

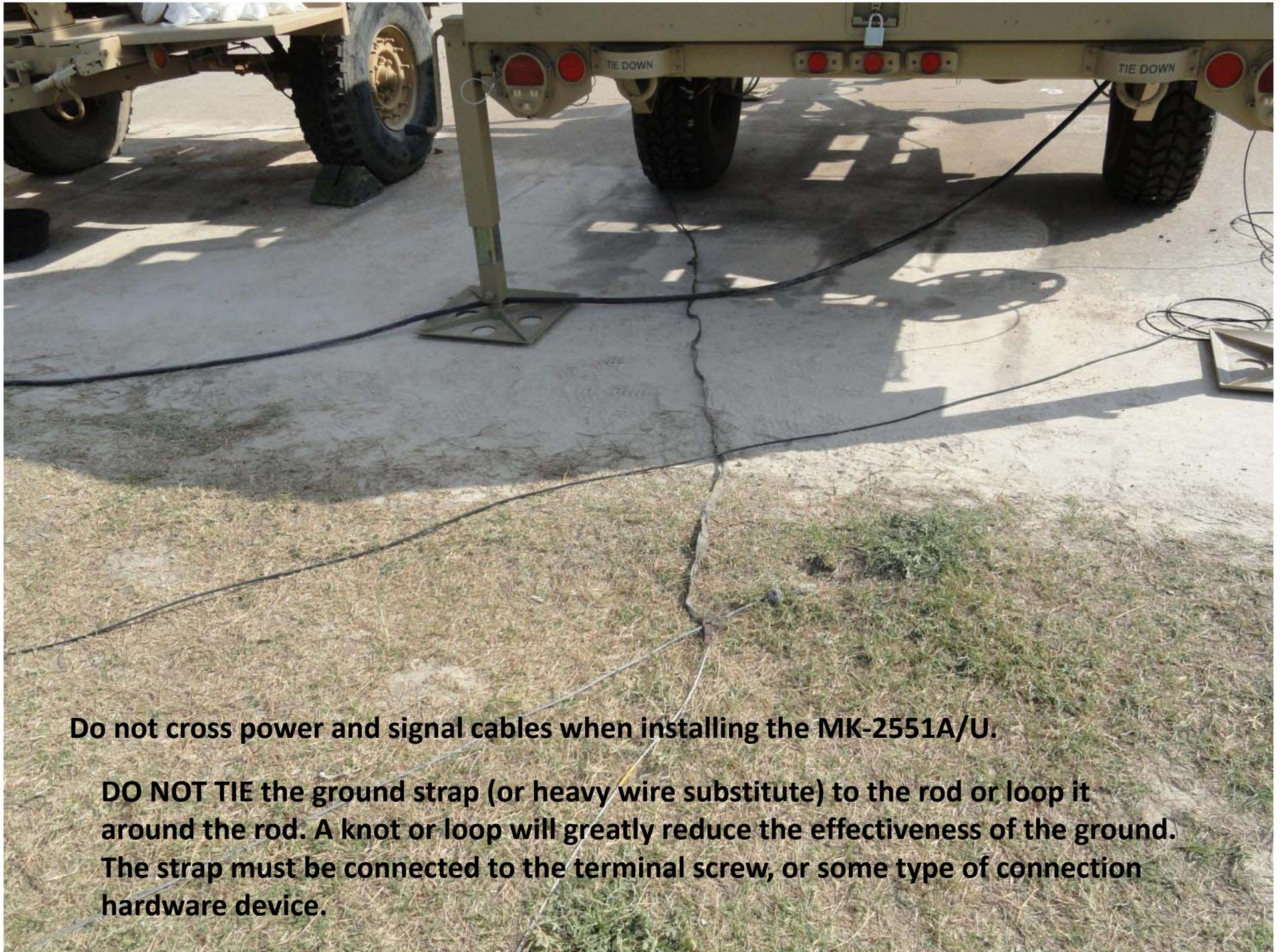


IN THIS SLIDE, THE INDIVIDUAL / S WHO MADE THIS CONNECTION NEEDS TO EXTENSIVELY READ THE MANUALS AND HAVE SOME TRAINING. THIS TYPE OF CONNECTION IS NOT EVEN LISTED IN THE TM'S AND THE CECOM GROUNDING BOOK.

