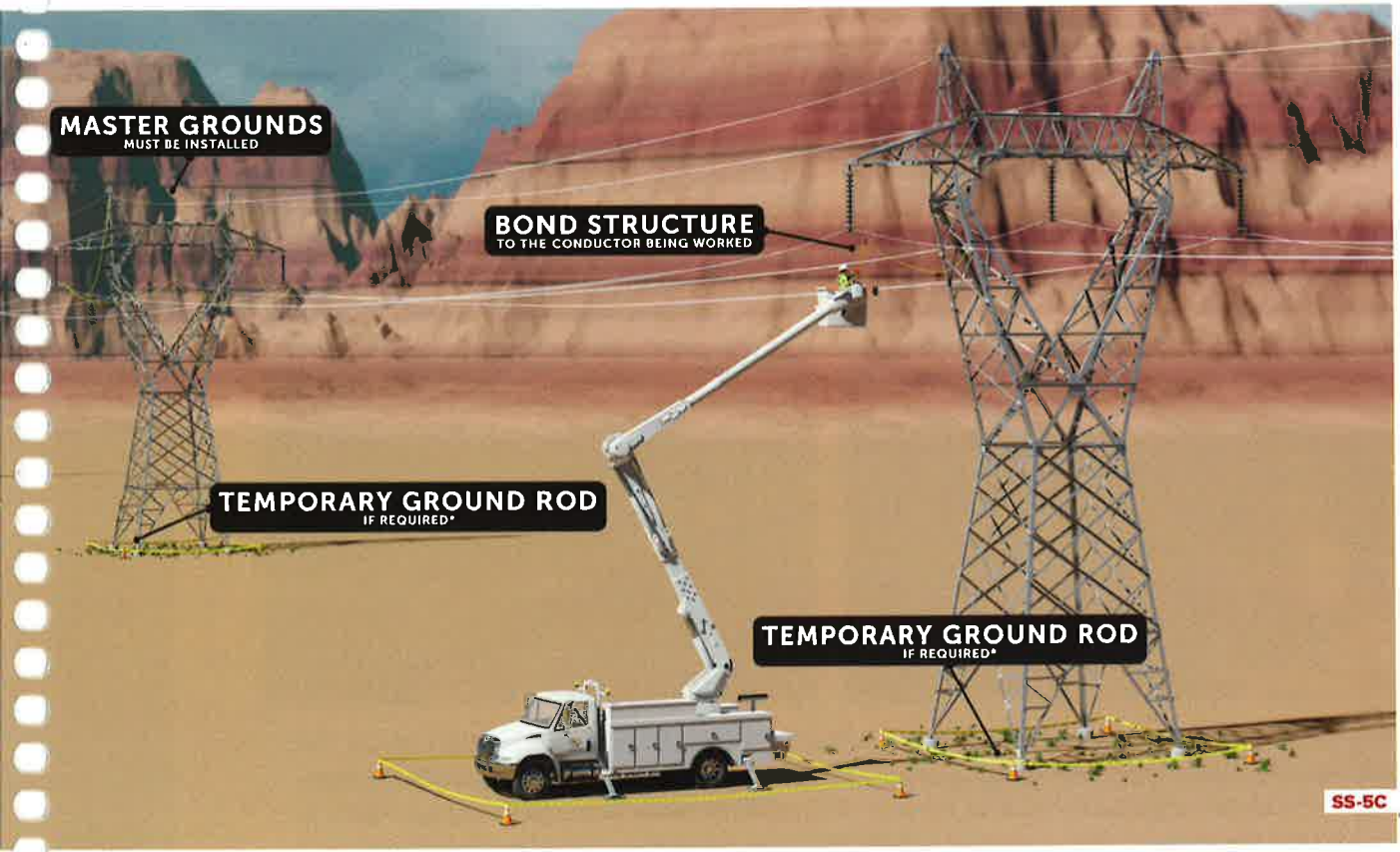
EPZ

INSULATED AERIAL LIFT

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED



Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements.


MASTER GROUNDS
MUST BE INSTALLED
BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
TEMPORARY GROUND ROD
IF REQUIRED*
TEMPORARY GROUND ROD
IF REQUIRED*
SS-5C

EPZ

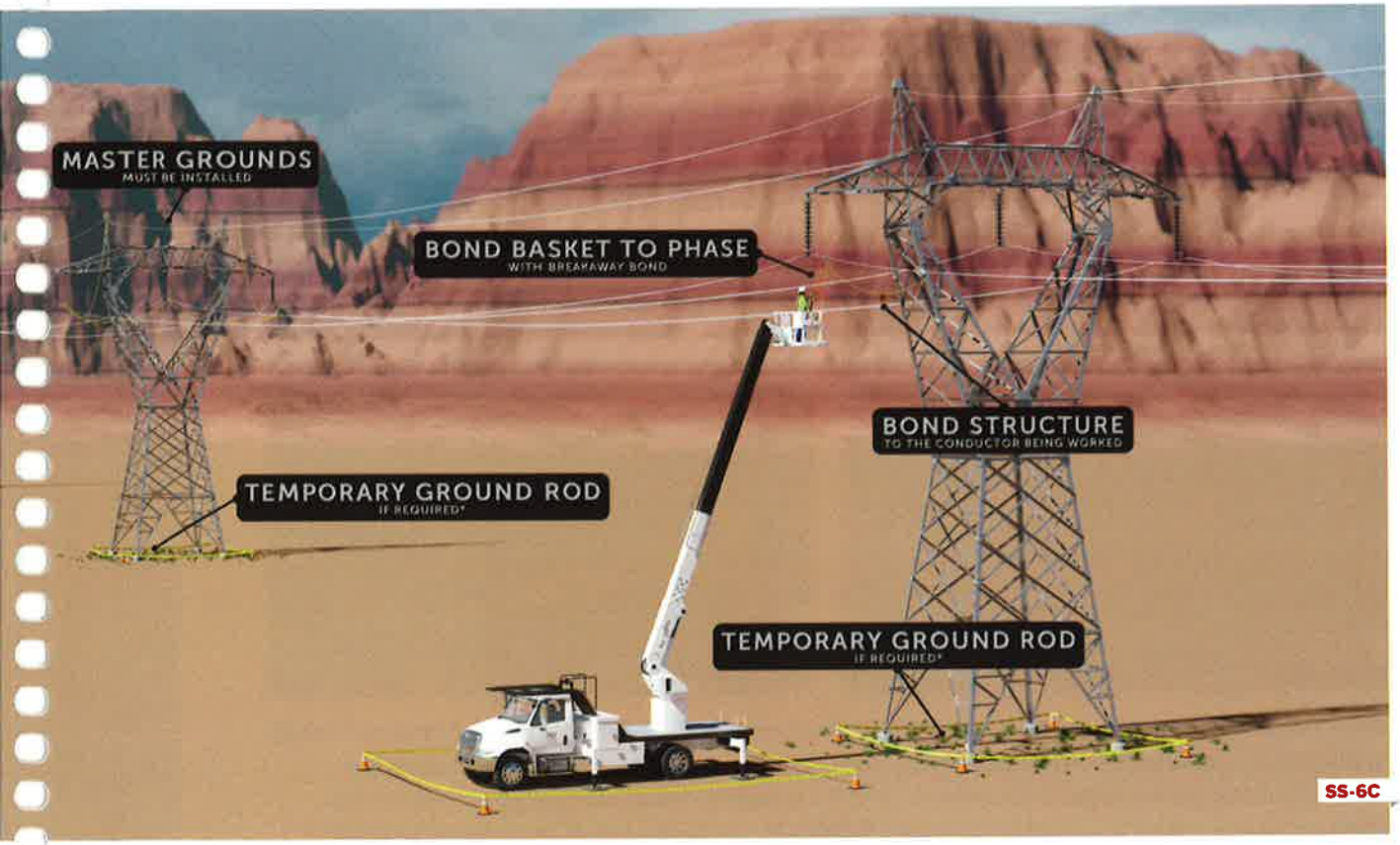
NON-INSULATED AERIAL LIFT

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED


SS-6A

SS-5B

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The breakaway bond clamp must make good surface contact with the platform of the non-insulated aerial lift. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements.


MASTER GROUNDS
MUST BE INSTALLED
BOND BASKET TO PHASE
WITH BREAKAWAY BOND
BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
TEMPORARY GROUND ROD
IF REQUIRED*
TEMPORARY GROUND ROD
IF REQUIRED*
SS-6C

EPZ

SHIELD WIRE

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED

Always inspect and test for energized shield wires. When working on or near shield wire it must be bonded to the structure. Bonds must always be installed and removed with a live line tool. Consult customer requirements for ground jumper installation on OPGW conductors. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements. Avoid touch potential hazards by using a non-conductive access platform. Consider having an access/egress point to the platform.


SS-7C

GROUNDING & BONDING

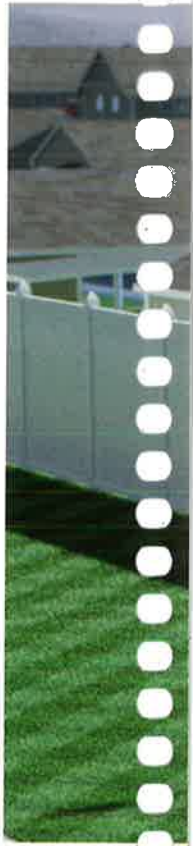
STEEL POLE

*As primary ground source

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: NEUTRAL

This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A grounding cluster may be required in the absence of grounding lugs.




BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
SP-1C

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TEMPORARY GROUND ROD


SP-2A


SP-2B

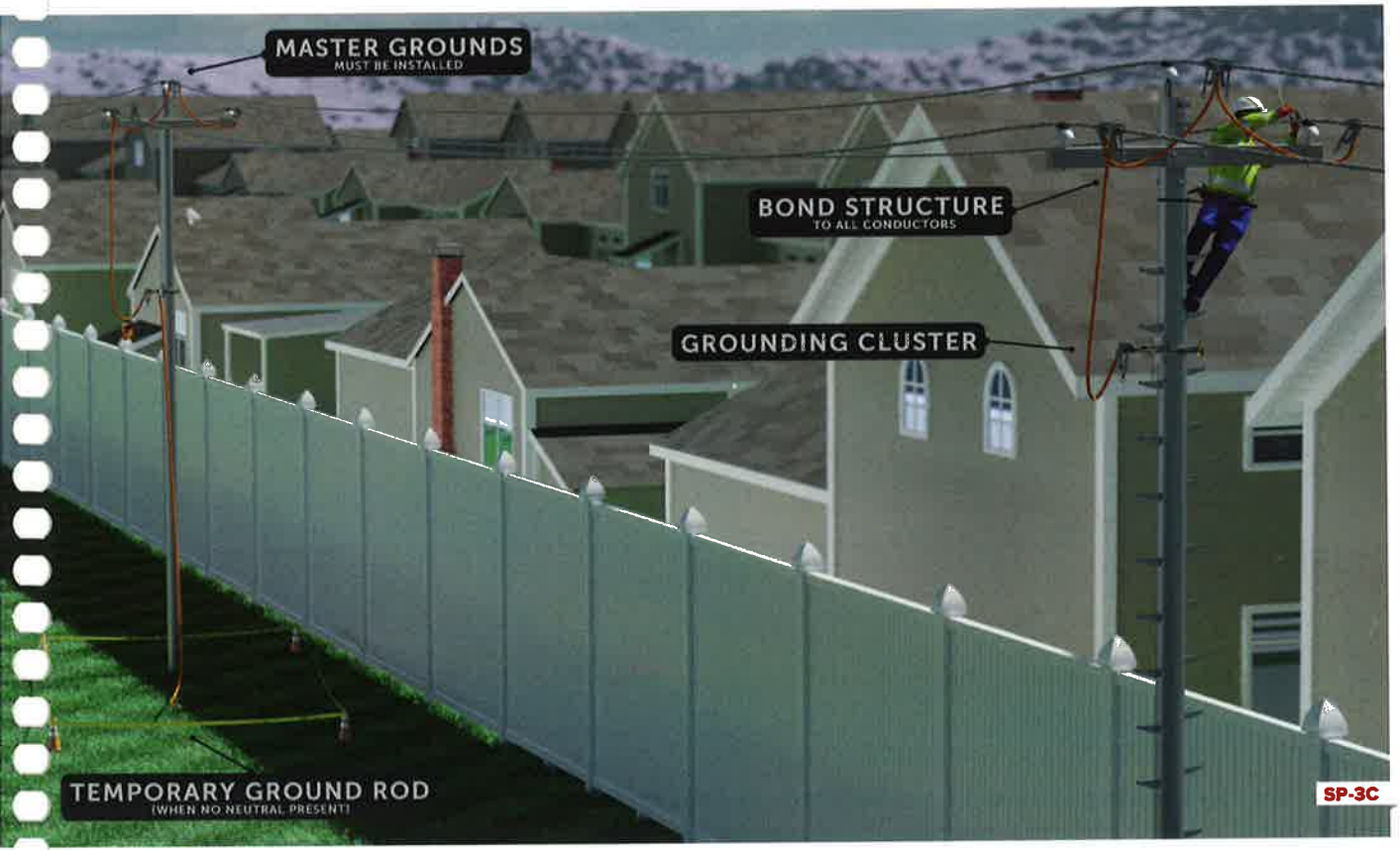
This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A temporary ground rod is needed when no neutral is present. A grounding cluster may be required in the absence of grounding lugs.


BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
SP-2C

WORKSITE BONDING WITH REMOTE GROUNDS

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.


MASTER GROUNDS
MUST BE INSTALLED
BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
SP-3C

EPZ

INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: NEUTRAL

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. A grounding cluster is not required at the master grounds if no work is to be performed at the structure.


BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
SP-4C

EPZ

INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD

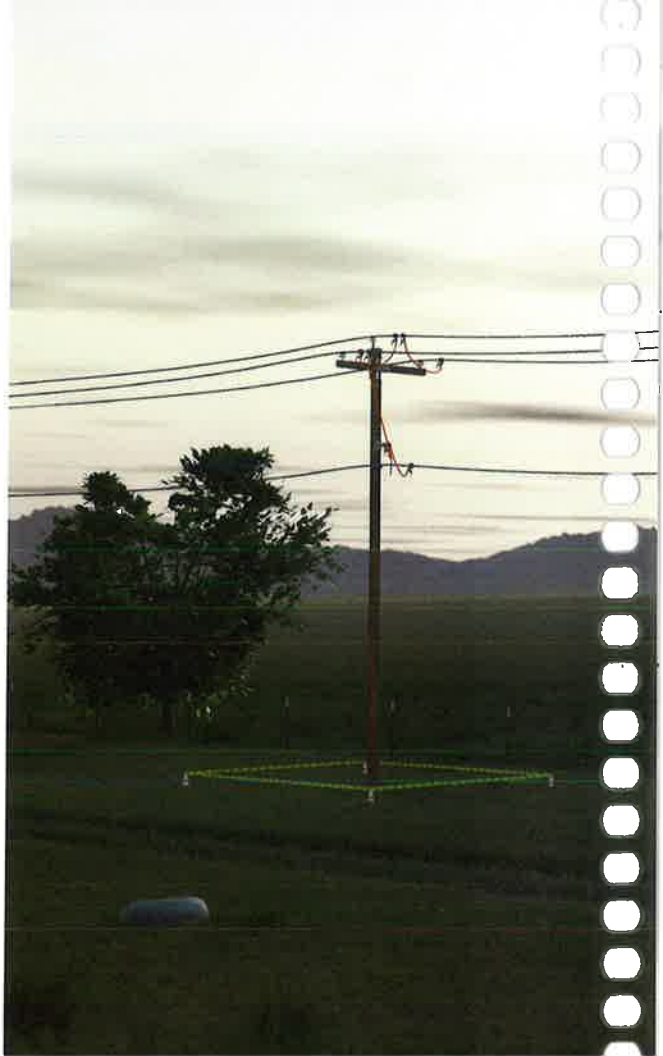
Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.


BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
SP-5C

GROUNDING & BONDING

WOOD POLE

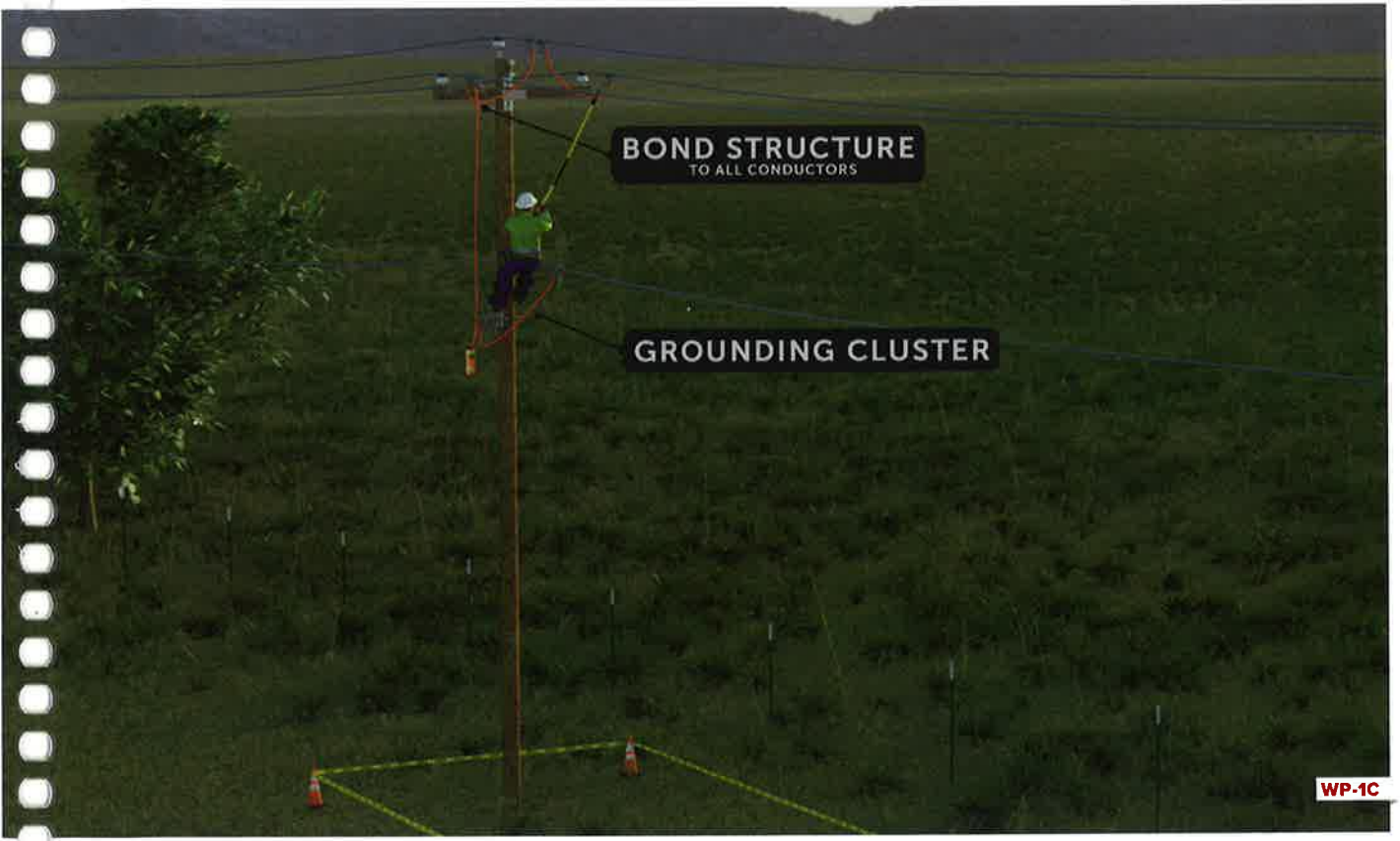
*As primary ground source



MASTER GROUNDS AT WORKSITE

EARTH SOURCE: NEUTRAL

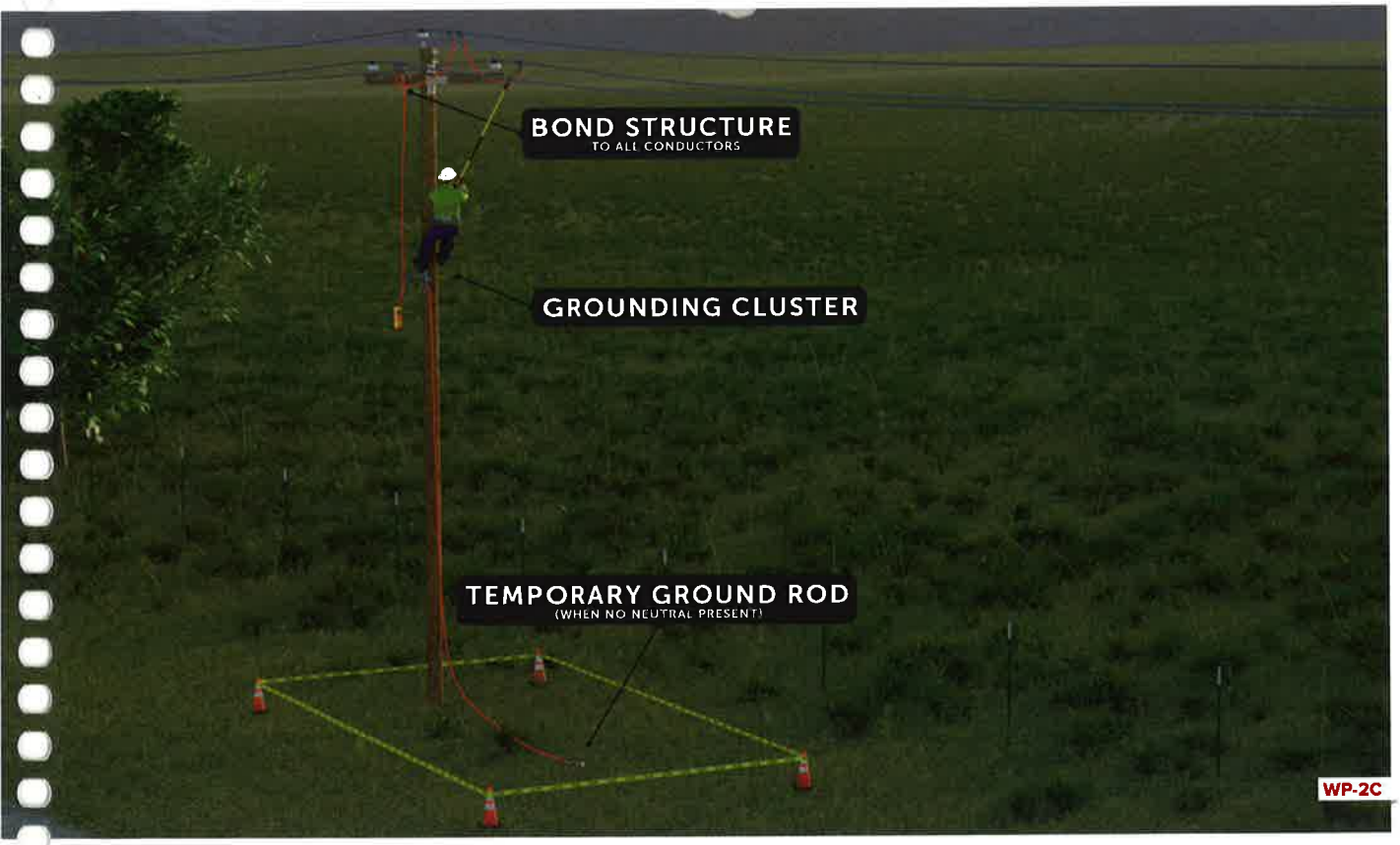
This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A short bonding jumper may be needed from the grounding cluster to the pole ground if no connection between the pole ground and the neutral exists or is suspect.


BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
WP-1C

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TEMPORARY GROUND ROD

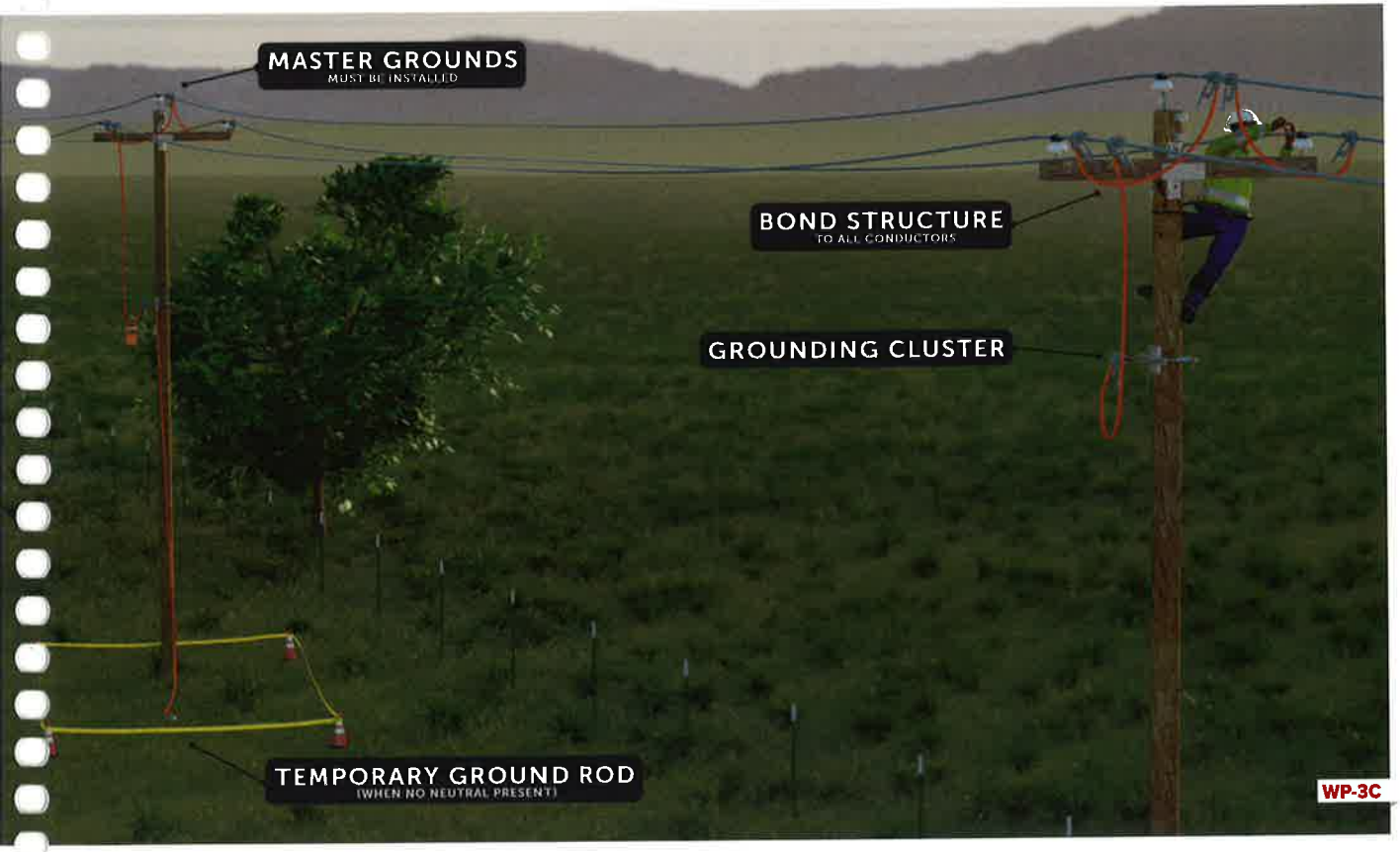
This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A temporary ground rod is needed when no neutral is present.


BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
WP-2C

WORKSITE BONDING WITH REMOTE GROUNDS

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.

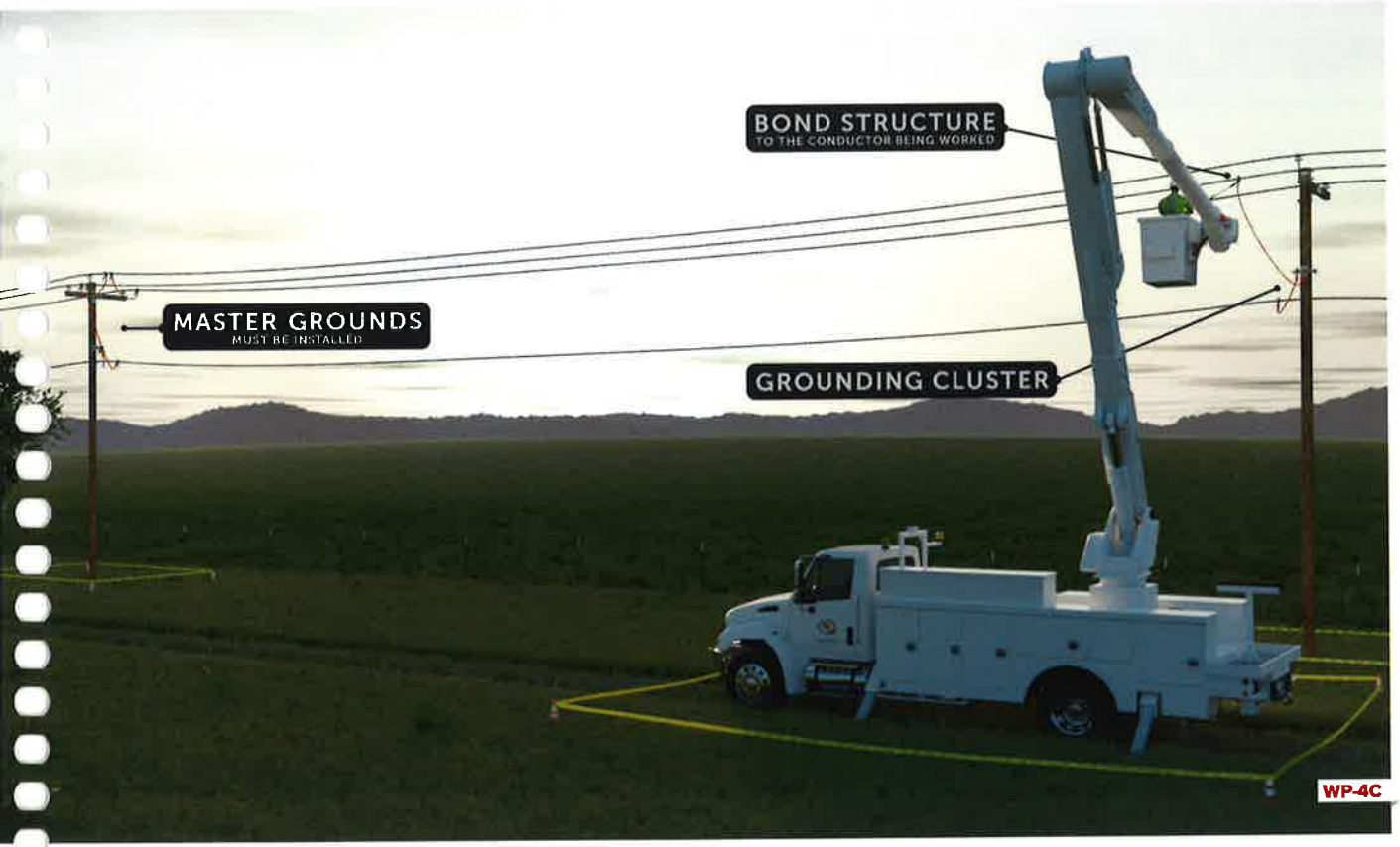

MASTER GROUNDS
MUST BE INSTALLED
BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
WP-3C

EPZ

INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: NEUTRAL

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. A grounding cluster is not required at the master grounds if no work is to be performed at the structure.

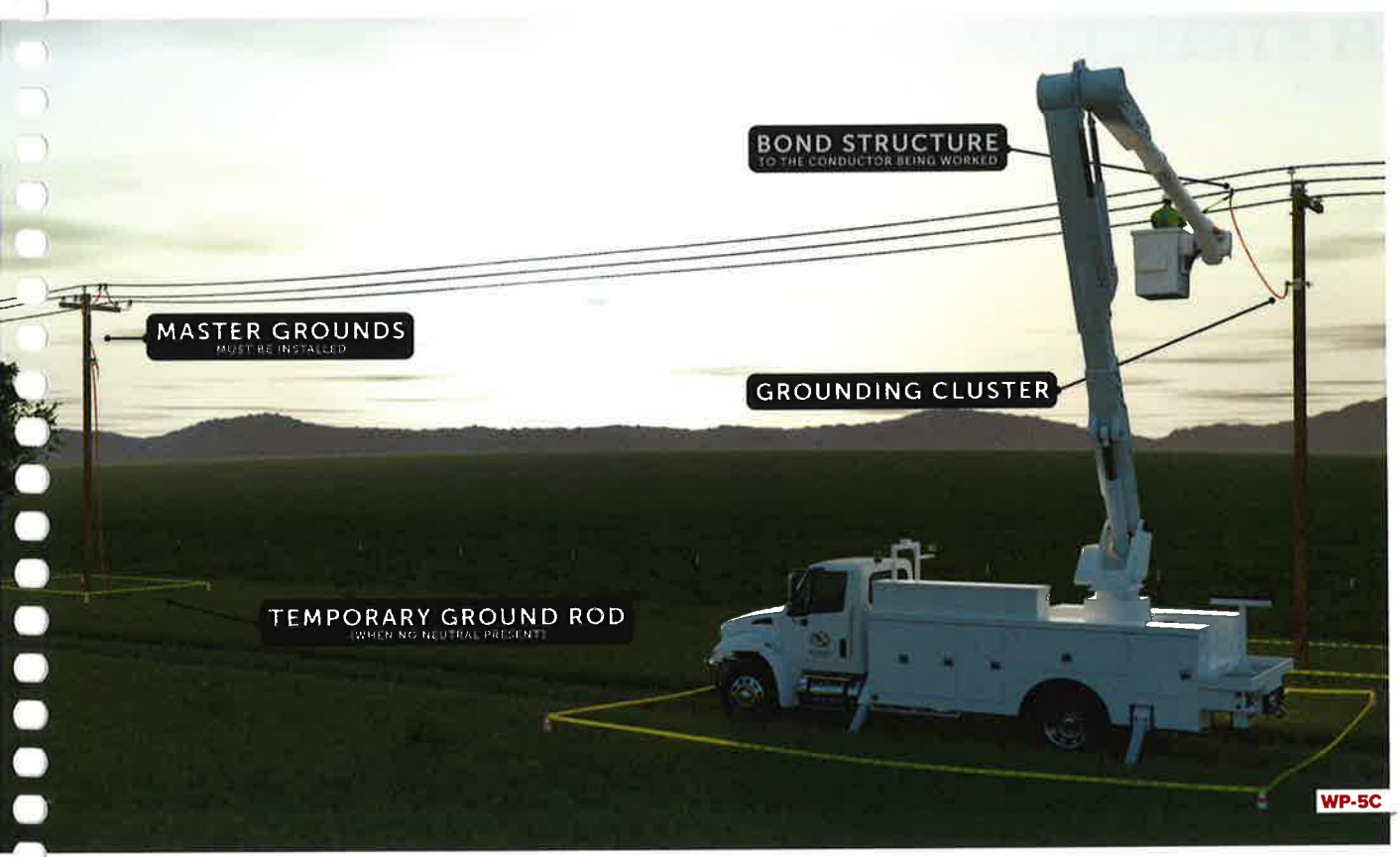

BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
WP-4C

EPZ

INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD

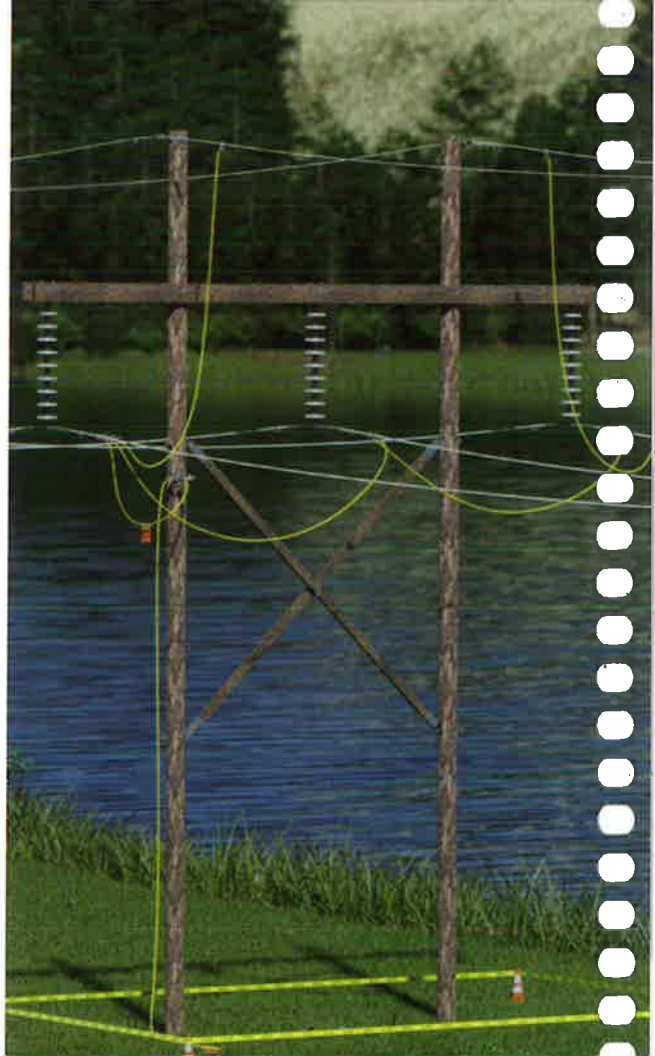
Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.


BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
WP-5C

GROUNDING & BONDING

H STRUCTURE

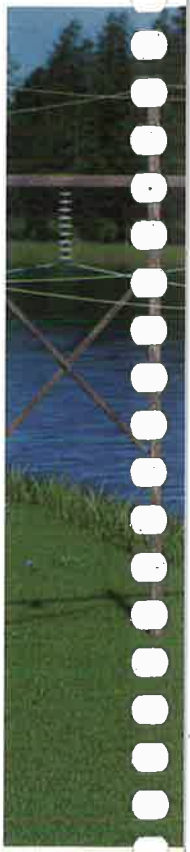
*As primary ground source



MASTER GROUNDS AT WORKSITE

EARTH SOURCE: SHIELD WIRE

This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. In the absence of a pole ground to bond to, place grounding cluster brackets below the bottom attachment points of each X brace.




GROUNDING CLUSTER
HS-1C

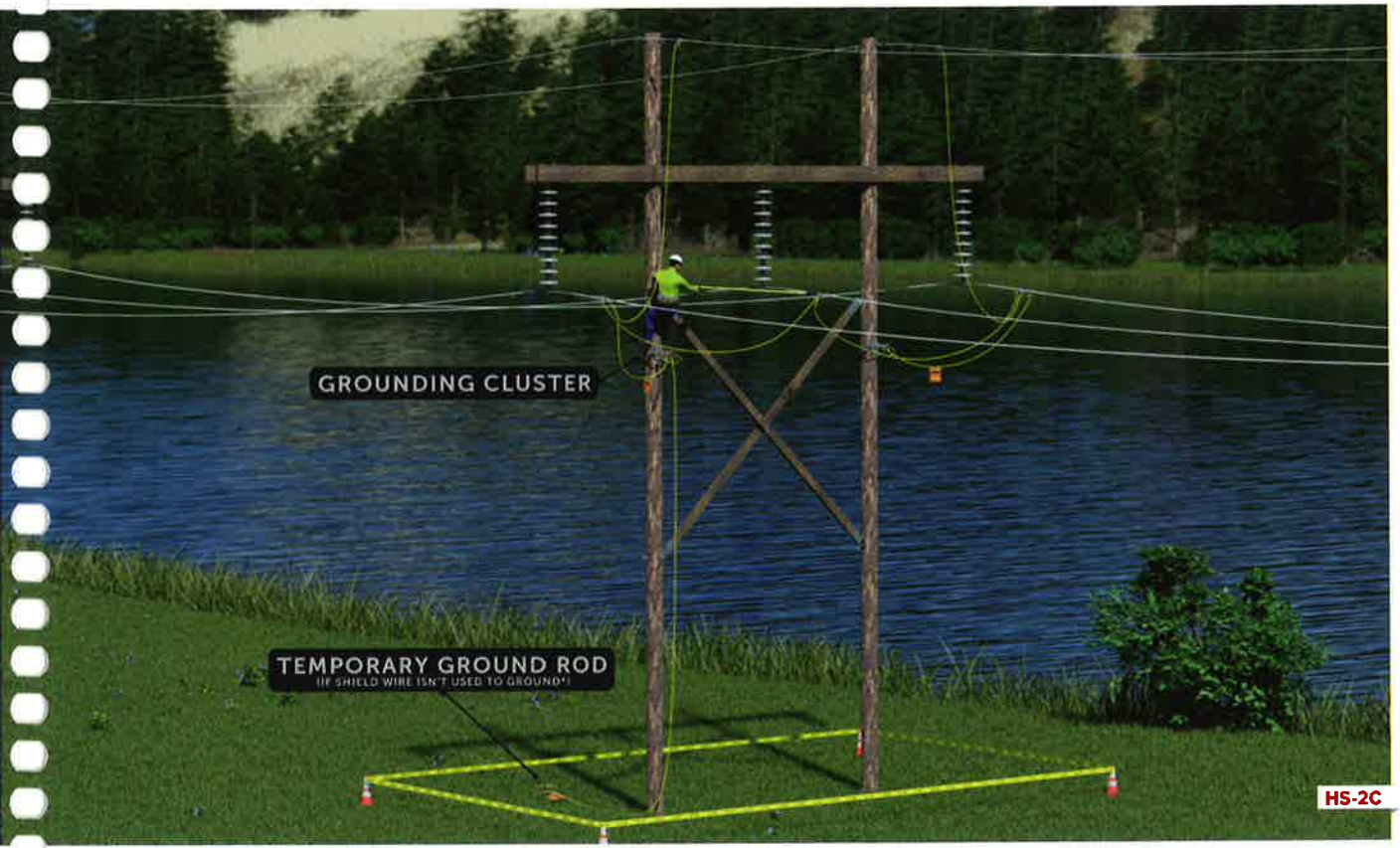
MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TEMPORARY GROUND ROD

HS-2A

HS-2B

This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A temporary ground rod is required when no shield wire is present or if the customer requires it. When working on or near shield wire it must be bonded to the EPZ. In the absence of a pole ground to bond to, place grounding cluster brackets below the bottom attachment points of each X brace.


GROUNDING CLUSTER
TEMPORARY GROUND ROD
(IF SHIELD WIRE ISN'T USED TO GROUND*)

HS-2C

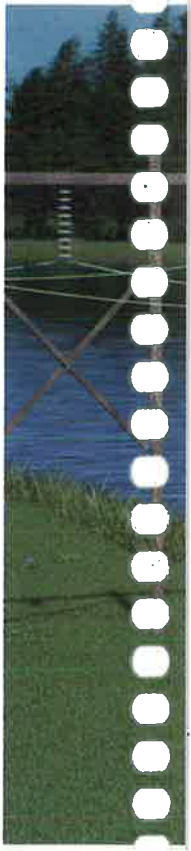
ABSENT SHIELD WIRE AND/OR STRUCTURE GROUND

MASTER GROUNDS AT WORKSITE

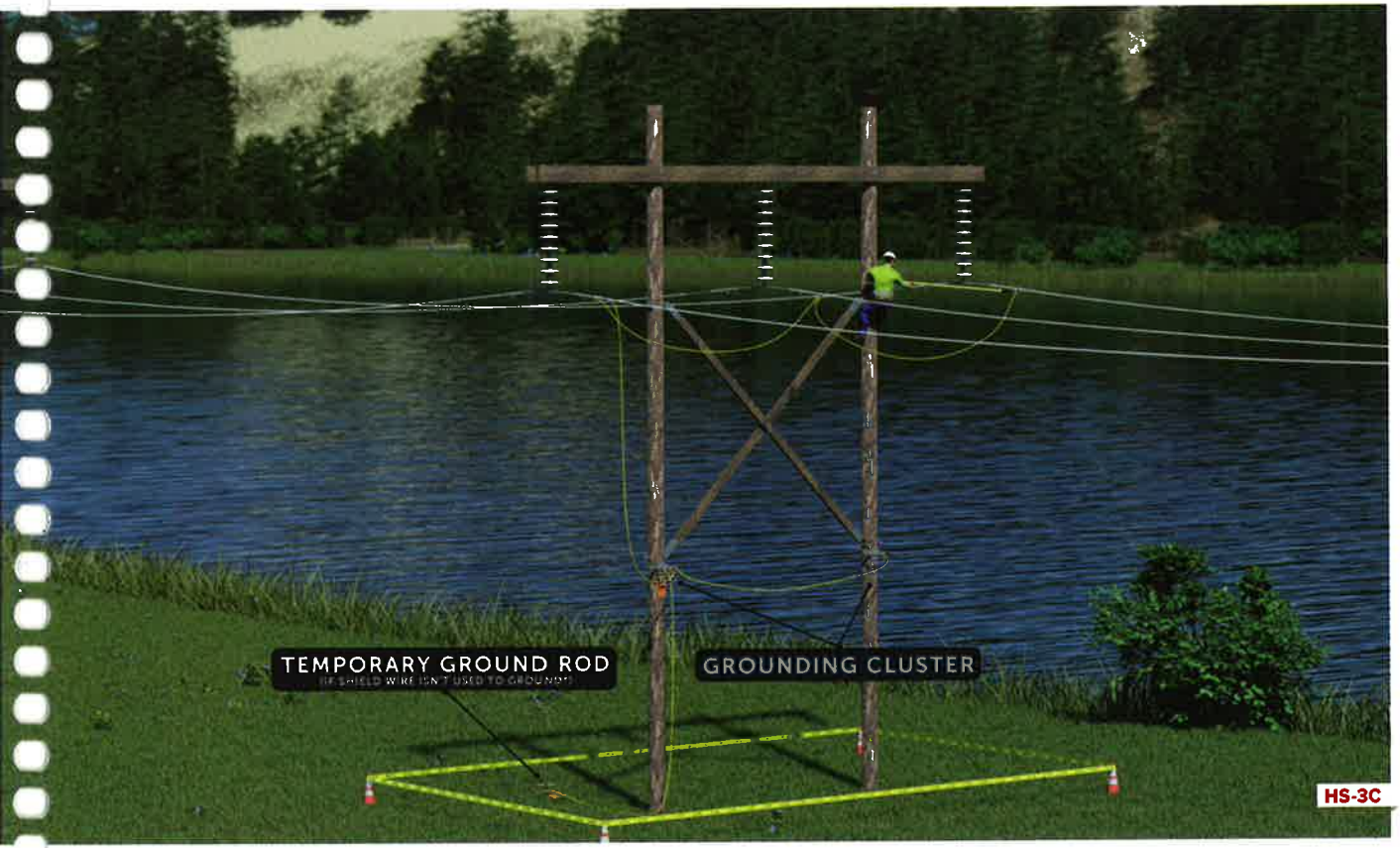
EARTH SOURCE: TEMPORARY GROUND ROD

HS-2A

HS-3B



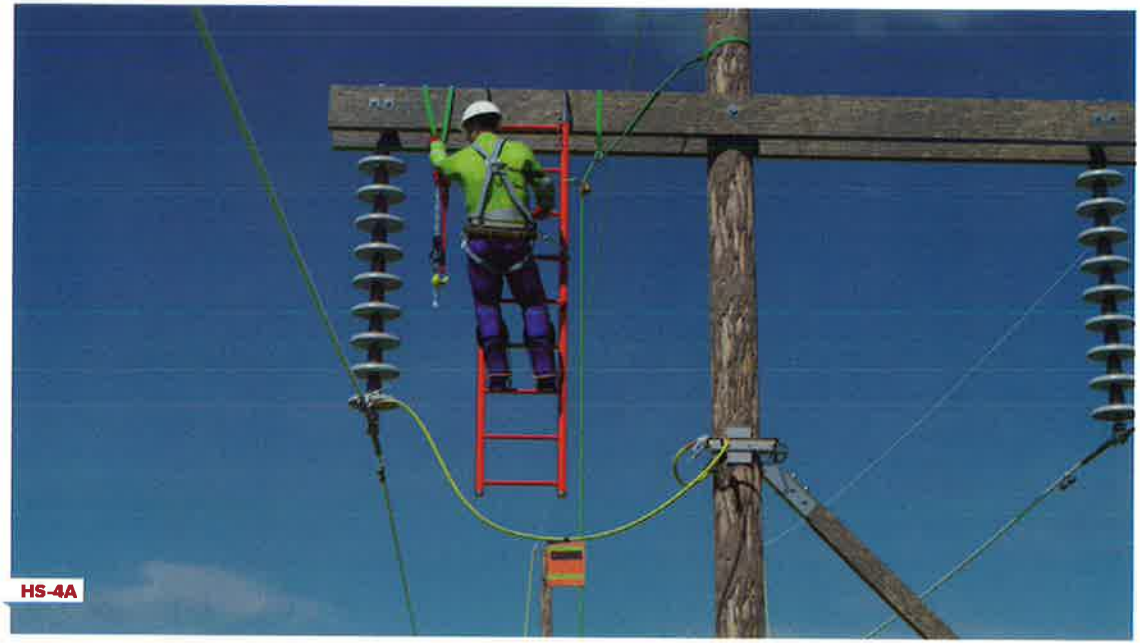
This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A temporary ground rod is required when no shield wire is present or if the customer requires it. If a shield wire and/or structure ground are absent, the cluster brackets must be above the top X brace attachment point and below the workers feet. If the workers feet are below the X brace (as shown) place grounding cluster brackets below the bottom attachment points of each X brace to incorporate all paths to ground into the EPZ.


TEMPORARY GROUND ROD
GROUNDING CLUSTER
HS-3C

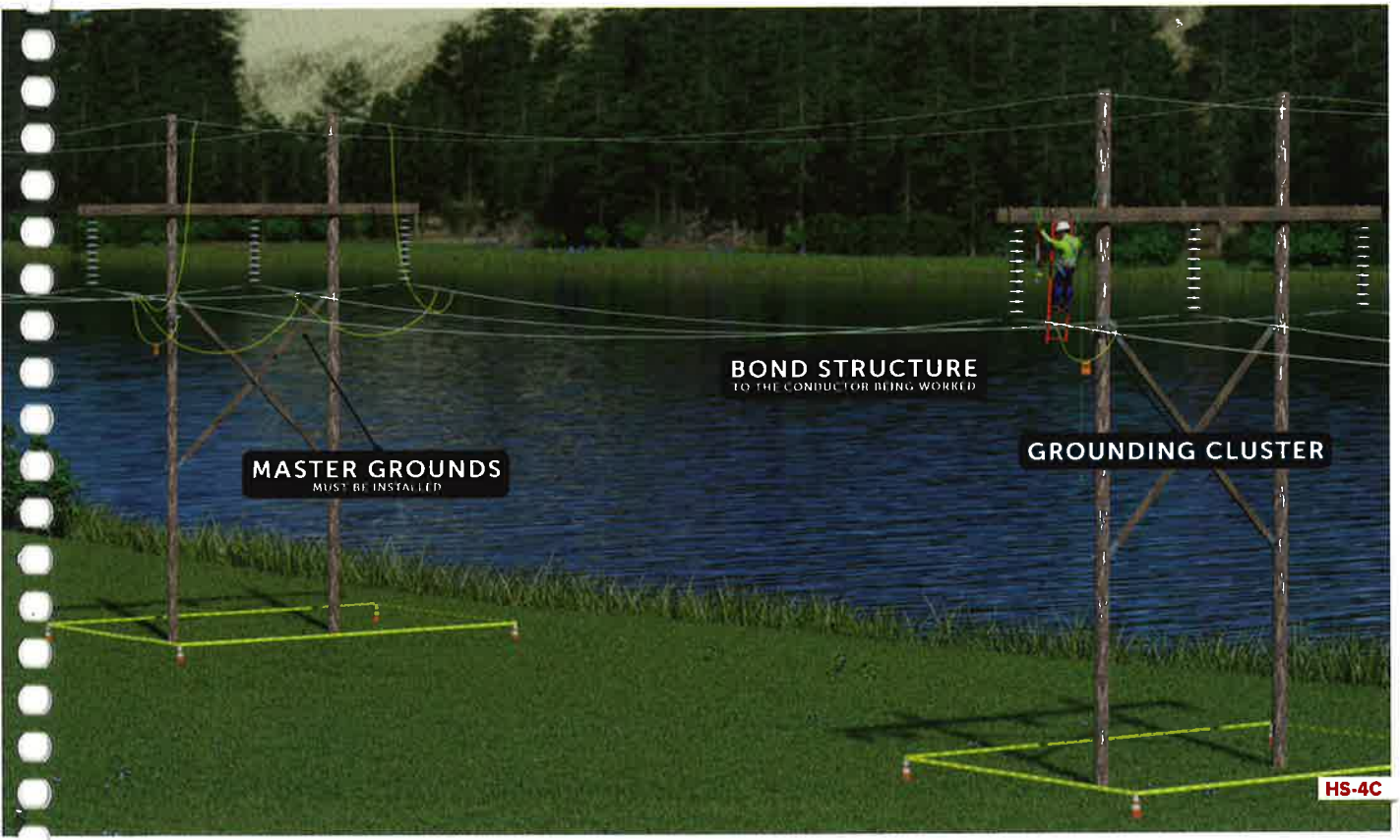
EPZ ON THE

CONDUCTOR BEING WORKED

REMOTE EARTH SOURCE: SHIELD WIRE



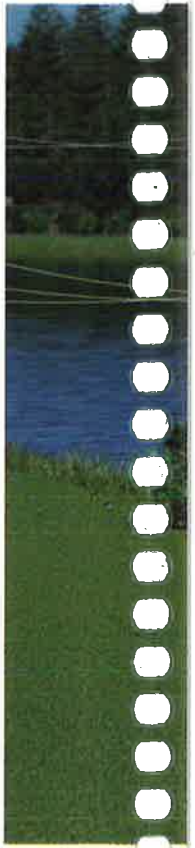
Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. A grounding cluster is not required at the master grounds if no work is to be performed at the structure.


BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
HS-4C

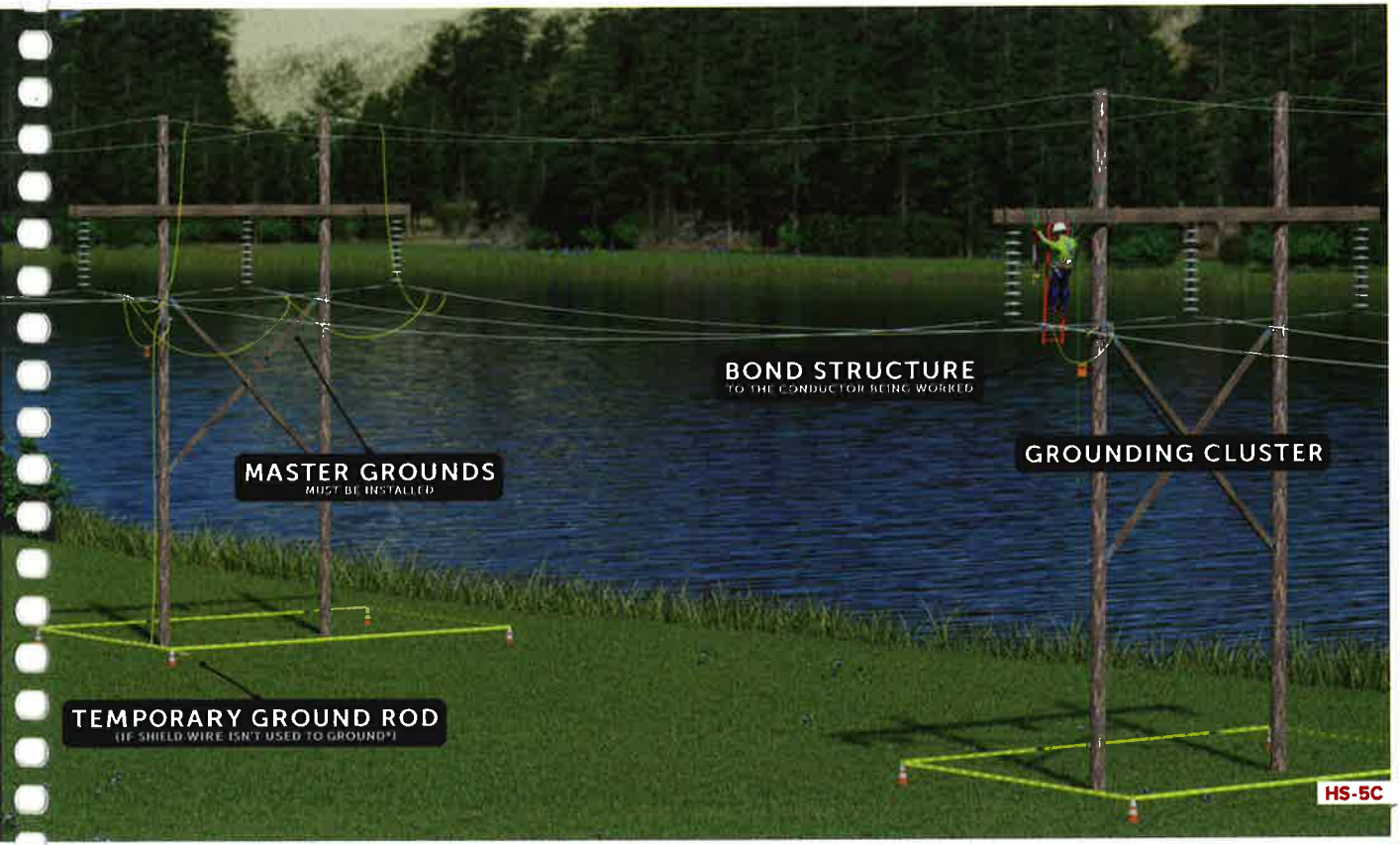
EPZ ON THE

CONDUCTOR BEING WORKED

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD



Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.

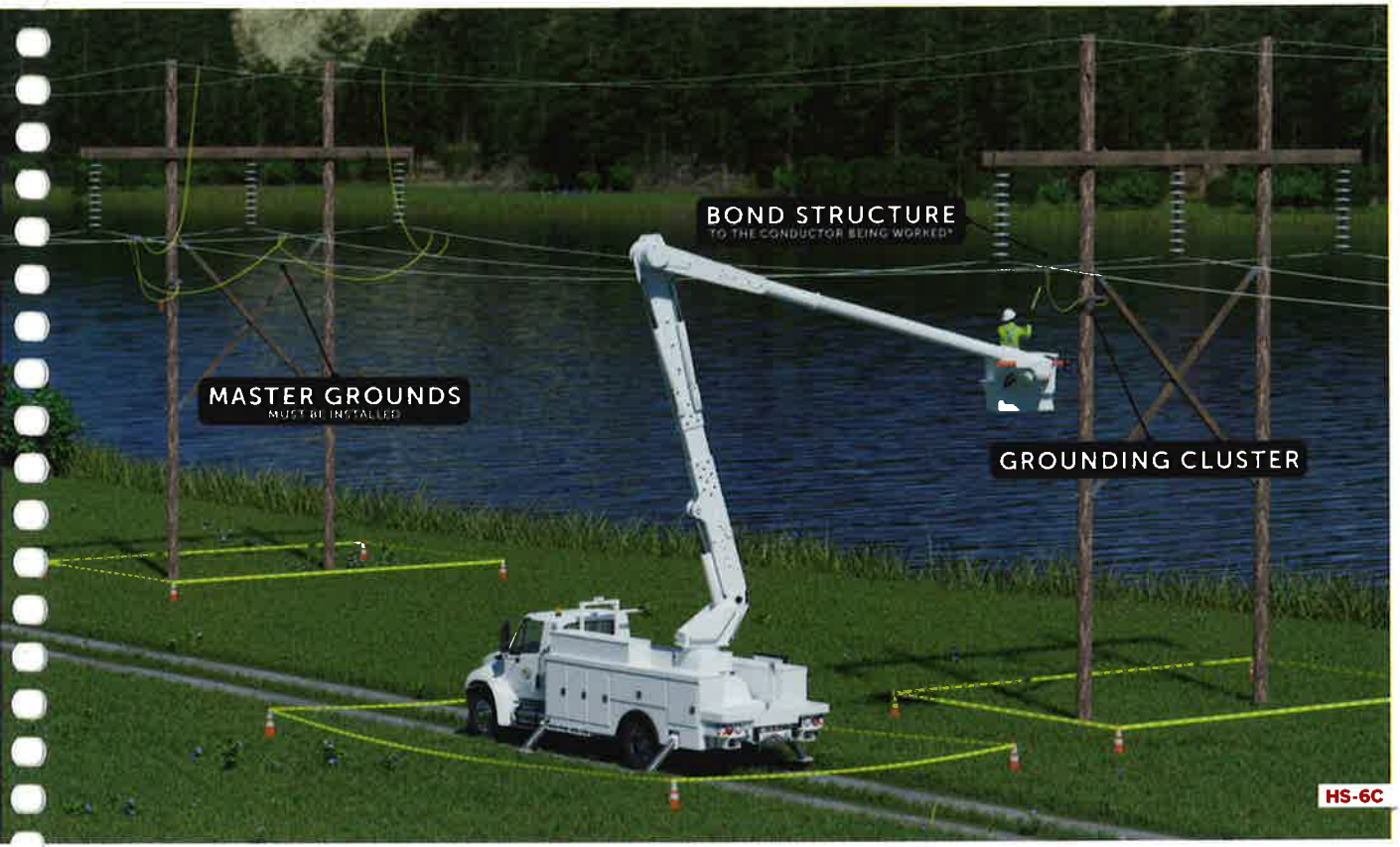

BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(IF SHIELD WIRE ISN'T USED TO GROUND*)
HS-5C

EPZ

INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: SHIELD WIRE

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. A grounding cluster is not required at the master grounds if no work is to be performed at the structure.

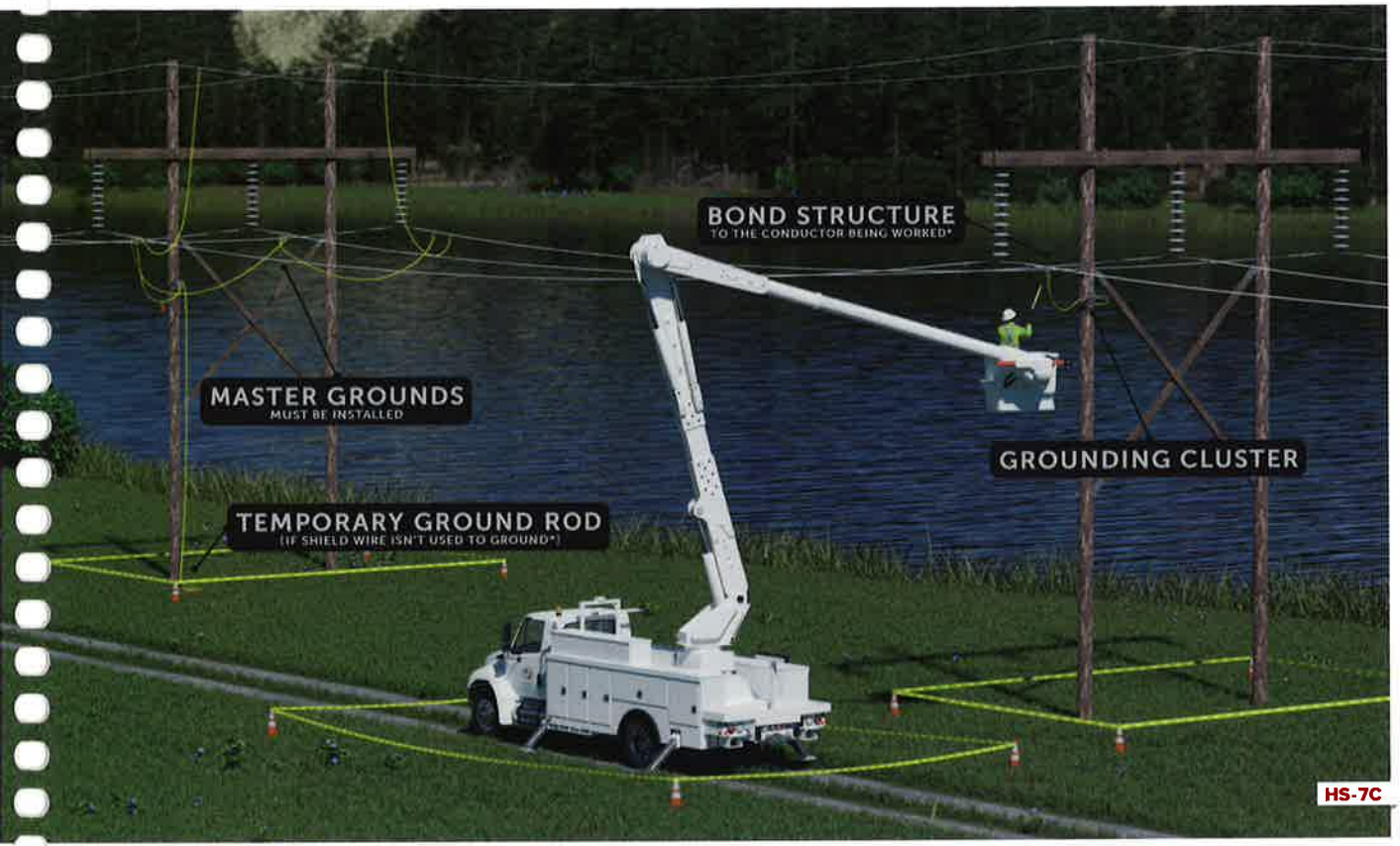

BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED*
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
HS-6C

EPZ

INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.

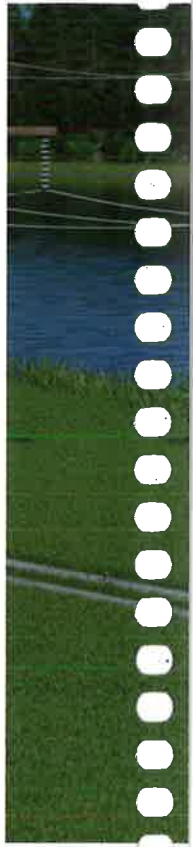

BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED*
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(IF SHIELD WIRE ISN'T USED TO GROUND*)
HS-7C

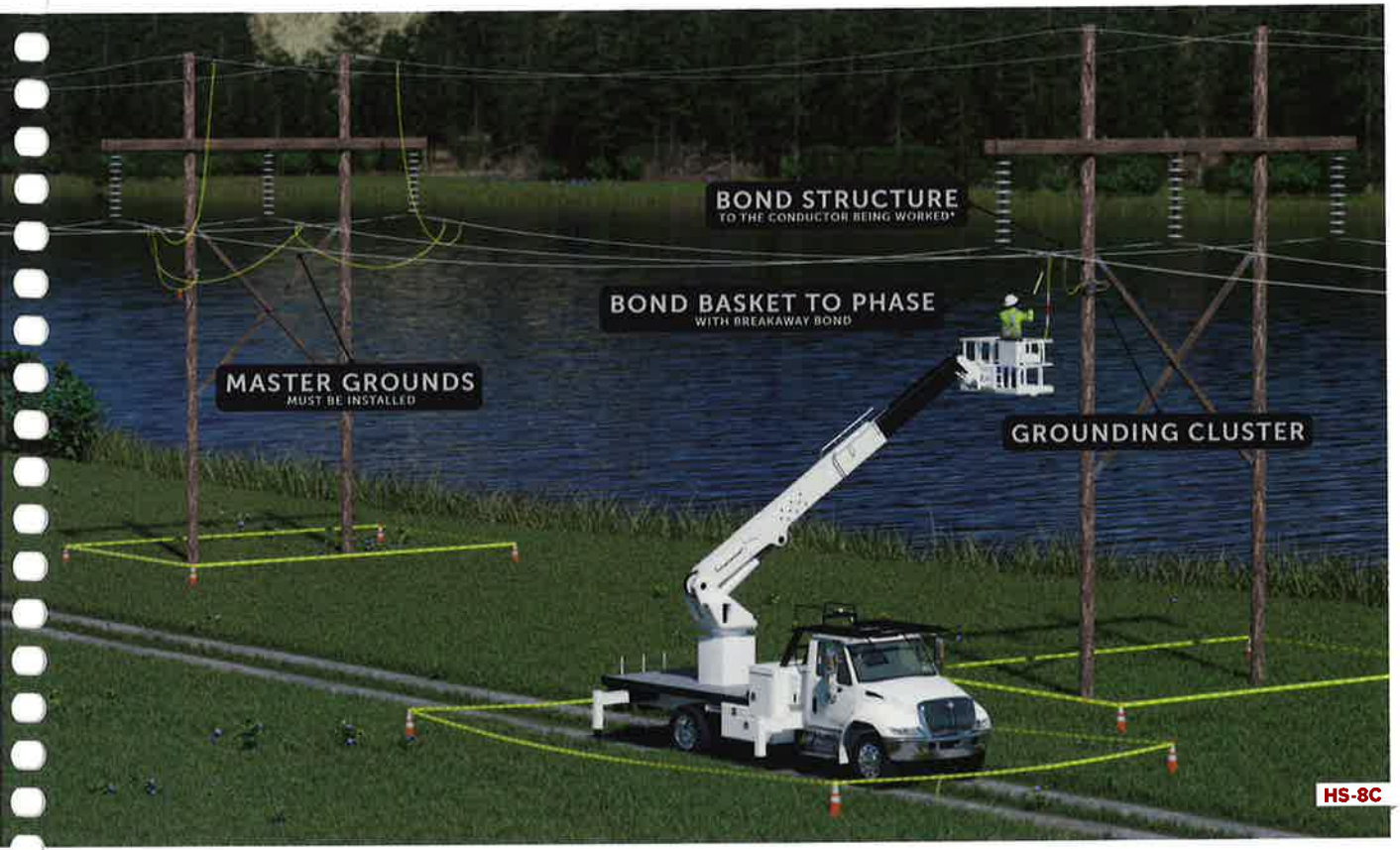
EPZ

NON-INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: SHIELD WIRE

Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The breakaway bond clamp must make good surface contact with the platform of the non-insulated aerial lift. A grounding cluster is not required at the master grounds if no work is to be performed at the structure.



