



DFS GROUNDING PROCEDURE

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Scope:

The purpose of this procedure is to outline the process of grounding DFS equipment to meet electrical safety requirements, lightning suppression requirements, and improve RF signal Propagation.

Requirements:

- Must have an earth ground clamp meter (recommended: Fluke 1630-2-FC or Megger DET14C).
- Must possess the NFPA 70E Cat 0 1,000VAC/ 1,500VDC rated gloves and other PPE.
- A locate must be performed before any work can be done with a new ground rod.
- The ground wire should be direct burial solid #6 (preferred) or #6 stranded in conduit.
(Note: #6 strand wire should be run within conduit. #6 sold bare wire should be ran outside of conduit)
- Zinc based Cold Galvanizing Compound Spray and tools to drive the rod will also be needed.
- All personnel implementing this process should have completed NFPA 70E or other electrical safety Training.



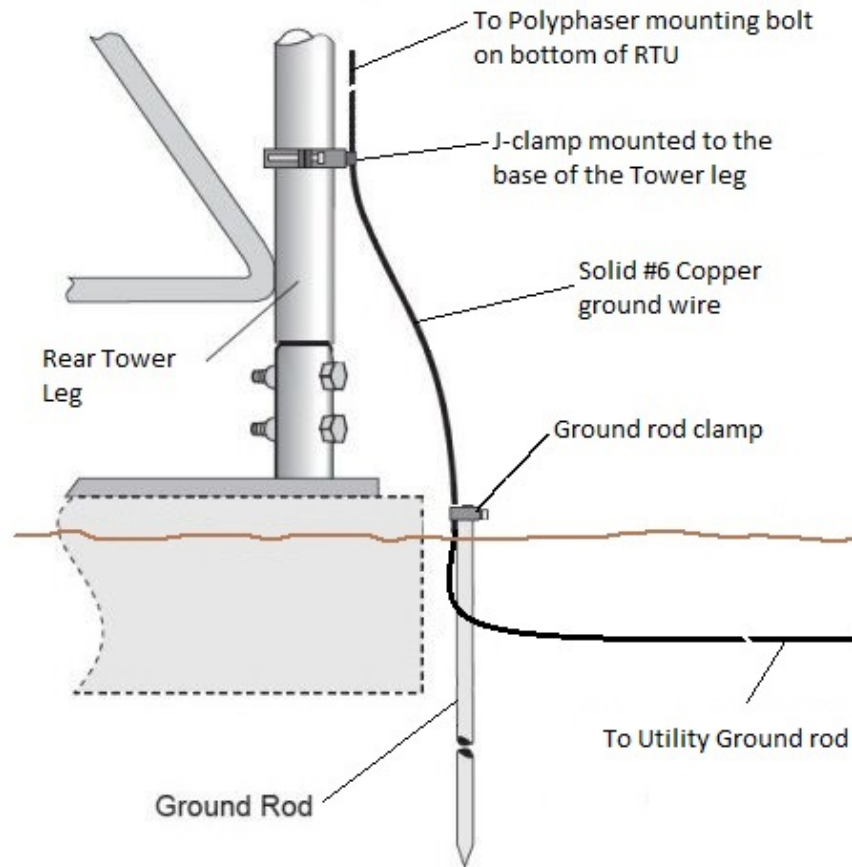
- **Note:** *Underground locates Must have been completed and NFPA 70E (Cat 0) 1,000VAC/ 1,500VDC rated Gloves and other Personal Protection Equipment (PPE) are Required prior to proceeding any further with this procedure.*

INSTRUCTIONS:

Section One: Tower Mounted RTU Grounding. (See illustration 1 and 2)