From a safety standpoint, the functions of the grounding system can be placed in two categories. One function is to provide a low impedance path between all equipment and power supply noncurrent-carrying metal parts (enclosures, etc.), as well as provide a bond between these parts and the power supply neutral conductor back at the power supply. Bonding of enclosures is carried out through the use of an equipment grounding conductor (the green wire provided with power cables), and bonding between the grounding and neutral conductor is provided through the main bonding jumper.

The second function involves keeping the equipment enclosures or other noncurrent carrying metal parts at earth potential, to provide a preferred discharge path to earth for surges, and provide a ground reference plane for communications signals.

It is important to stress that earth grounding is only part of the overall grounding system, and is not a substitute for the equipment grounding conductor or the main bonding jumper. Since power faults always follow a path back to the power source, and since the earth is a poor conductor of electricity, sufficient current will not flow back to the power supply to clear any circuit breaker protection. However, the limited current that will flow through the earth will cause equipment surfaces to have a raised voltage. The result is a shelter or piece of equipment that may be functioning without any visible signs of a problem and which has an energized surface – a very hazardous condition. A low impedance path must be provided back to the power source via the equipment grounding conductor to avoid this condition.



Do not cross power and signal cables when installing the MK-2551A/U.

DO NOT TIE the ground strap (or heavy wire substitute) to the rod or loop it around the rod. A knot or loop will greatly reduce the effectiveness of the ground. The strap must be connected to the terminal screw, or some type of connection hardware device.

THIS TYPE OF GROUNDING APPLICATIONS IS NOT EVEN LISTED IN THE **TM 11-5820-1118-12&P for the Star Grounding System and the CECOM CECOM TR-98-6 Earth Grounding and Bonding for Tactical Signal Systems.**



IT APPEARS THAT SOMEONE EITHER WRAPPED THE FLAT COPPER WOVEN STRAP AROUND THE STAR GROUNDING STAKE OR ATTACHED IT BY SOME MEANS, AND DROVE IT BELOW THE SURFACE LEVEL OF THE GROUND. THIS NEEDS DUG UP AND REDONE PER THE TM's.





THIS TYPE OF CONNECTION IS UNAUTHORIZED.

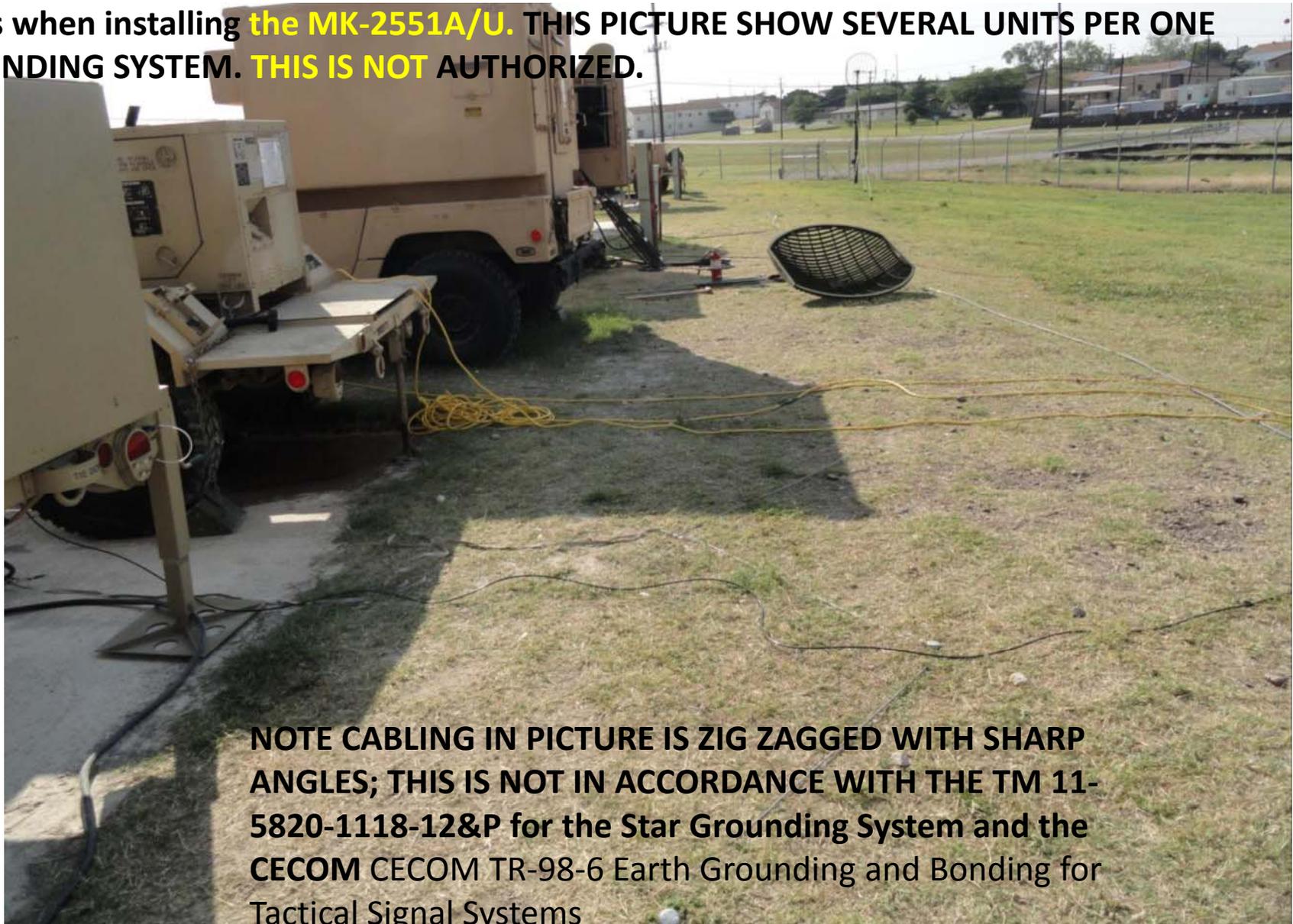
25 SERIES MOS SIGNAL
SOLDIERS ARE NOT
QUALIFIED JOURNEYMAN
OR MASTER ELECTRICIANS.
THEY ARE NOT QUALIFIED
BY KNOWLEDGE, TRAINING
AND EXPERIENCE TO
MANUFACTURE FIELD
EXPEDIENT SPLICES WITH
EXTENSION CORDS.