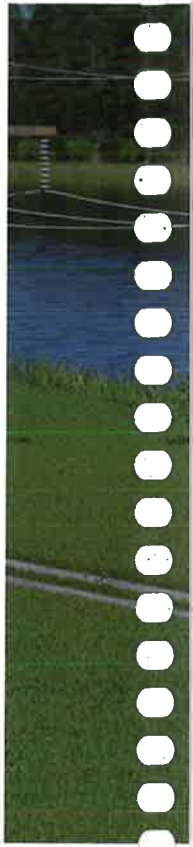

BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED*
BOND BASKET TO PHASE
WITH BREAKAWAY BOND
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
HS-8C

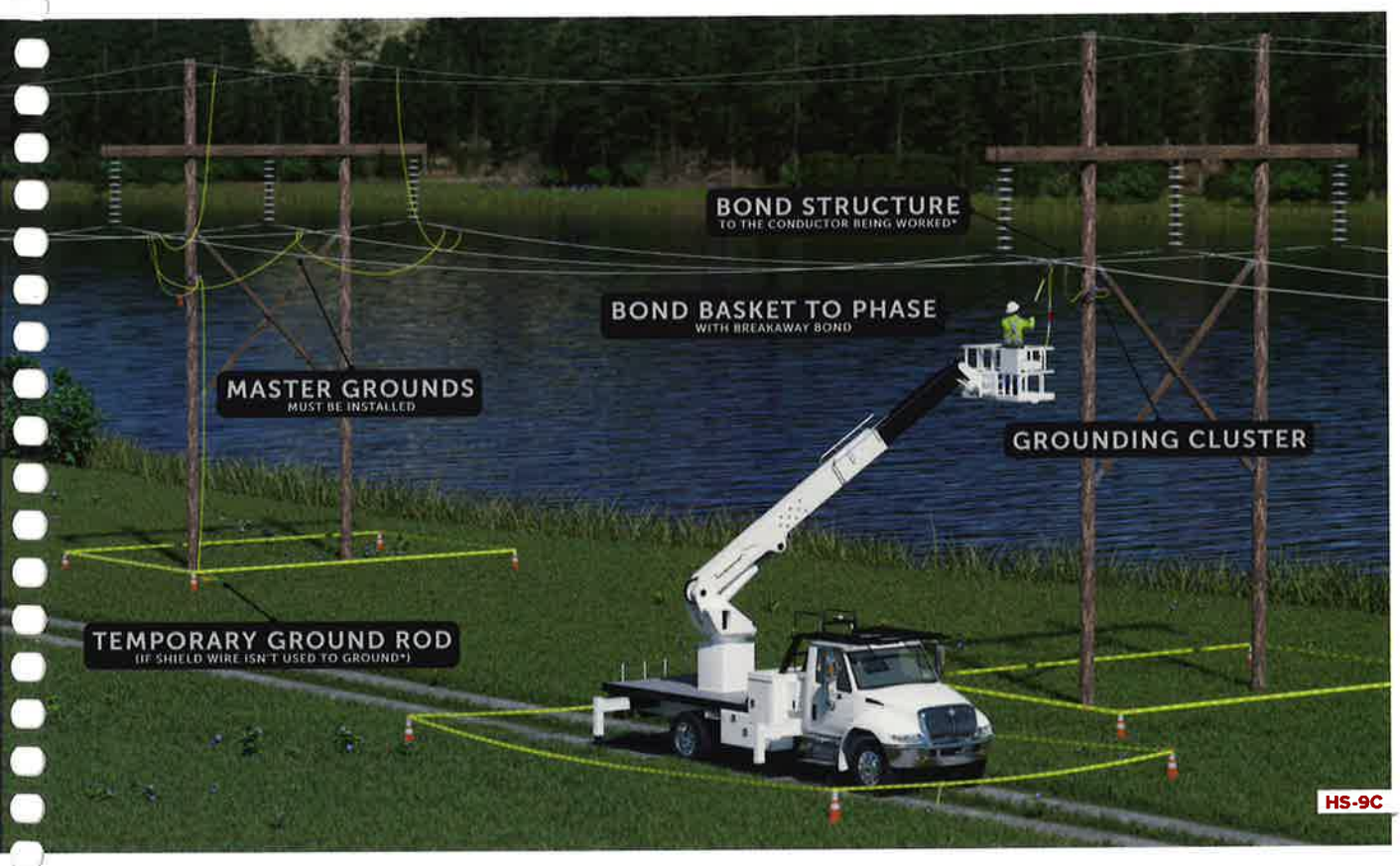
EPZ

NON-INSULATED AERIAL LIFT

REMOTE EARTH SOURCE: TEMPORARY GROUND ROD

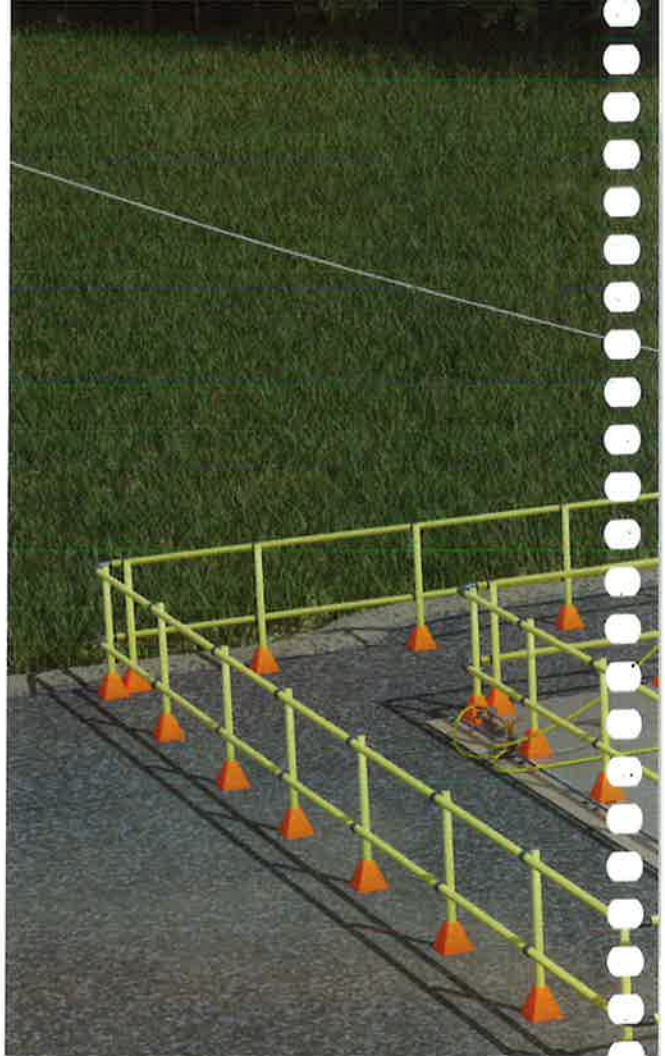
Prior to doing any conductor work, master grounds must be installed in conjunction with EPZ bonds. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The breakaway bond clamp must make good surface contact with the platform of the non-insulated aerial lift. The grounding cluster at the master grounds site is used to support the ground lead down to the temporary ground rod.




BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED*
BOND BASKET TO PHASE
WITH BREAKAWAY BOND
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(IF SHIELD WIRE ISN'T USED TO GROUND*)
HS-9C

GROUNDING & BONDING

STRINGING WIRE



EPZ

PULLER END

EARTH SOURCE: TEMPORARY GROUND ROD

BLOCK GROUND
(IF REQUIRED BY POLICY OR CLIENT)

REMOTE SNUBS

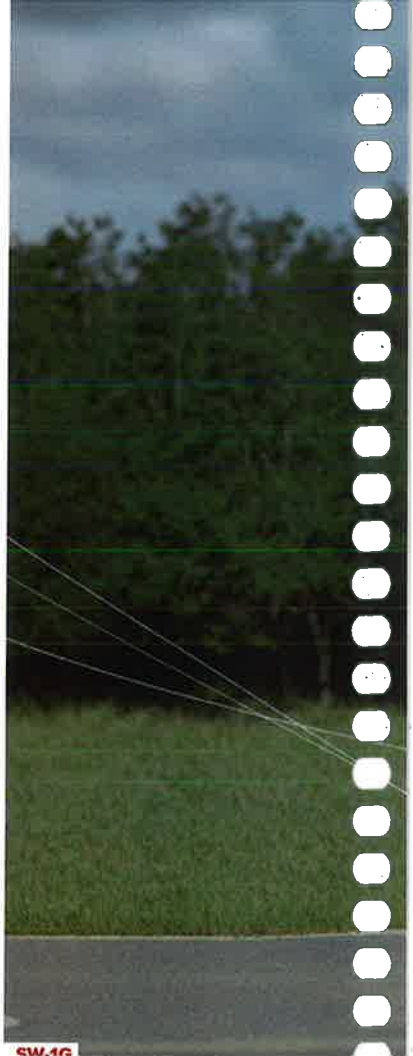
RUNNING GROUND

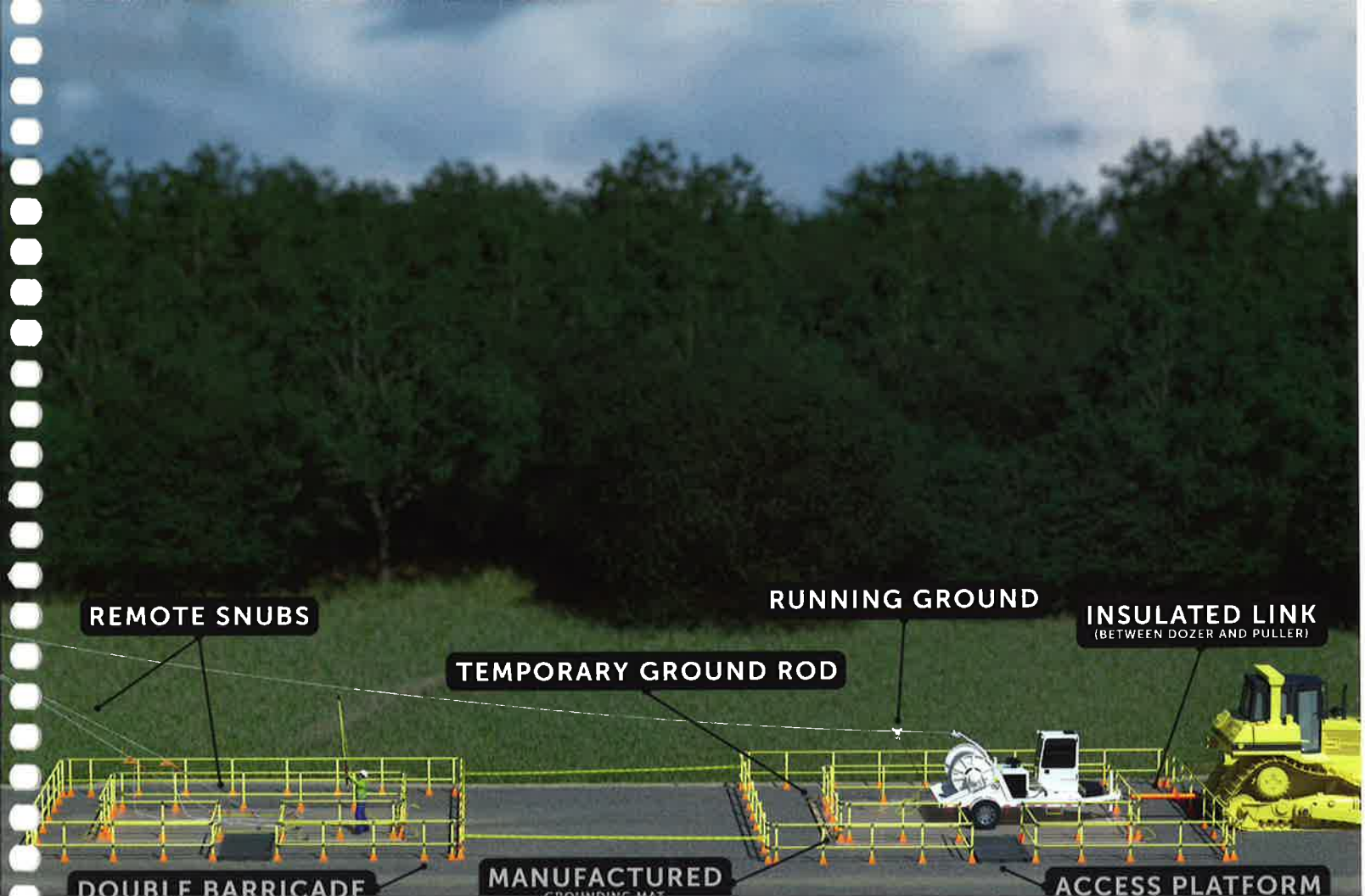
GROUNDING MAT

DOUBLE BARRICADE

INSULATED LINK

All equipment in the EPZ must be bonded together and connected to the temporary ground rod. The running ground and the EPZ mat must also be connected to the temporary ground rod. Avoid placing the EPZ mat in series between the running ground and/or equipment and the earth ground source or temporary ground rod. The double barricade must be spaced far enough to prevent contact between people and equipment on either side. The grounding mat must cover the entire area within the inner barricade.

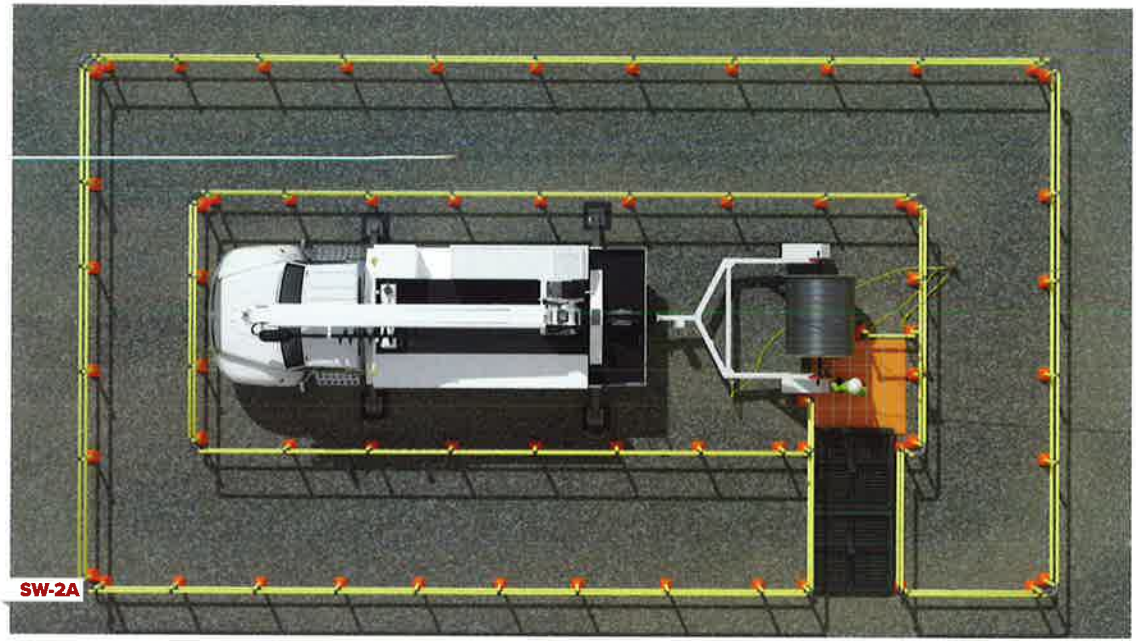


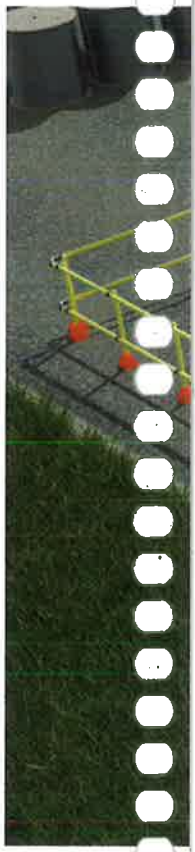

REMOTE SNUBS
RUNNING GROUND
INSULATED LINK
(BETWEEN DOZER AND PULLER)
TEMPORARY GROUND ROD
DOUBLE BARRICADE
MANUFACTURED
ACCESS PLATFORM