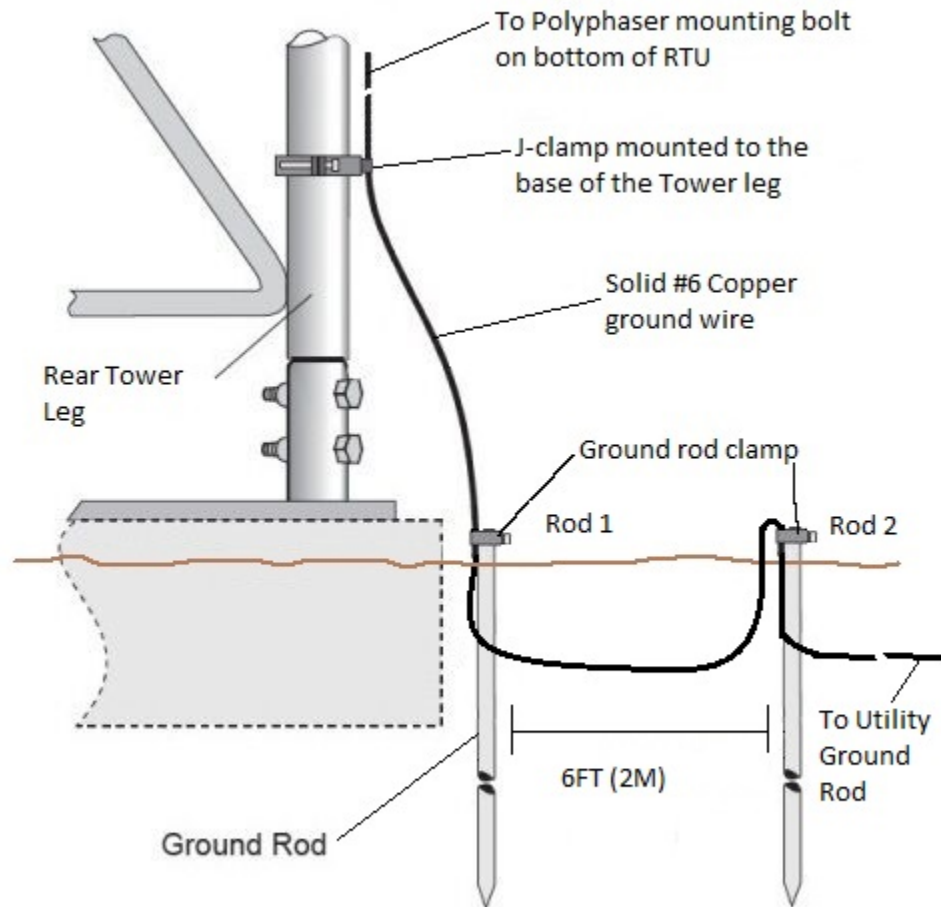
1. If possible, disable the main AC power for the station or building where the grounding process is being applied.
2. Verify the locate markers are not near the location where the ground rod is being placed.
3. At a position adjacent to the concrete pad nearest to the back of the tower's rear leg, drive the 5/8" X 10' ground rod in the ground until just below concrete pad.
4. Grounding: Determine if the site work is completed.
 - 4.1. **Temporary Ground (site work not complete)** - Run a #6 solid copper wire between the copper grounding rod and the tower base. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the temporary ground to the tower leg.
 - 4.2. **Permanent Ground (site work complete)** - Run a continuous run of #6 solid copper wire from the polyphaser mounting bolt, tower leg J-Clamp, DFS ground rod, and the local utility ground rod. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the tower rear leg.

Illustration 1 – Ground wire connected to Tower Leg



5. Once the grounding system is established, measure the resistance to Earth ground using an Earth ground clamp meter. With the display of the meter facing you, measure between the J-Clamp and the Ground rod clamp. The resistance should measure less than 25 Ω (ohm's) (NEC minimum ground resistance requirement). The ideal resistance for lightning suppression and RF signal efficiency is less than 5 Ω .
6. If the grounding system's resistance does not meet the 25 Ω requirement, an additional ground rod is needed. Place second ground rod no less than 6ft (2M) from the first ground rod. There must be a continuous run of #6 copper wire and no more than 1 conductor for each ground rod clamp.
(See illustration 2 below)