a. Remove the SWGK from the bag and lay it in a circular or "U" shaped pattern around the equipment without overlapping the cable. Inspect the components and make sure that they are clean and not damaged. Sharp bends and kinks must be avoided in the cable. An important step here is to maximize the spacing between the individual stakes. Wear gloves when handling the steel



WHEN QUESTIONED THE SOLDIERS FOR THIS PARTICULAR EXERCISE HAD CONDUCTED THIS SPLICE. THE INSPECTOR REQUESTED THAT THE CORD BE TOTALLY REPLACED AND DESTROYED. IS NOT IN ACCORDANCE WITH REGULATIONS, NEC; OSHA & ARMY.

Do not use the MK-2551A/U for multiple vehicles or multiple equipment grounding. The MK-2551A/U is intended for single unit applications only Do not cross power and signal cables when installing the MK-2551A/U. THIS PICTURE SHOW SEVERAL UNITS PER ONE GROUNDING SYSTEM. THIS IS NOT AUTHORIZED.



NOTE CABLING IN PICTURE IS ZIG ZAGGED WITH SHARP ANGLES; THIS IS NOT IN ACCORDANCE WITH THE TM 11-5820-1118-12&P for the Star Grounding System and the CECOM CECOM TR-98-6 Earth Grounding and Bonding for Tactical Signal Systems



ONE OF THE FUNDAMENTAL ISSUES IS CORROSIVE CONTROL. SOLDIERS ARE NOT EVEN AWARE OF THIS. IN LOOKING AT THE PICTURE BELOW AND TO THE LEFT THERE IS A LAYER OF CORRISION, THAT REQUIRES A BRIGHT CLEAN SHINEY METAL SURFACE FOR A CONTACT SURFACE IN ORDER TO GET A VERY GOOD CONTACT FOR PATH TO GROUND.

TWO ITEMS THAT MAY WORK OR BE USED IS A HAND WIRE BRUSH OR A WIRE WHEEL THAT FITS INTO THE END OF A DRILL. DIRTY CONNECTIONS DO NOT ENHANCE THE PATH TO GROUND BUT RETARD IT.





