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Utility Pole Climbing Procedures

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Chapter 4

Pole Climbing and Rescue

Topics

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Overview

For Construction Electricians, power pole climbing is an occupational task. Pole Climbing is necessary in the construction and maintenance of Overhead Electrical Distribution Systems. It is not difficult or hazardous if you take care in selecting, fitting, and maintaining rigging and climbing equipment. You must also be well aware of pole top resue. You need to be fully prepared to perform pole top and bucket truck rescues on any project.

Objectives

When you have completed this chapter, you will be able to do the following:

1. Describe the purpose and maintenance of climbing equipment.
2. Describe the procedures utilized for climbing power poles.
3. Describe the purpose and maintenance of rigging tools.
4. Identify the knots and hitches utilized in pole climbing.
5. Describe the different climbing techniques.
6. Describe the procedures utilized during pole top and bucket truck rescue.

Prerequisites

This course map shows all of the chapters in Construction Electrician Basic. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map.

1.0.0 INTRODUCTION TO CLIMBING EQUIPMENT

As an electrical systems specialist you will be provided personal climbing equipment. This equipment will help you to climb utility poles in a safe and efficient manner. It is important to maintain this equipment properly to prolong its useful life and ensure your personal safety. Inspection of your personal climbing equipment is an essential element of performing the lineman duties. Equipment failure while you are on a pole can result in serious injury or even death. In the following paragraphs, you will learn about the different types of climbing equipment, how they are used and how to inspect and maintain them.

Figure 4-1 – Construction Electricians performing pole climbling evolution.

You may need to perform installations or repairs on wooden utility poles (*See Figure 4-1*). Sometimes this can be accomplished with the use of an aerial lift or line maintenance truck; however, you may find that access to a pole with a truck may be difficult, or there may not be a truck available. This is when personal climbing equipment becomes necessary. An electrician's personal climbing equipment consists of a lineman's body belt, a lineman's safety strap, a pair of climbers, a pair of gloves, and a hard hat.

1.1.0 Climbing Equipment

1.1.1 Lineman's Body Belt

The lineman's body belt is made up four parts: cushion or pad section for comfort and support, a belt with a tongue and buckle, a tool saddle, and "D" rings attached to the cushion (*See Figure 4-2*). Two measurements are necessary for fitting the body belt. One is used to determine the "D" ring position on the belt and the other to actually fit the belt to your body. The most critical measurement of a body belt, in terms of comfort, is the dee

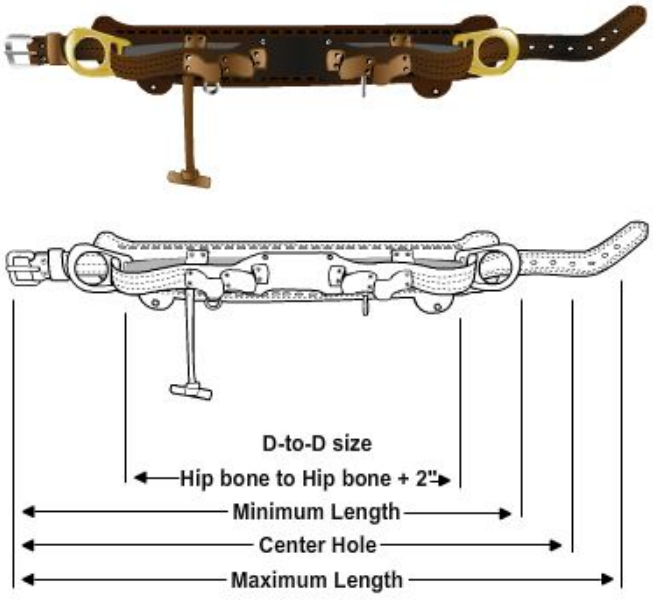

Figure 4-2 – Lineman's body belt.

measurement. The proper dee size is normally found by measuring from the prominent part of one hip around the back to the same point on the other hip bone. To this figure, two inches should be added so the dee ring heels will be just forward of the hip bones rather than on them. The measurement to properly size the body belt is determined by measuring completely around the waist where the belt is worn. All measuring is over the work clothing to be worn under the belt. Refer to *Figure 4-3* for distances.