Illustration 2 – Ground wire connected to Tower Leg using 2 ground Rods

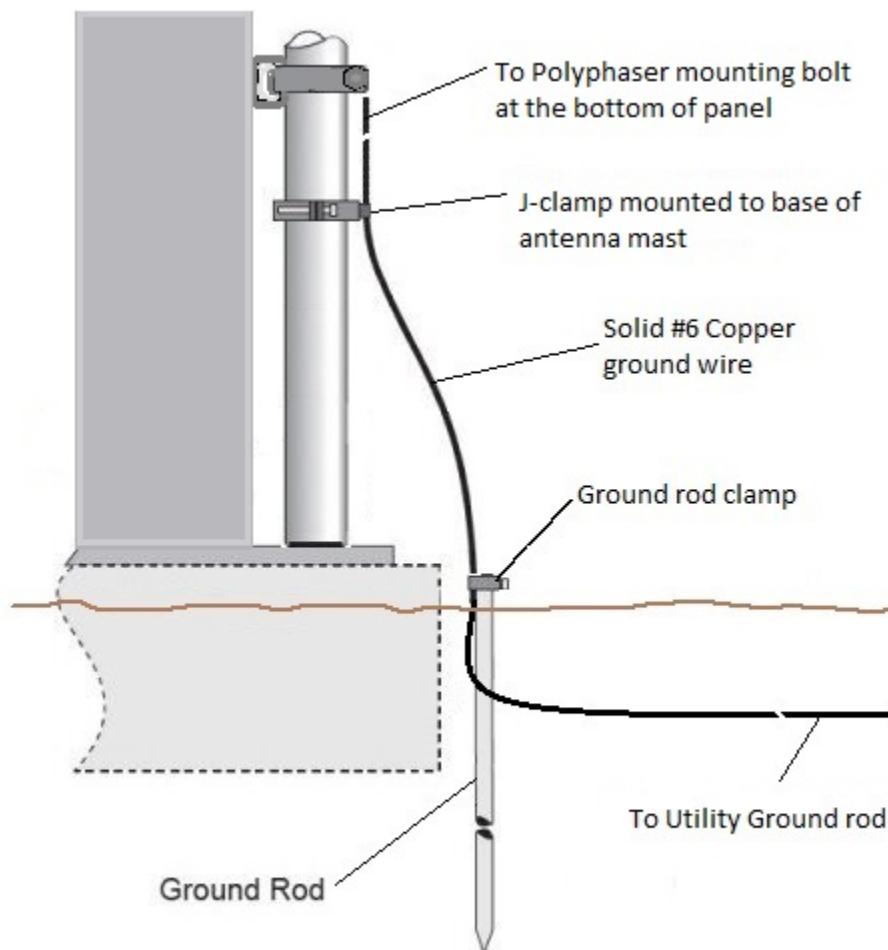


- Once grounding resistance and bonding has met the 25 Ω minimum, spray all Ground Rod clamps and J-clamps with a zinc based Cold Galvanizing Compound Spray for preventing oxidation from affecting the grounding system's resistance to corrosion.

Section Two: Unistrut mounted panel Grounding. (See illustration 3 and 4)

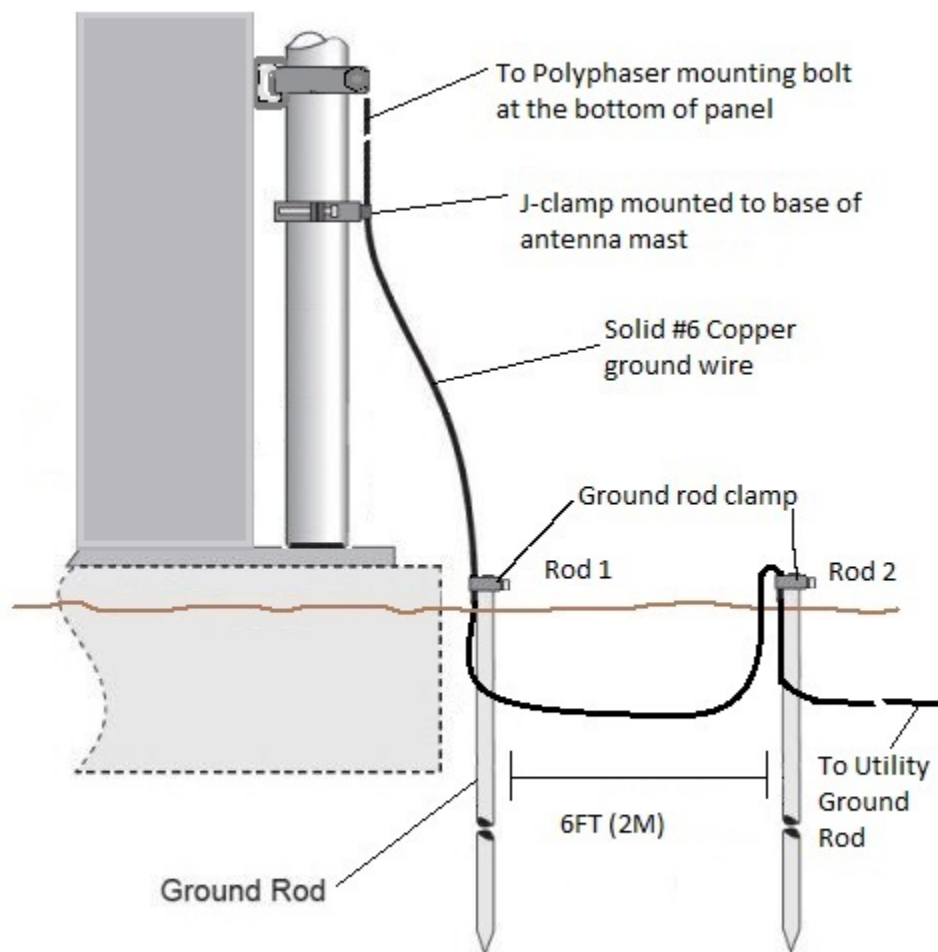
1. If possible, disable the main AC power for the station or building where the grounding process is being applied.
2. Verify the locate markers are not near the location where the ground rod is being placed.
3. At a position adjacent to the concrete pad nearest to the galvanized antenna mast, drive the 5/8" X 10' ground rod into the ground until just below concrete pad.
4. Grounding: Determine if the site work is completed.
 - 4.1. **Temporary Ground (site work not complete)** - Run a #6 solid copper wire between the copper grounding rod and the base of the galvanized antenna mast. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the temporary ground to the base of the galvanized antenna mast.
 - 4.2. **Permanent Ground (site work complete)** - Run a continuous run of #6 solid copper wire from the polyphaser mounting bolt, antenna mast J-Clamp, DFS ground rod, and the local utility ground rod. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the base of the antenna mast.