Figure 5 – Clamp for 1/2-inch thick rod

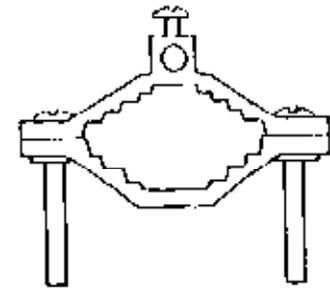


Figure 6 – Clamp for 5/8-inch thick rod

ONE OF THE BASICS IS THE RIGHT TOOLS FOR TIGHTENING VARIOUS ATTACHMENT HARDWARE. THESE NEED ADDED TO INVENTORY. LEATHERMAN TYPE TOOLS WORK IN SOME SITUATIONS, BUT NOT ALL.

SOLDIERS ARE MISSING BASIC HANDTOOLS FOR TIGHTENING VARIOUS NUT AND BOLTS.

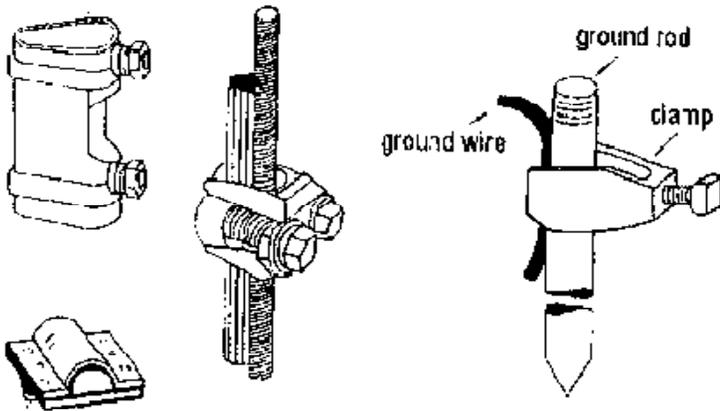


Figure 3 - Examples of suitable clamping devices



IN LOOKING AT THIS PICTURE THE TEAM LEADER AND THE SOLDIERS DO NOT UNDERSTAND THE MEANING OF THE WARNING LABEL THAT IS POSTED ON THE EQUIPMENT FOR THE MAIN GROUNDING POINT CONNECTION.

WHEN LOOKING AT THIS TYPE OF CONNECTION, INDIVIDUALS ARE INCREASING THEIR CHANCES OF SUFFERING ELECTRICAL SHOCK, INJURY OR DEATH AND CAUSING EXTENSIVE PROPERTY DAMAGE TO THEIR EQUIPMENT, PLUS A VERY POOR COMMUNICATIONS PRODUCT IS NOT ACHIEVED FOR TRANSMITTING AND RECEIVING.



ALL FUEL AND POL POINTS OR STORAGE AREAS SHALL HAVE THE PROPER SECONDARY

CONTAINMENT. THESE EXAMPLES FROM THE FIELD TRAINING EXERCISE ARE NOT THE RIGHT EXAMPLES. SEE THE NEXT SLIDE FOR SOME SUGGESTIONS OF THE RIGHT CONTAINMENT. PALLETIZING TOP AND

BOTTOM PIECES ARE NOT SECONDARY CONTAINMENT.

SEE NEXT SLIDE.



SOME EXAMPLES OF THE RIGHT TYPE OF CONTAINMENT FOR USE FOR FUEL POINTS. SECONDARY CONTAINMENT IS REQUIRED BY THE GARRISON.



SOME GENERAL DO's AND DON'T's ABOUT GROUNDING AND BONDING FROM THE CECOM BOOK.

Never lay system power cables or signal cables over the location of the earth grounding electrode, grounding electrode conductors, or SWGK cable. During a fault condition, step potentials at and near these components may be induced on collocated signal and power cables.

GROUND ROD INSTALLATION

Drive the rod through to the moist subsoil. The ground rod should be installed straight if possible, but can be installed up to an angle of 45 degrees. Allow about 3 inches of the rod to protrude above the bottom of the hole. When installing a multiple section ground rod, ensure that top section is tight against the lower rod to prevent damage to the coupling sleeve threads. Similarly, the driving bolt should be tight against the lower rod (see figure 10). Be careful not to hit the threaded end of the rod section with the hammer, or damage the threads in any other way. A slide hammer (NSN 5120-01-013-1676) can make the task of installing and pulling out a multiple section ground rod easier and safer.

After the ground rod is in place, connect the rod to the equipment or shelter using a ground strap or other suitable grounding electrode conductor. Connect the ground strap to the ground rod using the provided terminal screw. If your ground rod has no terminal screw or if it is missing or broken, connect the ground strap with the proper brass, bronze or copper coated hardware attachment device.