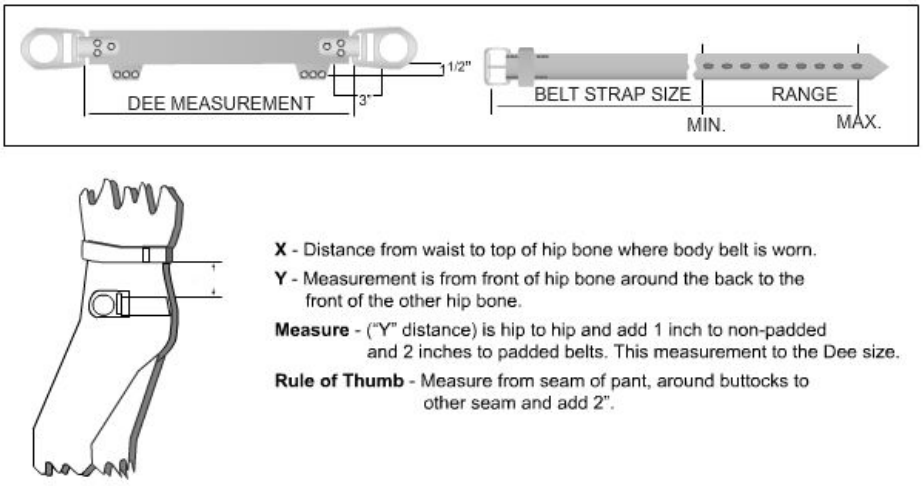

Figure 4-3 – Measurements corcerning lineman's body belt.

1.1.1.1 Inspection

Inspect the body belt before use. Inspect all leather parts for tears, cracks and cuts; the stitching for rotting, broken threads; and the "D" rings and rivets for rust, breaks, and cracks.

1.1.1.2 Maintenance

Leather makes up most of the body belt. Clean it by wiping the surface with a soft, dampened cloth or sponge. After wiping the surface, work a neutral soap (such as saddle soap) to a good lather into the leather with a clean cloth or sponge. Then wipe the lather clean from the leather.

While the leather is still damp, apply leather dressing or neatsfoot oil. Take care not to apply excessive leather dressing. Then leave the leather to dry naturally for 24 hours, after which, remove excessive dressing with a clean cloth. Give leather parts thorough treatment of leather dressing or neatsfoot oil every 30 days to keep the leather soft and flexible. Some body belts are made of nylon or layered straps; these must be cleaned with an approved solvent recommended by the manufacturer.

1.1.2 Lineman's Safety Strap

Workers must use their safety straps (see *Figure 4-4*) at all times upon reaching a work position on any pole, tower or structure. Before workers transfer their weight to the safety strap, they should ensure that the snaps on the safety strap are fastened properly to the "D" ring of the Lineman's body belt. The only safe way to determine that the snap is securely fastened to the "D" ring is to actually look at the "D" ring each time you fasten the snap. Never depend upon the sound or feel of the snap. Leaning back for a

test can also be dangerous as the snap may be caught in something other than the “D” ring.

1.1.2.1 Inspection

Inspect the straps before each use and every 6 months when they are stored for a period of time. The inspection is done in accordance with Unified Facilities Criteria (**UFC**) 3-560-01 (Electrical Safety, Operation and Maintenance). Inspect the strap for tears, cracks and cuts. Also inspect the stitching for rotting and broken threads. Inspect the buckle for rust, breaks and cracks. If you discover any discrepancies on the strap, it will be taken out of service. If there is any doubt about the serviceability of the strap, discard it.

Figure 4-4 – Lineman’s safety strap

1.1.2.2 Maintenance

Never expose the strap to excessive heat or punch extra holes into it. When straps are stored in a bag with other equipment, ensure sharp objects and tools are stored in special compartments to avoid damage to the strap. Never drop the strap and body belt or throw them to the ground. The strap is a leather product and should be protected from damage. The cleaning procedure is similar to that of the body belt.

1.1.3 Lineman’s Climbers

Climbers are used for ascending, descending and maintaining work positions on the pole. See *Figure 4-5*. They consist of leg irons with straps, pads and gaffs. The leg irons are adjustable from 14 to 20 inches in half-inch increments. The gaffs are attached to the leg iron and are normally replaceable. Adjust the leg iron to a position one inch below the prominent inside bone of the knee. Secure the climber to your leg and foot with adjustable leather or Velcro straps.