Illustration 3 – Ground wire connected to antenna mast mounted on Unistrut



5. Once the grounding system is established, measure the resistance to Earth ground using an Earth Ground clamp meter. With the display of the meter facing you, measure between the J-Clamp and the Ground rod clamp. The resistance should measure less than 25 Ω (ohm's) (NEC minimum ground resistance requirement). The ideal resistance for lightning suppression and RF signal efficiency is less than 5 Ω .
6. If the grounding system's resistance does not meet the 25 Ω requirement, an additional ground rod is needed. Place second ground rod no less than 6ft (2M) from the first ground rod. There must be a continuous run of #6 copper wire and no more than 1 conductor for each ground rod clamp.
(See illustration 4 below)

Illustration 4 – Ground wire connected to antenna mast mounted on Unistrut using 2 ground Rods



7. Once grounding resistance and bonding has met the 25 Ω minimum, spray all Ground Rod clamps and J-clamps with a zinc based Cold Galvanizing Compound Spray for preventing oxidation from affecting the grounding system's resistance to corrosion.

Section Three: Building mounted RTU/panel grounding. (See illustration 5 through 9) (Note: The bond to the Utility Ground Rod can be made by connecting the polyphaser to the electrical Service Ground)

1. If possible, disable the main AC power for the station or building where the grounding process is being applied.
2. Verify the locate markers are not near the location where the Ground rod is being placed.
3. At a position adjacent to the concrete pad nearest to the back of the tower's rear leg, drive the 5/8" X 10' ground rod in the ground until just below concrete pad.
4. Grounding: Determine if the site work is completed.
 - 4.1. **Temporary Ground (site work not complete)** - Run a #6 solid copper wire between the copper grounding rod and the tower base. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the temporary ground to the tower leg.
 - 4.2. **Permanent Ground (site work complete)** - Run a continuous run of #6 copper wire from the polyphaser mounting bolt, tower leg J-Clamp, DFS ground rod, and the building's utility ground rod. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the tower rear leg.