PARTIAL EPZ

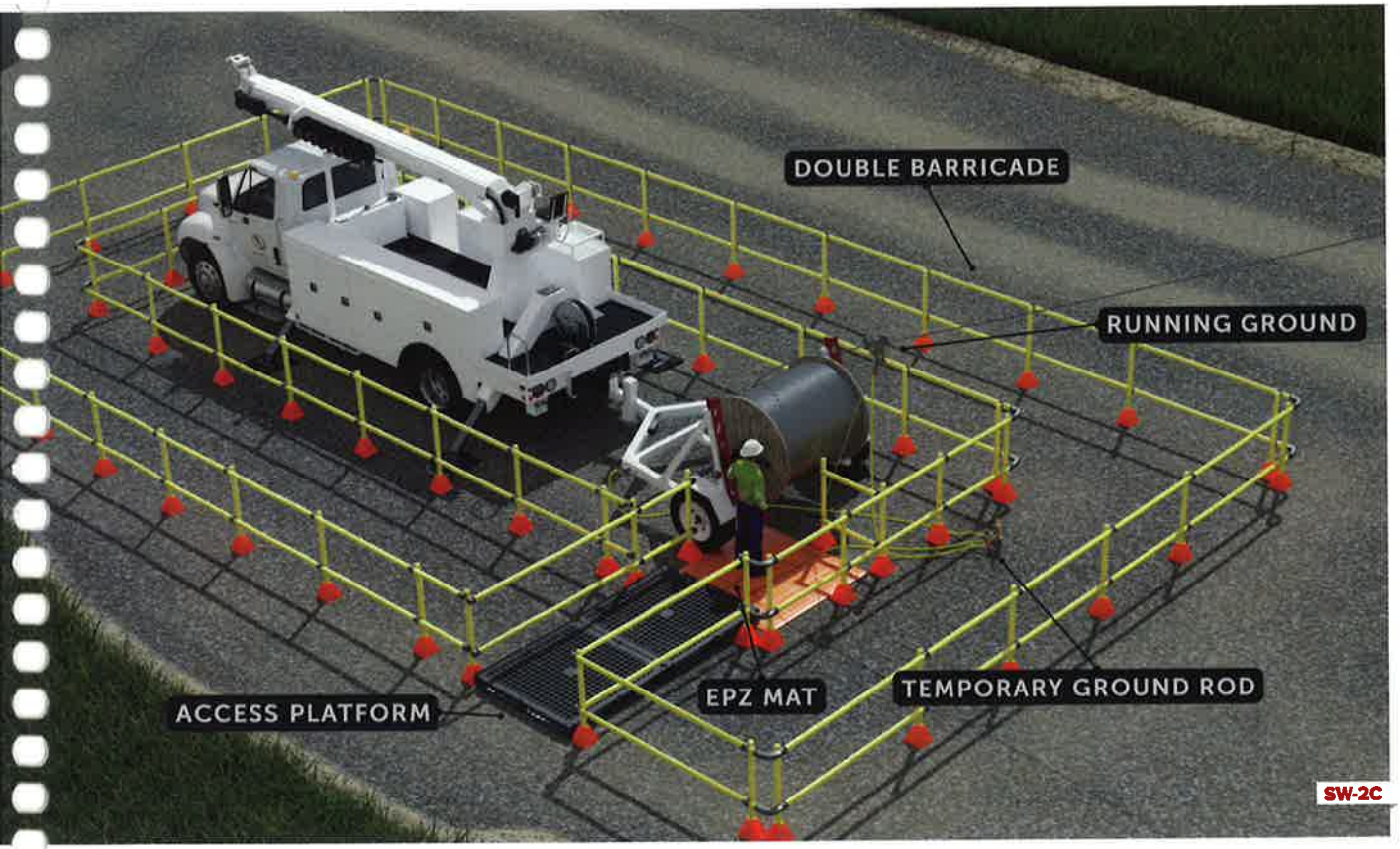
WITH RESTRICTED ACCESS

EARTH SOURCE: TEMPORARY GROUND ROD





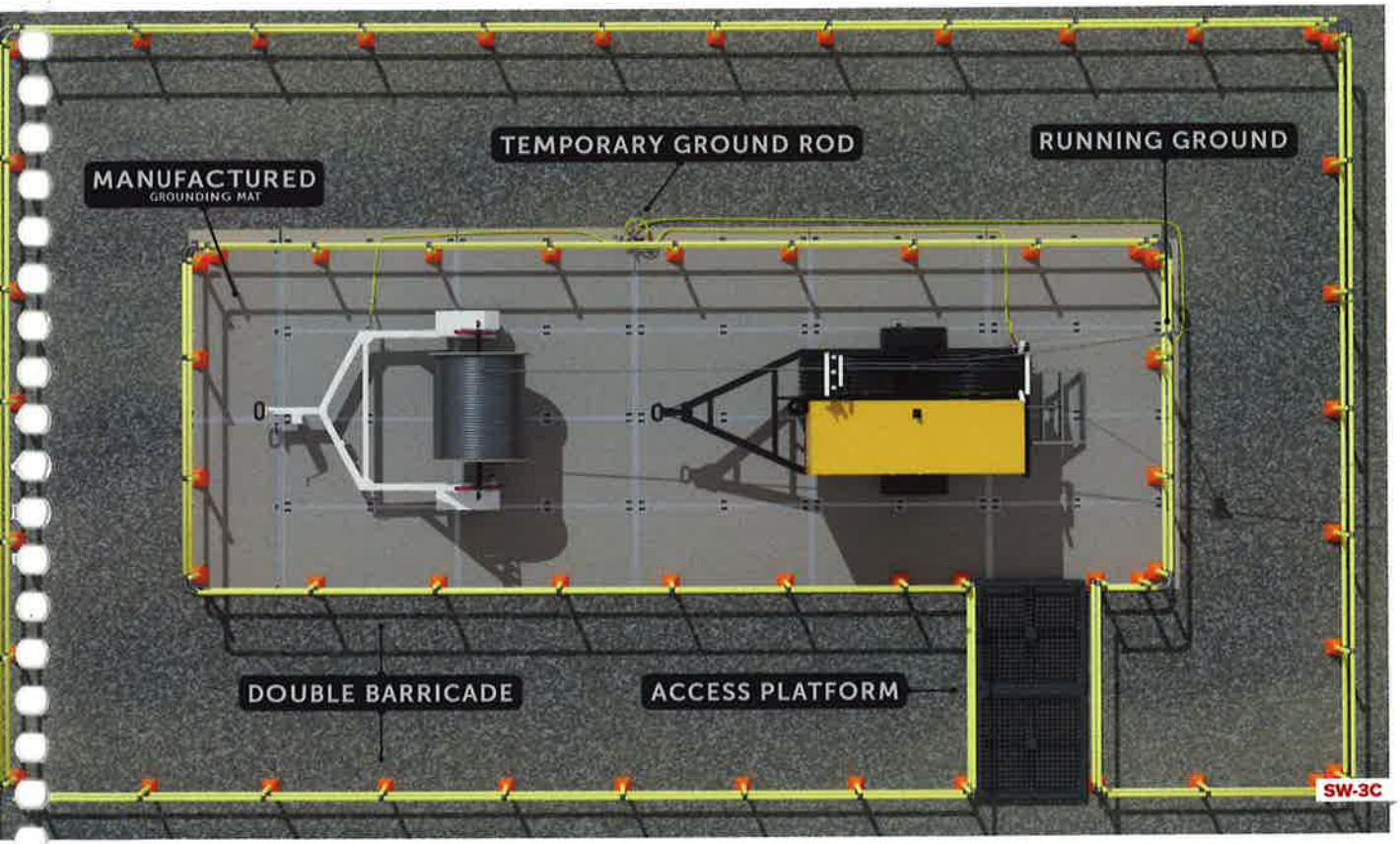
In locations where large equal potential zones are not practical, limited access zones may be utilized. Entry into any area adjacent to equipment not included in the EPZ shall be prohibited by sufficient barricades. Avoid placing the EPZ mat in series between the running ground and/or equipment and the earth ground source or temporary ground rod. The double barricade must be spaced far enough to prevent contact between people and equipment on either side.


DOUBLE BARRICADE
RUNNING GROUND
ACCESS PLATFORM
EPZ MAT
TEMPORARY GROUND ROD
SW-2C

TENSIONER WITH
MANUFACTURED MAT

EARTH SOURCE: TEMPORARY GROUND ROD

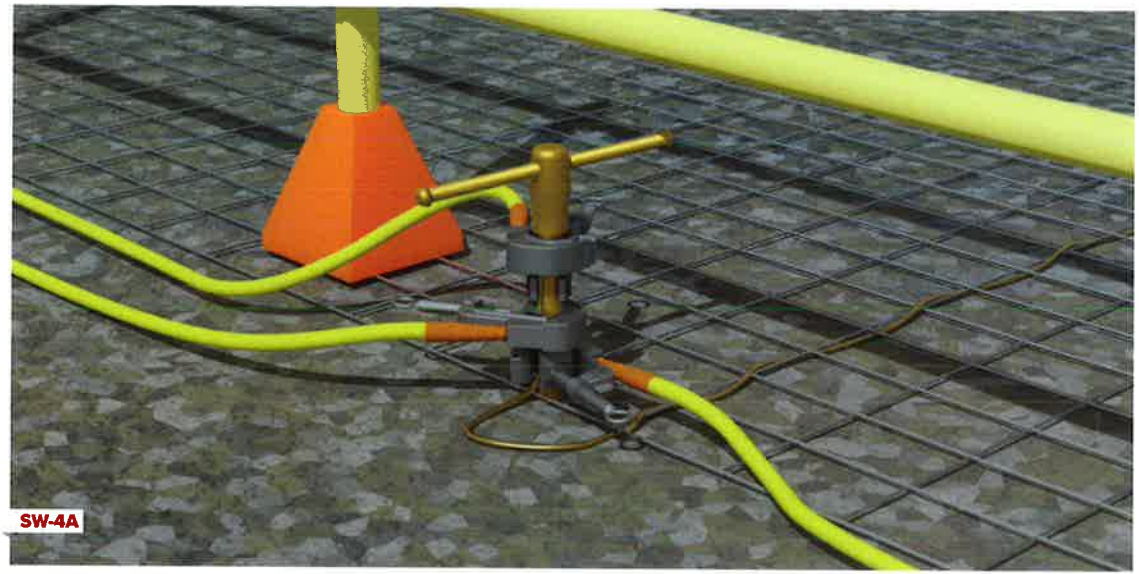
Multiple pieces of equipment in the EPZ must be bonded together, to the running ground and to the EPZ matting. Avoid placing the EPZ mat in series between the running ground and/or equipment and the earth ground source or temporary ground rod. The double barricade must be spaced far enough to prevent contact between people and equipment on either side. The grounding mat must cover the entire area within the inner barricade.


MANUFACTURED
GROUNDING MAT
TEMPORARY GROUND ROD
RUNNING GROUND
DOUBLE BARRICADE
ACCESS PLATFORM
SW-3C

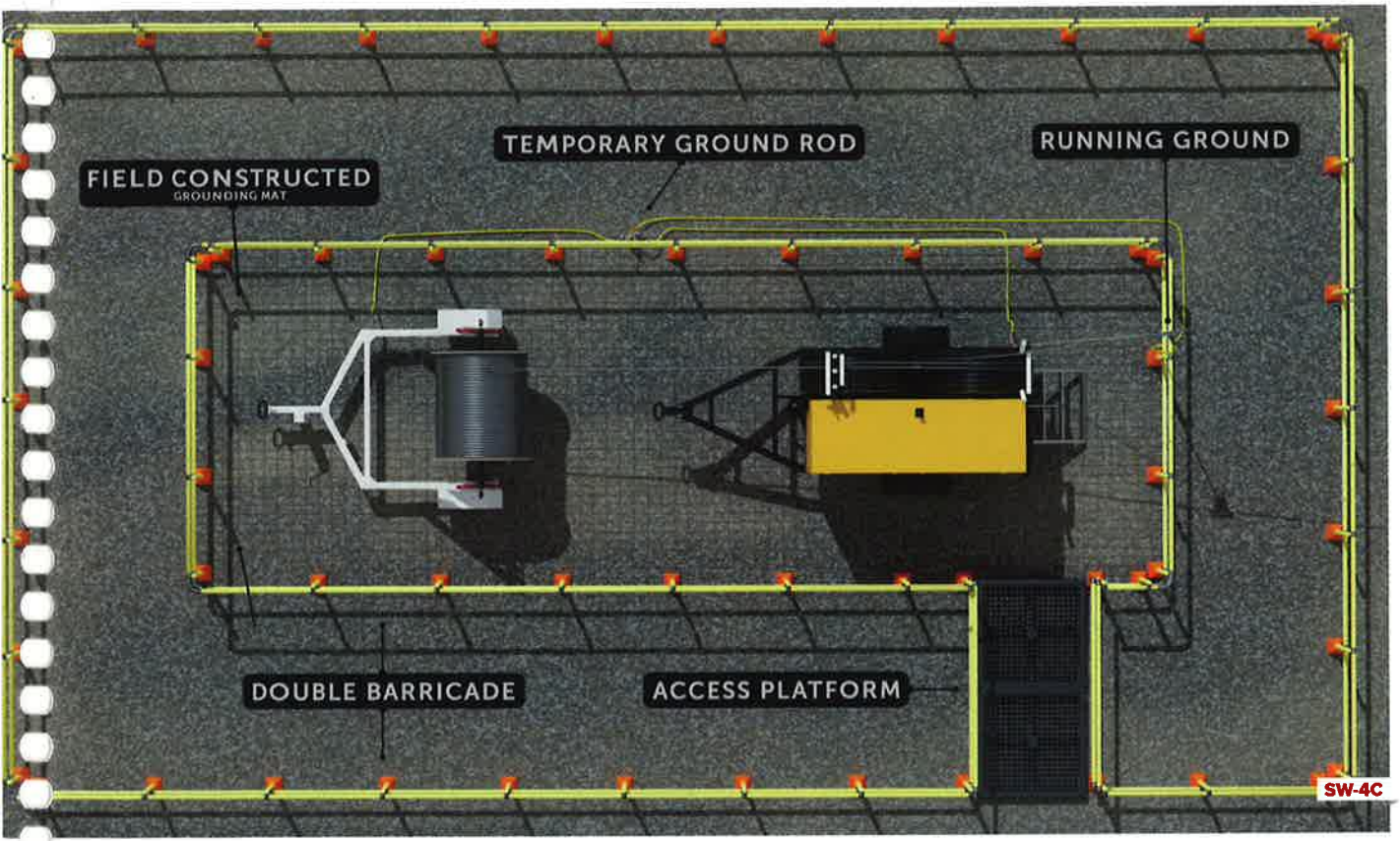
TENSIONER WITH

FIELD CONSTRUCTED MAT

EARTH SOURCE: TEMPORARY GROUND ROD



Each individual mat panel must be bonded to all adjacent panels with a minimum of #4 Cu conductor and connectors. Mat assemblies must be bonded to ground rod, equipment and running ground. If inner barricades utilize metal fence posts, metal posts must be bonded to mat. Avoid placing the EPZ mat in series between the running ground and/or equipment and the earth ground source or temporary ground rod. The double barricade must be spaced far enough to prevent contact between people and equipment on either side. The grounding mat must cover the entire area within the inner barricade.


FIELD CONSTRUCTED
GROUNDING MAT
TEMPORARY GROUND ROD
RUNNING GROUND
DOUBLE BARRICADE
ACCESS PLATFORM
SW-4C

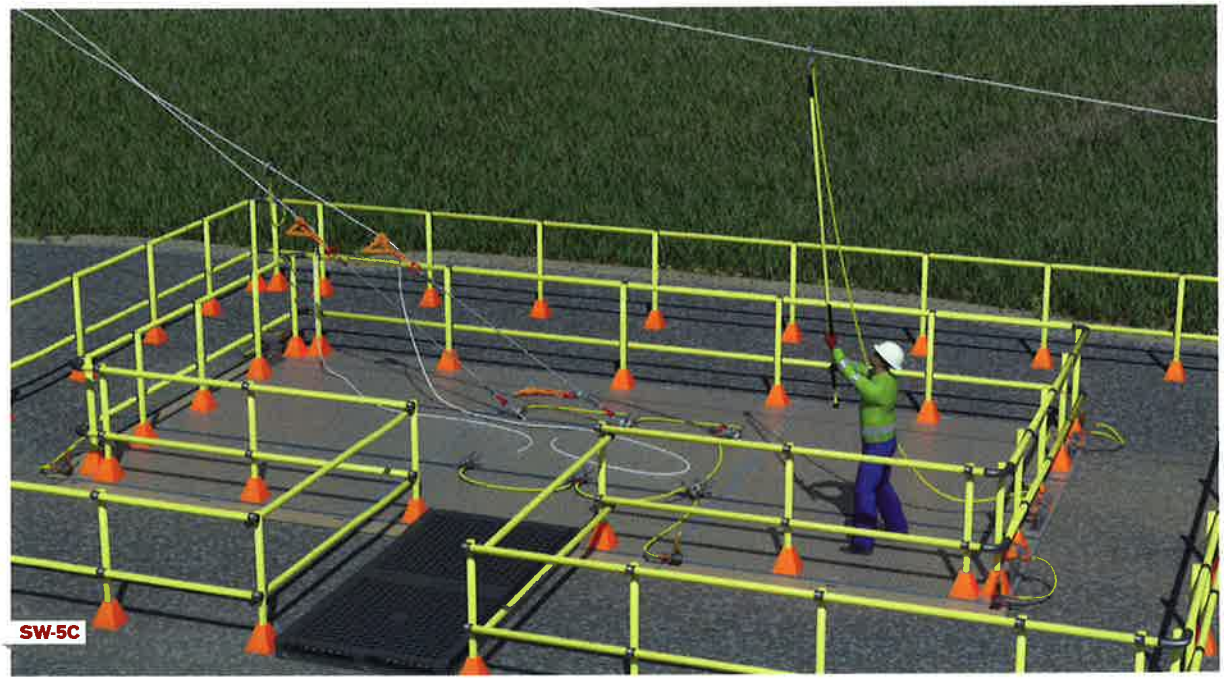
DOUBLE BARRICADE

The double barricade must be spaced far enough to prevent contact between people and equipment on either side.

ACCESS PLATFORMS

Non conductive access bridge, pallet or platform must be used when transitioning on and off equal potential zones.

SNUBBING OFF



All equipment and conductors in the EPZ must be bonded together and connected to the temporary ground rod. Anchor rods or other equipment used to temporarily hold back or 'snub off' conductors during stringing operations shall be within the established EPZ. Bonds must always be installed and removed with a live line tool.