Figure 4-5 – Lineman’s climbers.

1.1.3.1 Inspection

Inspect climbers before each use. Inspect straps and pads frequently for cuts, loose stitching, enlarged eyelet holes, and tears; and inspect buckles for rust and damage.

1.1.3.2 Maintenance

Like other climbing equipment, climbers require routine maintenance including cleaning and sharpening.

1.1.3.2.1 Cleaning

Treat leather straps with an approved leather dressing or neatsfoot oil the same as with the body belt and safety strap.

1.1.3.2.2 Sharpening Procedures

Sharpen the gaff with an 8-inch smooth knife file or a 10- inch bastard file (Refer to *Figure 4-6*). The underside of the metal gaff is the area that is filed and is located between the gaff itself and the climber. Do not file in rocking motions, as this will round the edges of the gaff. After sharpening, the underside of the gaff should be straight to within one sixteenth of an inch to the end point, and then rounded slightly toward the ridge of the gaff to a radius of one inch. You can obtain additional sharpness by dressing the underside and rounded portion of the tip with a ***honing*** stone made of ***carborundum***. Verify measurements with a gaff gauge, as shown in *Figure 4-7*.

Figure 4-6 – Gaff sharpening tools.

Also remove burrs along the edge with the honing stone. NEVER file the outer edge of the gaff.

Honing is all that is necessary for a machine-sharpened climber. If you cannot restore gaffs to a satisfactory condition with a hone in a short period of time, return them for machine sharpening or replacement. The shortest permitted length of a gaff is 1-1/4 inches as measured from the underside. The average lifetime of a climber is five years or by the time the gaffs have been replaced twice.

After gaffs have been machined sharpened or gauged, they may be tested on the pole. To do this, put the climber on with only the foot strap fastened. With this leg at a thirty-degree angle to the pole, stick the gaff into the pole at a position one foot above ground level. Ensure that 1/4 inch of the gaff penetrates the pole. Apply enough pressure downward on the climber to hold the gaff in the pole and maintain the same penetration. While in this position, use the other hand to maintain balance and move the knee toward the pole until the strap-loop or pad of the leg iron rests against the pole.

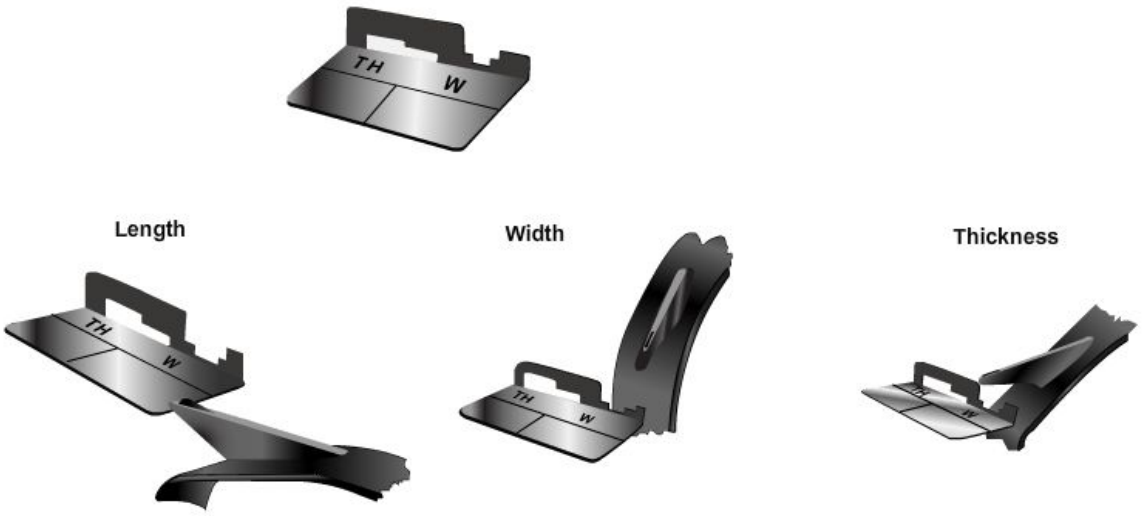

Figure 4-7 – Proper method of measuring gaffs using the gaff gauge.

Gradually exert pressure downward with the foot, while keeping the climber pad in contact with the pole with the knee.