Illustration 5 – Ground wire connected to Tower Leg

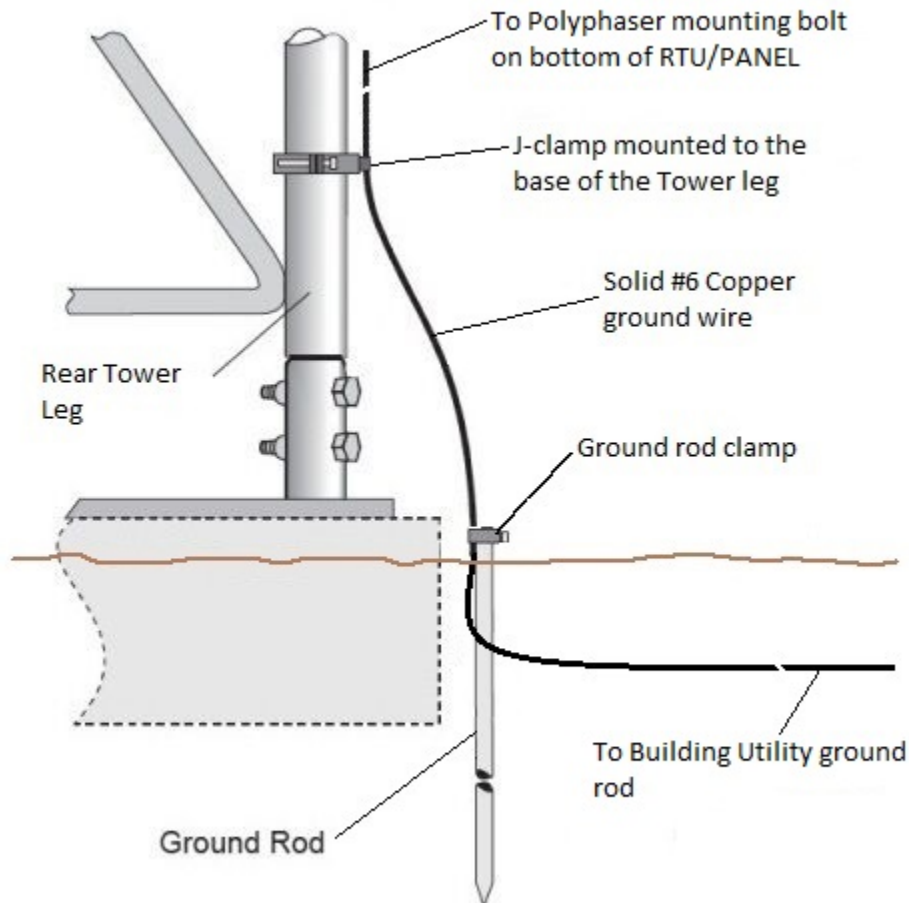


Illustration 6 – Ground wire connected to Tower Leg using 2 ground Rods

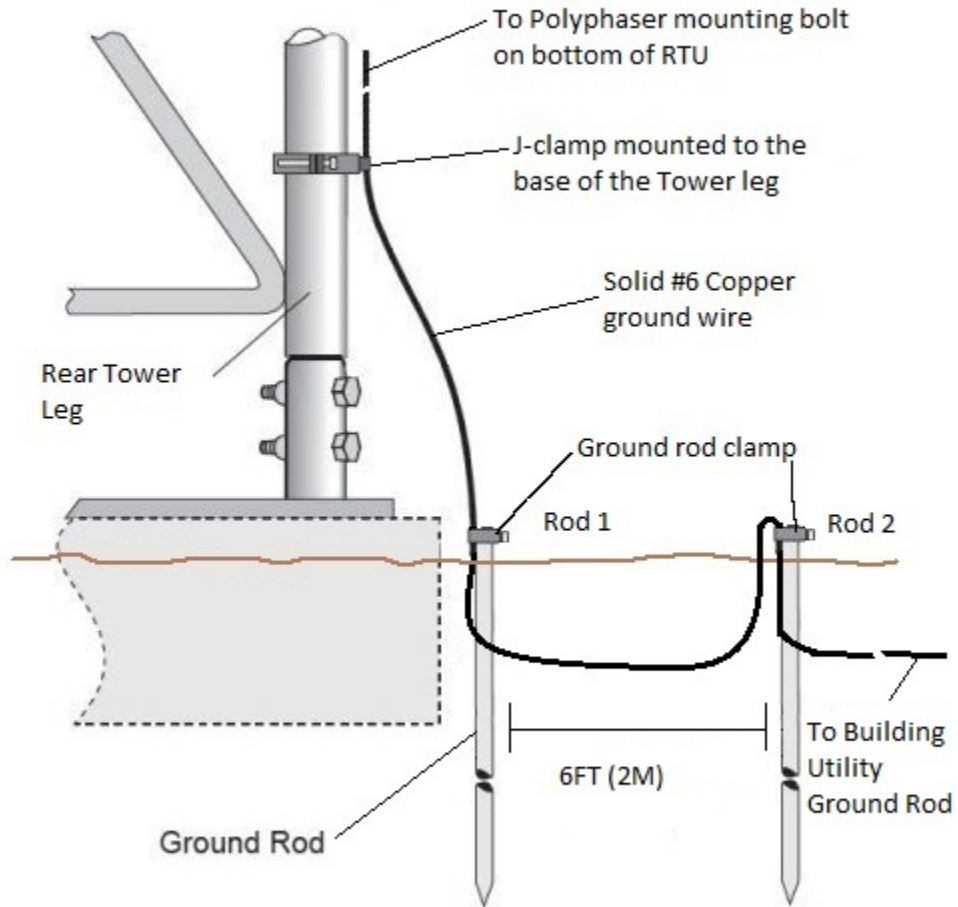
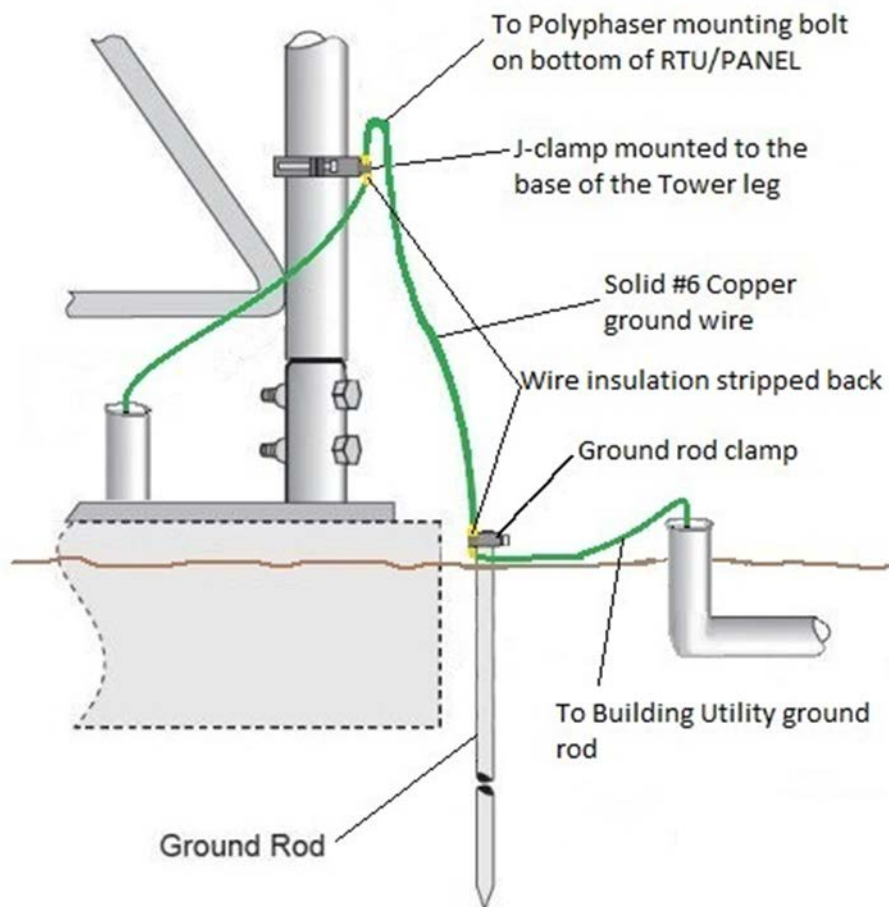