GROUNDING & BONDING

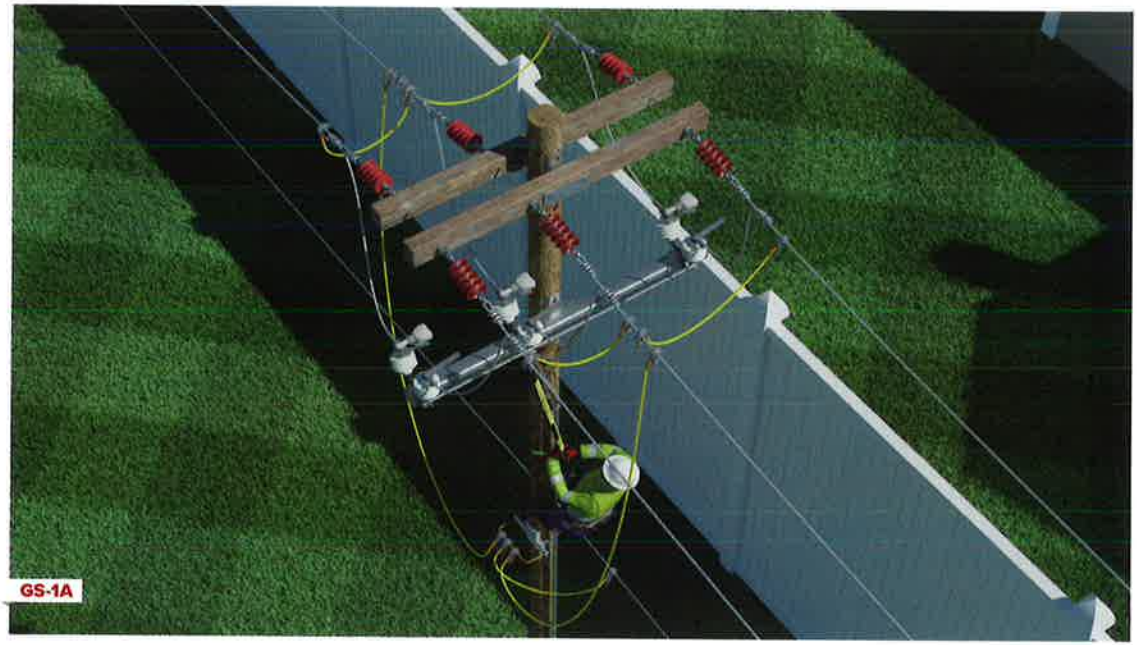
OTHER GROUNDING SCENARIOS

*As primary ground source

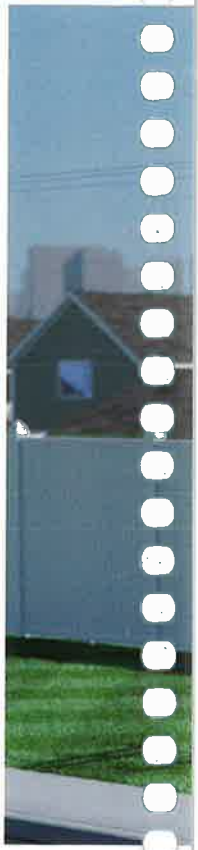
EPZ OPEN DISCONNECTS OR

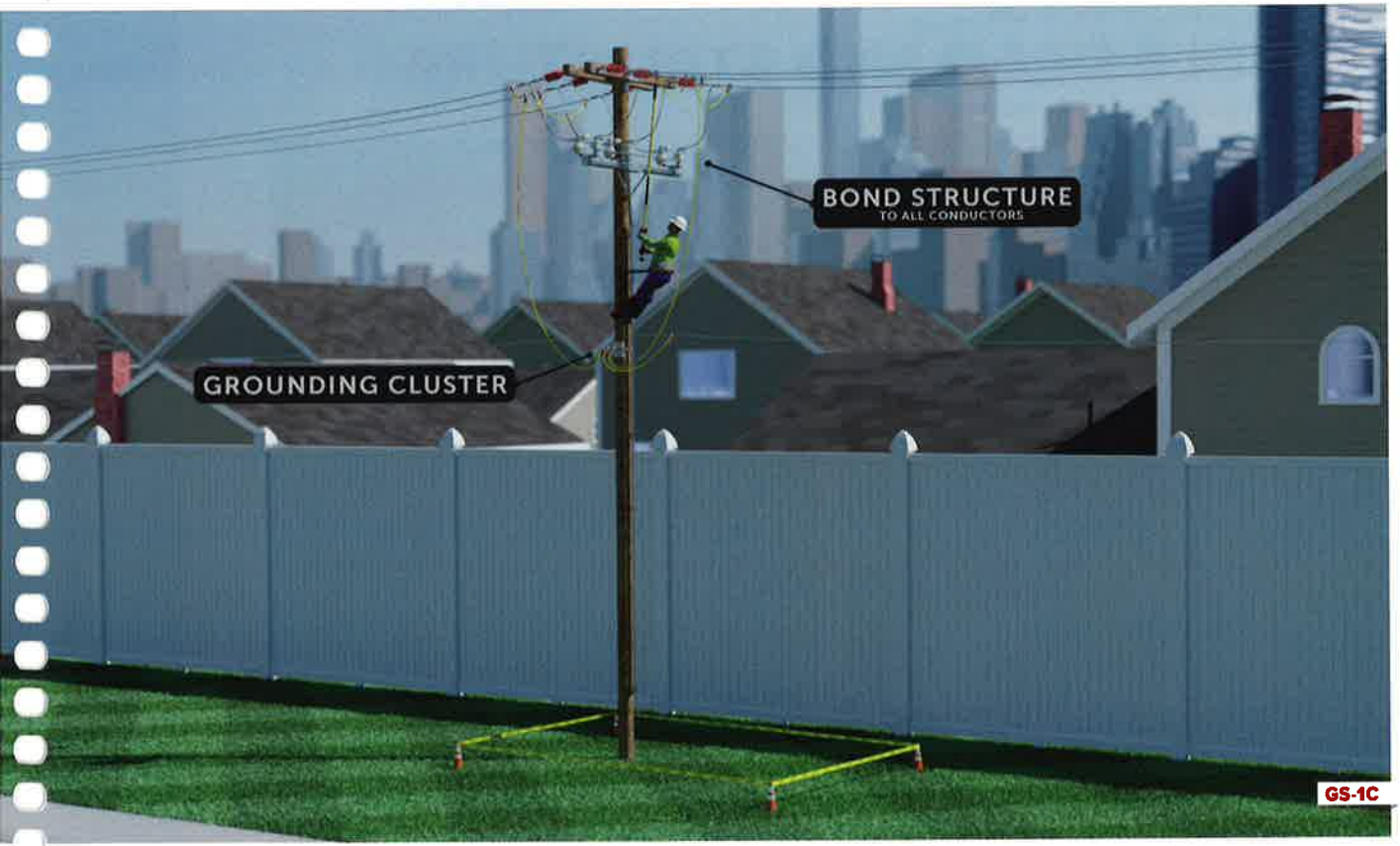
DOUBLE DEAD END STRUCTURE

EARTH SOURCE: NEUTRAL



Ground both sides or across open disconnects for continuity. Do not ground through switch. A short bonding jumper may be needed from the grounding cluster to the pole ground if no connection between the pole ground and the neutral exists or is suspect.

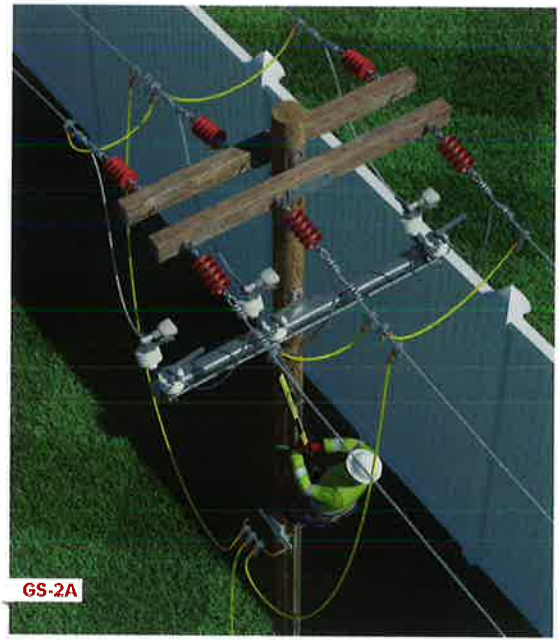



BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
GS-1C

EPZ OPEN DISCONNECTS OR

DOUBLE DEAD END STRUCTURE

EARTH SOURCE: TEMPORARY GROUND ROD



GS-2A

GS-2B

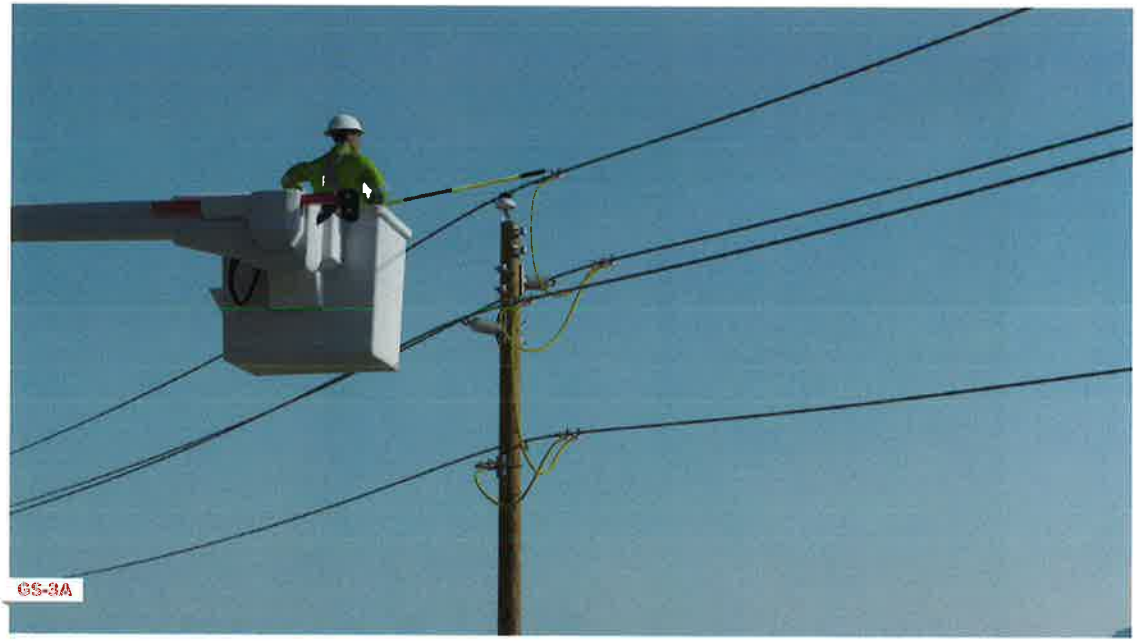
Ground both sides or across open disconnects for continuity. Do not ground through switch. If a pole ground is present, install a short bonding jumper from the grounding cluster to the pole ground.


BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
GS-2C

EPZ

ARMLESS CONSTRUCTION

EARTH SOURCE: NEUTRAL



This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A short bonding jumper may be needed from the grounding cluster to the pole ground if no connection between the pole ground and the neutral exists or is suspect.


BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
GS-3C

EPZ

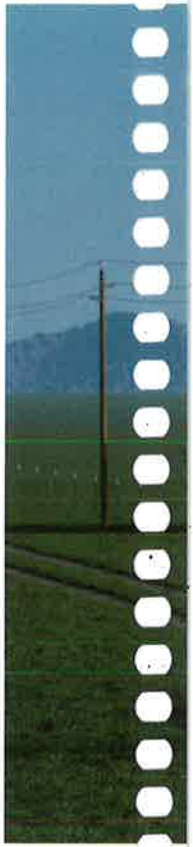
ARMLESS CONSTRUCTION

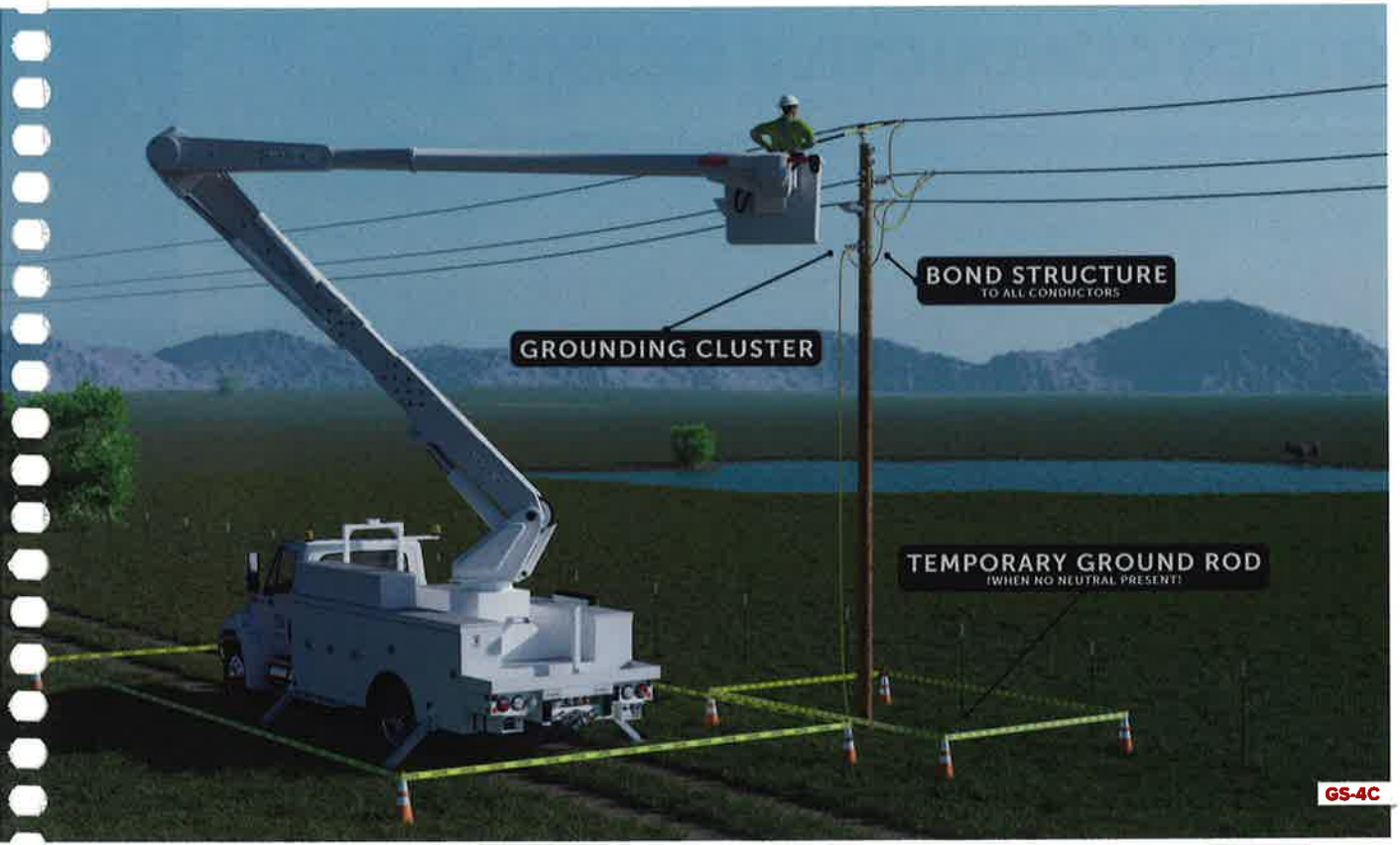
EARTH SOURCE: TEMPORARY GROUND ROD

GS-4A

GS-4B

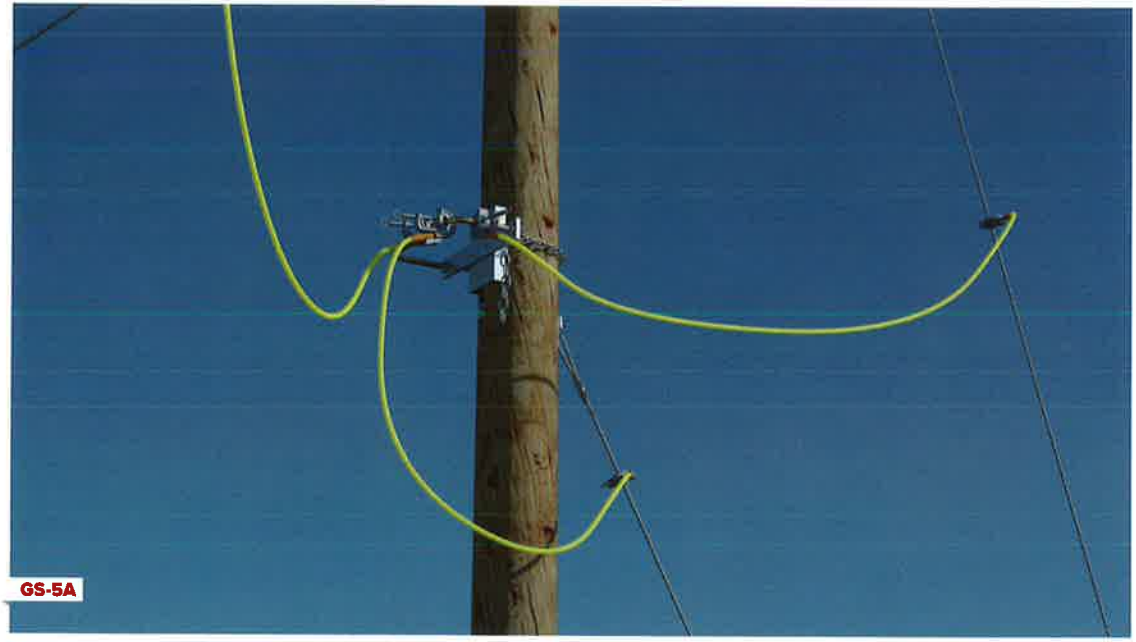
This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A temporary ground rod is needed when no neutral is present.



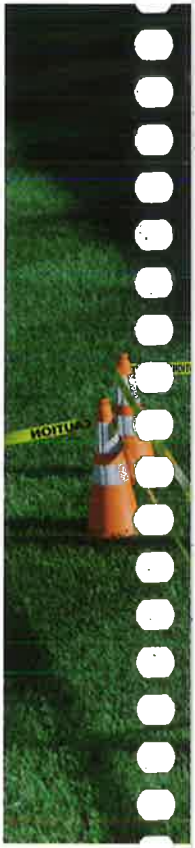

BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
GS-4C

OTHER CONDUCTIVE OBJECTS

EARTH SOURCE: NEUTRAL



Any other grounded items within the EPZ, such as guy wires, communications messenger cables, etc. are referred to as other conductive objects and should be bonded to the personal protective grounding scenario so workers may avoid touch potential hazards. Barricade guy wires so workers may avoid step and touch potential hazards.