After one end of the ground strap or conductor is connected to the ground rod, connect the other end to the ground lug on the shelter or equipment. Keep the strap or conductor as short and straight as possible. Make sure that there are no loops or knots in the ground strap or conductor. See that all connections are clean and tight.

Fill the hole with water, and let it soak in. Then fill the hole with soil. Add water as often as needed to keep the soil moist around the ground rod. Check the grounding electrode conductor and connections every day and keep them clean and tight.

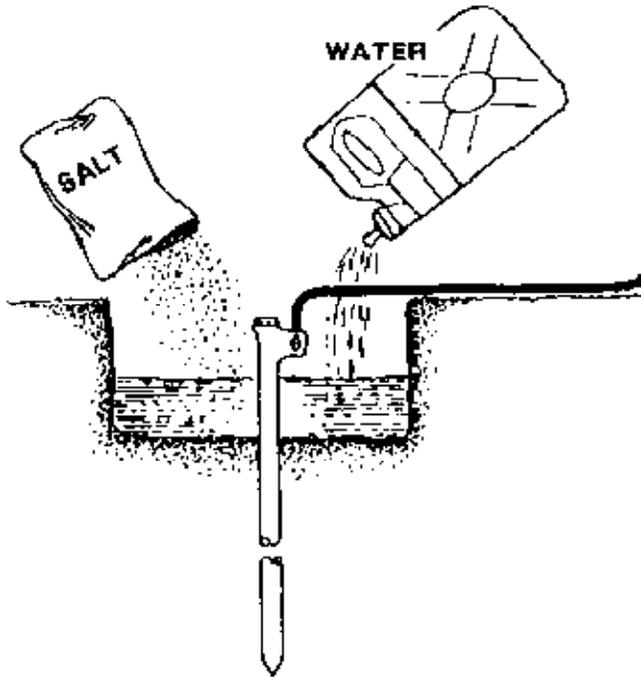


Figure 12 - Treatment of soil

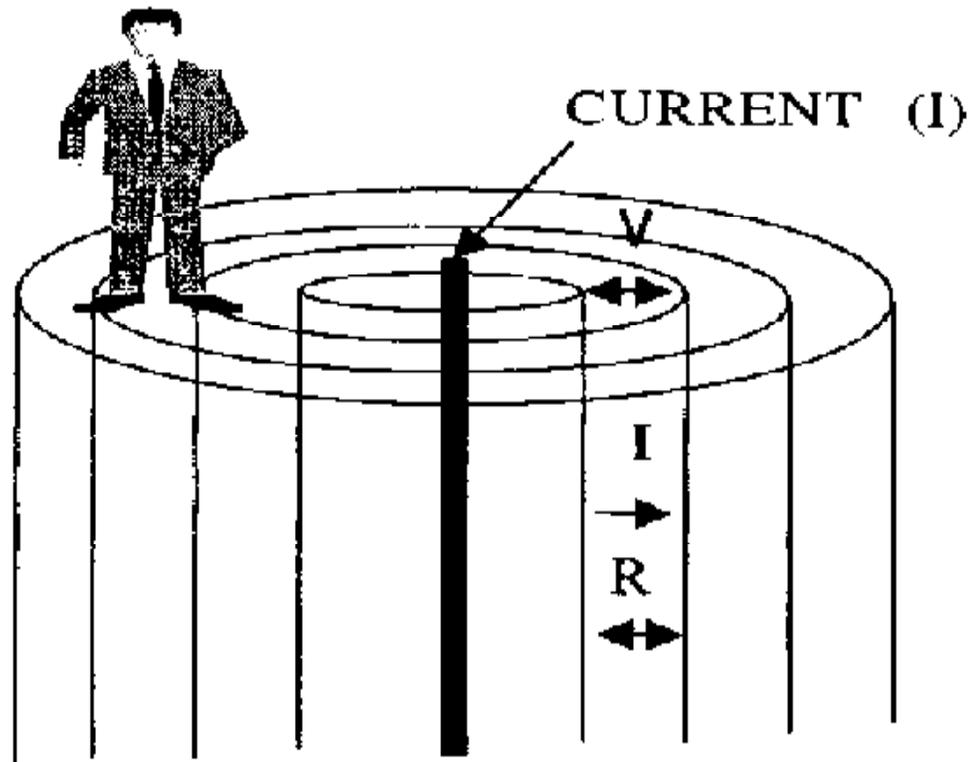


Figure 26 Step potentials

HAZARDS DUE TO STEP POTENTIALS

In figure 26, previous slide, we illustrate a ground rod with a current flowing into it and then outward through surrounding cylindrical shells of earth. We know that each shell of earth has some electrical resistance. As the current flows through each resistive shell a voltage is developed on the surface of the earth. This is called the step potential or step voltage, or simply the voltage that can develop over the space of one step on the surface of the earth. The step voltage can be several thousand volts, which is enough to do serious injury, or even be lethal. If the person in this figure were unfortunate enough to be near a ground rod subject to a high current event like lightning, he would probably experience a momentary but very severe shock due to current travelling through his body from one foot to the other due to this voltage difference between his feet.