Illustration 7 – stranded ground wire in conduit connected to Tower Leg



5. Once the grounding system is established, measure the resistance to earth ground using an Earth Ground clamp meter. With the display of the meter facing you, measure between the J-Clamp and the Ground rod clamp. The resistance should measure less than 25 Ω (ohm's) (NEC minimum ground resistance requirement). The ideal resistance for lightning suppression and RF signal efficiency is less than 5 Ω .
6. If the grounding system's resistance does not meet the 25 Ω requirement, an additional ground rod is needed. Place second ground rod no less than 6ft (2M) from the first ground rod. There must be a continuous run of #6 copper wire and no more than 1 conductor for each ground clamp.
7. Once grounding resistance and bonding has met the 25 Ω minimum, spray all Ground Rod clamps and J-clamps with a zinc based Cold Galvanizing Compound Spray for preventing oxidation from affecting the grounding system's resistance to corrosion.

Illustration 8 – Stranded ground wire in conduit connected to Tower Leg (Note: The green wire on the polyphaser is bonded to the building's electrical service ground.)

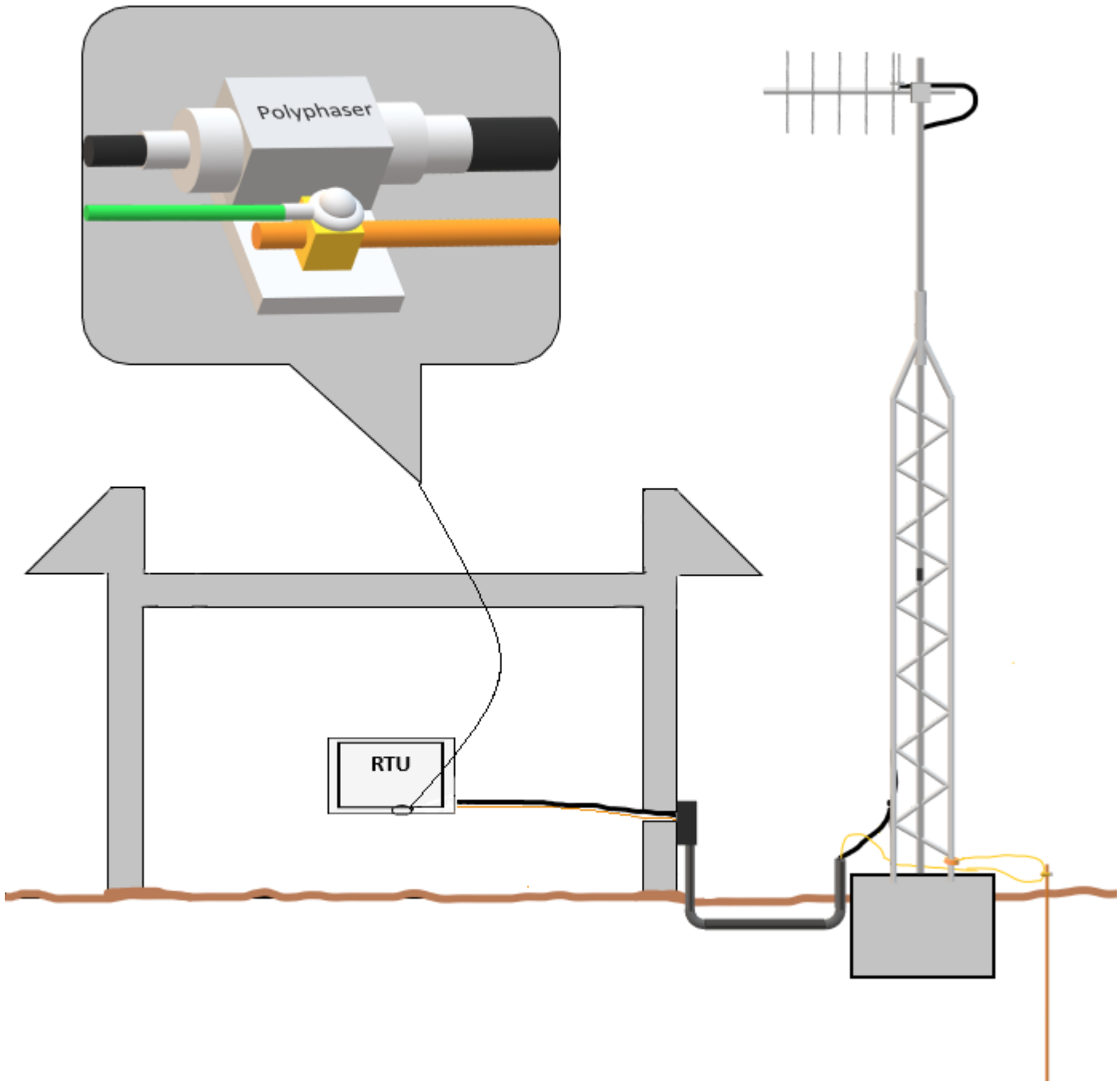
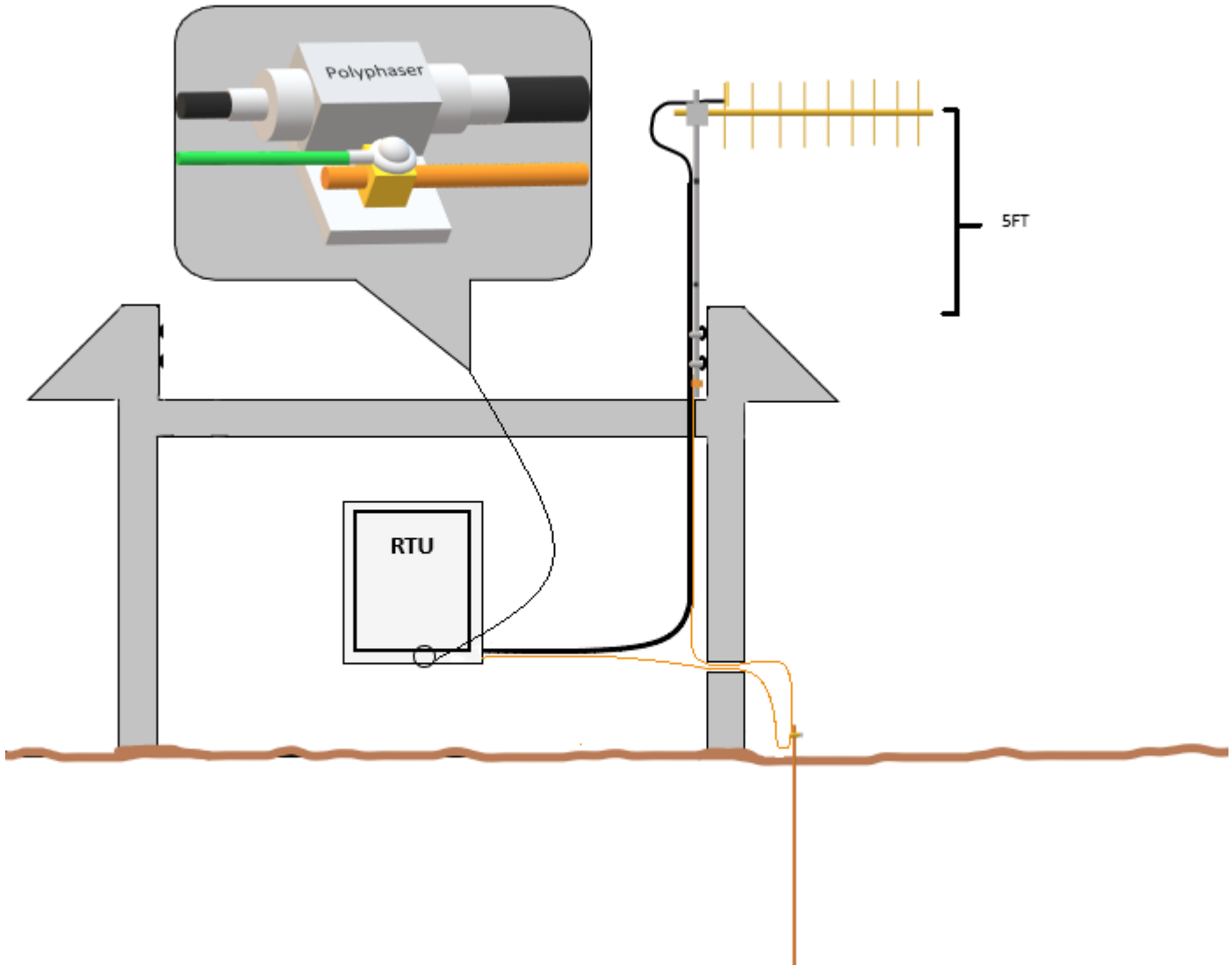