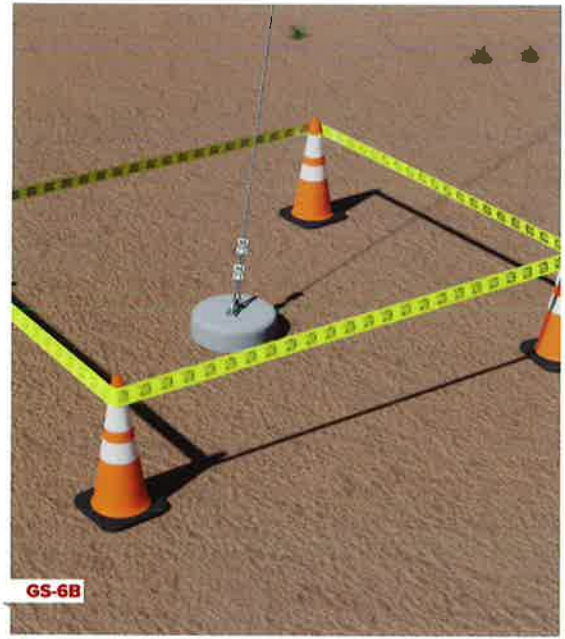



CAUTION
CAUTION
CAUTION
CAUTION
CAUTION
CAUTION
GS-5C

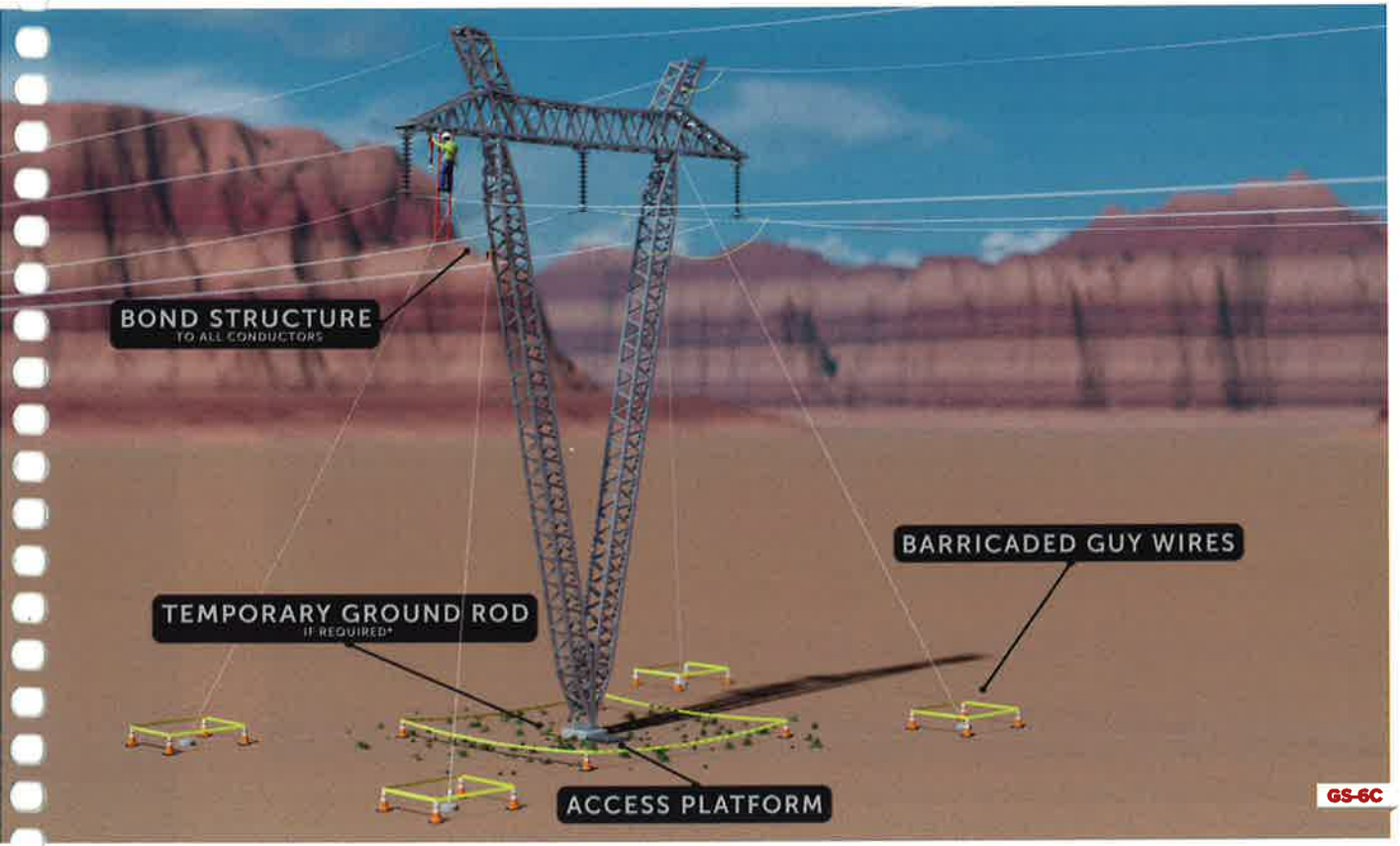
EPZ GUYED V TOWER

MASTER GROUNDS AT WORKSITE

EARTH SOURCE: TOWER FOUNDATION AND TEMPORARY GROUND ROD IF REQUIRED



This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. Install a temporary ground rod if the tower grounding system is suspect or if required by jurisdictional requirements. Avoid touch potential hazards by using a non-conductive access platform. Barricade guy wires so workers may avoid touch and/or step potential hazards.


BOND STRUCTURE
TO ALL CONDUCTORS
BARRICADED GUY WIRES
TEMPORARY GROUND ROD
IF REQUIRED*
ACCESS PLATFORM
GS-6C

EPZ

VERTICAL CONSTRUCTION

EARTH SOURCE: NEUTRAL/SHIELD WIRE

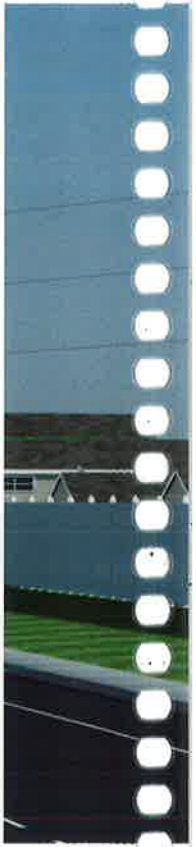
This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location.


BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
BARRICADED GUY WIRES
GS-7C

EPZ

VERTICAL CONSTRUCTION

EARTH SOURCE: TEMPORARY GROUND ROD



This grounding scenario can be used for master grounds and/or worksite grounding and bonding at the work location. A temporary ground rod is needed when no neutral is present.

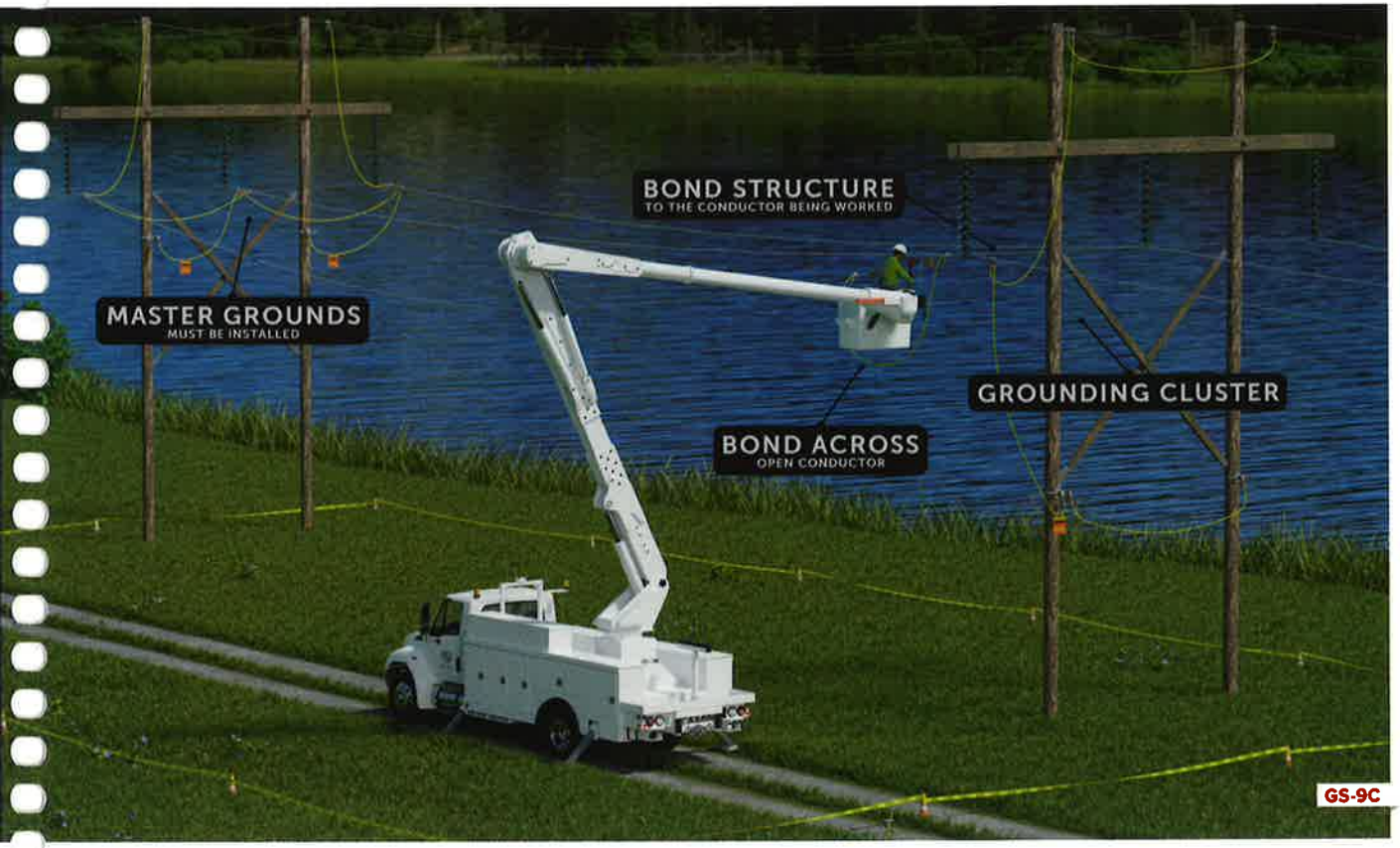

BOND STRUCTURE
TO ALL CONDUCTORS
GROUNDING CLUSTER
BARRICADED GUY WIRES
TEMPORARY GROUND ROD
(WHEN NO NEUTRAL PRESENT)
GS-8C

EPZ CUTTING OR JOINING CONDUCTOR

INSULATED BUCKET TRUCK

EARTH SOURCE: SHIELD WIRE

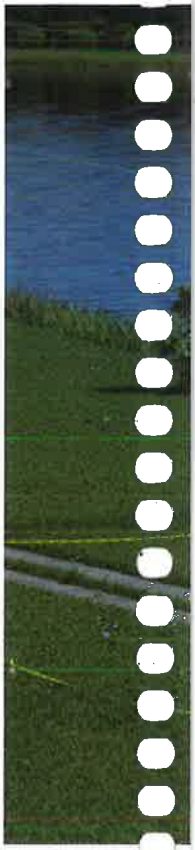
Ensure bond jumper is installed before contacting both sides of conductor. If cutting conductor, ensure bond jumper is installed before making cut. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. Grounding clusters are only required at the master grounds if work is to be performed at the structure.


BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
BOND ACROSS
OPEN CONDUCTOR
GS-9C

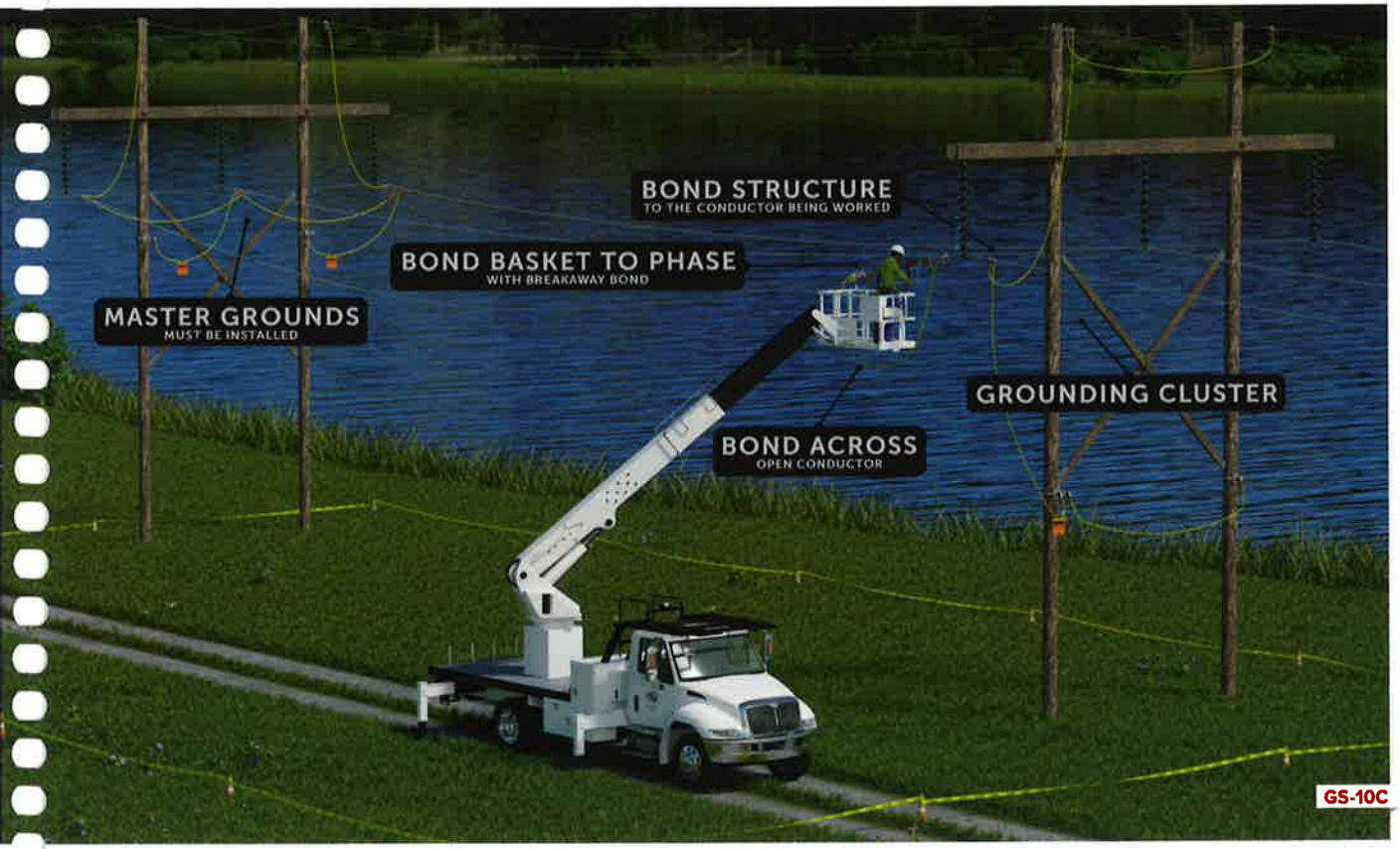
EPZ CUTTING OR JOINING CONDUCTOR

NON-INSULATED BUCKET TRUCK

EARTH SOURCE: SHIELD WIRE



Ensure bond jumper is installed before contacting both sides of conductor. If cutting conductor, ensure bond jumper is installed before making cut. The EPZ bond must be on the conductor being worked. All phase conductors within the applicable minimum approach distance of the worker must be bonded. The breakaway bond clamp must make good surface contact with the platform of the non-insulated aerial lift. Grounding clusters are only required at the master grounds if work is to be performed at the structure.


BOND STRUCTURE
TO THE CONDUCTOR BEING WORKED
BOND BASKET TO PHASE
WITH BREAKAWAY BOND
MASTER GROUNDS
MUST BE INSTALLED
GROUNDING CLUSTER
BOND ACROSS
OPEN CONDUCTOR
GS-10C

DEDICATED TO
JAMES McGOWAN

JOURNEYMAN LINEMAN
CERTIFIED SAFETY PROFESSIONAL
GROUNDING & BONDING SUBJECT-MATTER EXPERT

Through his passion for training and the trade, James has provided countless contributions to Quanta and the industry. His legacy of providing outstanding training and ability to effectively connect to trainees is unparalleled. James spent 40 years in the industry and 15 years at Quanta Services. Following his graduation from college, James became a Certified Safety Professional. Prior to joining the corporate ranks at Quanta, James was the Vice President of Safety at Irby Construction. Out of many accomplishments, one most notable was his involvement with the OSHA Strategic Partnership, a role key in developing the OSHA ET&D 10hr and 20hr -- two courses that have influenced more lineman than any other. He also played a key role in the initial development of The Capacity Model and even coined the acronym STKY! James' sharp wit, unparalleled expertise and dedicated service make him a rare commodity.

GROUNDING & BONDING DEVELOPMENT COMMITTEE

James McGowan, *Safety Training Director, Quanta Services*
Lucas Moore, *Division Manager, PAR Electric*
Phillip Quaedvlieg, *HSE Technical Advisor, Quanta Energized Services*
James Tomaseski, *Director of Safety Corporate, PAR Electric*
Joe Wiley, *Editor in Chief, Alexander Publications*
Michael Hennesey, *President, Alexander Publications*
Prestin Apsley, *Creative Director, Education Media, Northwest Lineman College*

DESIGN TEAM

Prestin Apsley, *Creative Director, Education Media, Northwest Lineman College*
Matthew Ramsay, *3D Modeler, Northwest Lineman College*
Ian Rohnert, *Graphic Designer, Northwest Lineman College*
Brand Adams, *3D Modeler, Northwest Lineman College*

SPECIAL THANKS

Matt Compher, *VP, Heath Safety & Environmental, Quanta Services*
David Fiener, *Sr Safety Dir, Power Division, Quanta Services*
Mark Groves, *President, NLC Innovations*
Tony Alves, *Training Advisor, Northwest Lineman College*
Jeremy Wiese, *VP Creative, Northwest Lineman College*

PRODUCED BY NLC CREATIVE

LINEMAN.EDU

DISTRIBUTED BY:

ALEXANDER *publications*