Step potential is greatly reduced, in most cases, as one moves further from the ground rod.

One of the surest methods, however, is to keep personnel away from the grounding Elements. Ground rods should be installed away from walk areas: at least 6 feet. It should be noted that a person lying on the ground near a grounding electrode can also experience severe shock; keep sleeping quarters away.

The equipment grounding conductor is typically adequate to keep surfaces grounded during a power fault, and will also discharge some of the current during minor lightning related events. However, its small relative size and the way it's run (twists, turns, kinks, etc.) can create a higher impedance path that can fail.

However, the best way to substantially improve the earth grounding electrode resistance is to use salt and water (see figure 12).

THIS IS A PICTURE OF THE STAR GROUNDING SYSTEM; MAIN GROUND ATTACHMENT TERMINAL LUG THAT GOES TO THE MAIN GROUNDING POINT ON THE EQUIPMENT. IT IS LAYING LOOSE FOR SOME REASON. AGAIN THE TM SAYS THAT ONE COM UNIT SHALL USE ONE GROUNDING SYSTEM. IN THIS SERIES OF PICTURES A FLAT WEB COPPER STRAP IS TIED IN A KNOT, TO ACHIEVE A CONNECTION. TOTALLY WRONG.



A KNOTTED CONNECTION WILL FAIL EVERY TIME, CONNECTION DEVICE HARDWARE NEEDS USED.





THIS KNOTTED CONNECTION IS FURTHER EXTENSION PICTURES OF SLIDE # 32. VERY HUGE POSSIBILITY AND POTENTIAL FOR FAILURE AND CAN CAUSE ELECTRICAL SHOCK, INJURY OR DEATH TO A SOLDIER. CONNECTION DEVICE HARDWARE SHALL ALWAYS BE USED IN THIS SITUATION.



BONDING JUMPER CABLE BEING USED INSTEAD OF MAIN STAR GROUNDING TERMINAL LUG CONNECTOR. NO CONNECTION HARDWARE DEVICE BEING USED. THIS ONE WILL FAIL.