Illustration 9 – Stranded ground wire to roof mounted antenna. (Note: The green wire on the polyphaser is bonded to the building's electrical service ground.)



Section Four: Building mounted CTU grounding. (See illustration 10 and 11) (Note: The bond to the Utility Ground Rod can be made by connecting the polyphaser to the electrical Service Ground.)

1. If possible, disable the main AC power for the station or building where the grounding process is being applied.
2. Verify the locate markers are not near the location where the ground rod is being placed.
3. At a position adjacent to the concrete pad nearest to the back of the tower's rear leg,
 - 3.1. drive the 5/8" X 10' ground rod in the ground until just below concrete pad.
4. Grounding: Determine if the site work is completed.
 - 4.1. **Temporary Ground (site work not complete)** - Run a #6 solid copper wire between the copper grounding rod and the tower base. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the temporary ground to the tower leg.
 - 4.2. **Permanent Ground (site work complete)** - Run a continuous run of #6 copper wire from the polyphaser mounting bolt, tower leg J-Clamp, DFS ground rod, and the building's utility ground rod. Attach the wire to the ground rod with a 5/8" tear drop ground rod clamp. Use a 1-1/4" J-clamp with copper screw to attach the tower rear leg.
5. Once the grounding system is established, measure the resistance to earth ground using an Earth Ground clamp meter. With the display of the meter facing you, measure between the J-Clamp and the Ground rod clamp. The resistance should measure less than 25 Ω (ohm's) (NEC minimum ground resistance requirement). The ideal resistance for lightning suppression and RF signal efficiency is less than 5 Ω .
6. If the grounding system's resistance does not meet the 25 Ω requirement, an additional ground rod is needed. Place second ground rod no less than 6ft (2M) from the first ground rod. There must be a continuous run of #6 copper wire and no more than 1 conductor for each ground clamp.
7. Once grounding resistance and bonding has met the 25 Ω minimum, spray all Ground Rod clamps and J-clamps with a zinc based Cold Galvanizing Compound Spray to prevent any oxidation from affecting the grounding system's resistance to corrosion.

Illustration 10 – Stranded CTU ground wire in conduit connected to CTU Tower Leg (Note: The green wire on the polyphaser is bonded to the building's electrical service ground.)

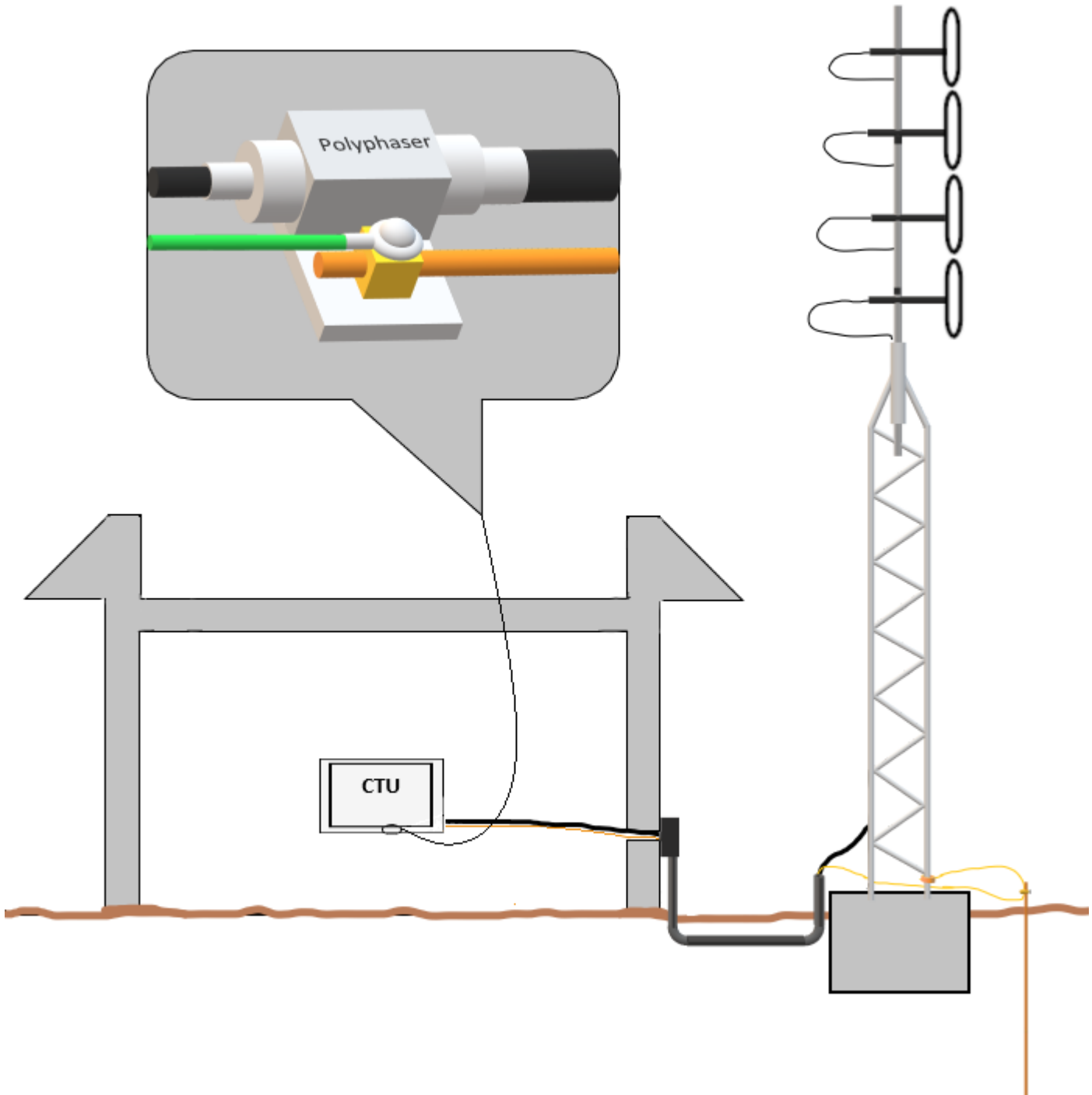


Illustration 11 – Stranded CTU ground wire in conduit connected to CTU Tower Leg (Note: The green wire on the polyphaser is bonded to the building's electrical service ground.)