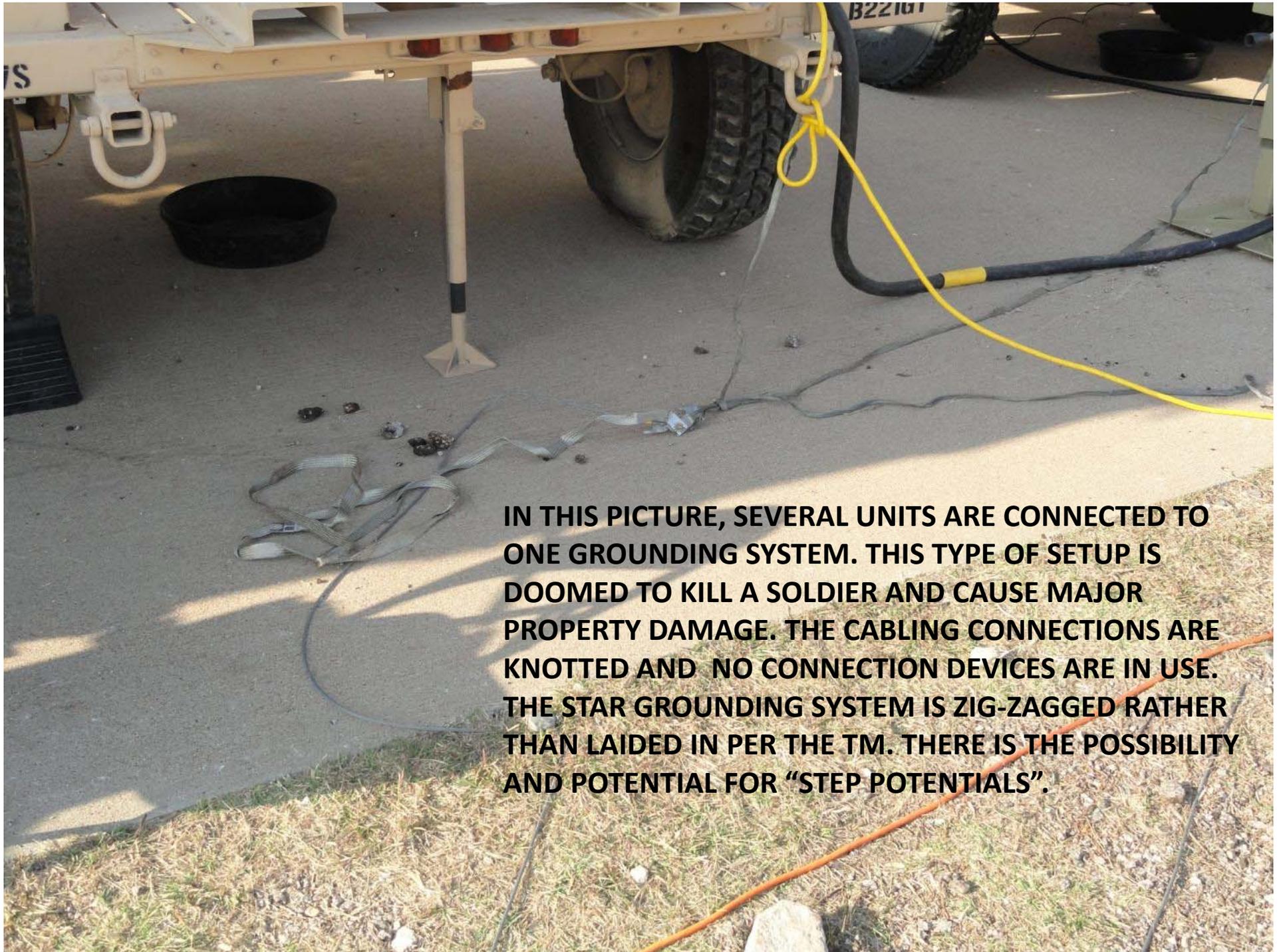
THE HOSE CLAMP WILL FAIL AND COME LOOSE, AND THE TWISTED WIRING IS NOT A TIGHT CONNECTION. THIS TYPE OF CONNECTION WILL CAUSE A SOLDIER TO GET AN ELECTRICAL SHOCK OR KILLED. IN THE SHOT AT THE BOTTOM, THERE ARE SEVERAL ISSUES HERE. GROUNDING, FIBRE, AND ELECTRICAL CABLE CANNOT BE CROSSED. THIS TYPE OF HARDWARE CONNECTION DEVICE DOES NOT ACHIEVE THE SAME TIGHT CONNECTION THAT A REGULAR COPPER, BRASS OR BRONZE CONNECTION HARDWARE DEVICE WILL ACHIEVE. THE BONDING JUMPER IS ONLY FOR BONDING NOT MAIN TERMINAL GROUNDING.



REFER TO **TM 11-5820-1118-12&P** for the **Star Grounding System** and the **CECOM** CECOM TR-98-6 Earth Grounding and Bonding for Tactical Signal Systems.

**THIS TYPE OF CONNECTION IS NO CONNECTION AT ALL.
GROUNDING AND BONDING SHALL NOT CROSS FIBRE AND ELECTRICAL.**





IN THIS PICTURE, SEVERAL UNITS ARE CONNECTED TO ONE GROUNDING SYSTEM. THIS TYPE OF SETUP IS DOOMED TO KILL A SOLDIER AND CAUSE MAJOR PROPERTY DAMAGE. THE CABLING CONNECTIONS ARE KNOTTED AND NO CONNECTION DEVICES ARE IN USE. THE STAR GROUNDING SYSTEM IS ZIG-ZAGGED RATHER THAN LAID IN PER THE TM. THERE IS THE POSSIBILITY AND POTENTIAL FOR "STEP POTENTIALS".