A properly sharpened and shaped gaff will cut into the pole and hold, within a distance of no more than 2 inches. This distance is measured from the point of the first penetration to the bottom of the cut made by the gaff, as the knee was moved toward the pole.

1.1.3.2.3 Safe Storage

Use gaff guards to protect the gaffs when the climbers are not in use or are stored in the climbing bag. When climbers are stored they must be wrapped in pairs and fastened with their straps. Secure them in a dry location away from direct heat.

1.1.4 Gloves

Wear gloves to protect your hands (Refer to *Figure 4-8*). Use gloves whenever you are required to handle rough, scaly or splintered objects such as a wooden pole. Gloves should fit snugly, but not tightly. They should be flexible enough to allow for easy movement of the hand when working or handling tools.

1.1.4.1 Inspection

Inspect gloves for tears, holes and cuts. Also inspect the stitching for rotting and broken threads. If there is any doubt about the serviceability of the gloves, discard and replace them.

Figure 4-8 – Gloves

1.1.4.2 Maintenance

The glove is generally made of leather, canvass or a combination of both products. The maintenance requirements are minimal. To prolong their serviceability simply keep them clean and dry. Brush off any

accumulated dirt on the glove. If the gloves get wet, allow them to dry naturally. Never expose gloves to excessive heat when leaving them to dry, as this will cause them to shrink and become rigid.

1.1.5 Hard Hat

A hard hat protects your head from falling objects and accidental contact with electrical circuits (*See Figure 4-9*). It is made up of a shell and a suspension system. The headband portion of the suspension system should be adjusted to fit around the crown of the head. The chinstrap, which is attached to the shell, should also be adjusted to fit beneath the chin. Both the headband and the chinstrap should be adjusted to fit comfortably. **DO NOT OVERTIGHTEN**. Electrical workers must wear insulating hard hats rated as class B, high voltage resistant type. Class B hard hats are rated to meet a test of 20,000 volts 60 Hertz (**Hz**) for 3 minutes with 9 milliamps (**MA**) maximum leakage. Hard hat requirements are found in 29 CFR Article 1926.100 and American National Standards Institute (**ANSI**) Z89.2-1971**.**

Figure 4-9 – Lineman's hard hat.

1.1.5.1 Inspection

Inspect the hard hat shell for cracks and burns. Check the suspension system for cuts and the chinstrap for elasticity and fraying before use. Replace the hard hat immediately if there are any signs of wear, damage, abuse, or environmental degradation.

1.1.5.2 Maintenance

Maintenance is limited to keeping the shell clean. Do this with mild soap and warm water. If the suspension system or chinstrap is damaged in any way, replace these items. Never clean hard hats with solvents, abrasives or other petroleum products.

1.1.6 Safety

Inspection of your personal climbing equipment is an essential element of working as an electrical systems specialist. Equipment failure while you are on a pole can result in serious injury or death. If you fail to take care of your equipment, it will fail to take care of you.

Test your Knowledge (Select the Correct Response)

1. Which of the following tools is used for sharpening gaffs?

   A. 6 inch Bastard File
   B. 8 inch Coarse File
   C. 10 inch Bastard File
   D. 12 inch Smooth File

2.0.0 CLIMBING PROCEDURES

Now that you are familiar with your personal climbing equipment, it is time to inspect the utility pole you are about to climb. In this case, it's a wooden pole. What you will be checking is the serviceability of the pole to ensure it can withstand your weight and any equipment you may be installing.

2.1.0 Pre Climb Actions

Prior to climbing any pole you must conduct an inspection of the pole and your climbing equipment.

2.1.1 Inspect Pole

Naturally, you should take a close look at the pole you are about to climb since climbing an unsafe pole could lead to serious injury. The following paragraphs will provide you with specific pole inspection procedures.

2.1.1.1 Sound Test

Prior to climbing, determine the structural soundness of the pole. Rot can be internal or external with the most evident place being where the pole enters the gound. This type of rot is called "Butt Rot". Buckling of the pole at ground level is a good indicator of butt rot. Other types of rot can only be determined through by a sound test. You accomplish a sound test by taking a 2 pound hammer (See *Figure 4-10*) and striking the pole squarely and firmly on numerous points all around the pole from the ground line to as high as can be safely reached and listen to the sound that returns after each blow. A good pole will produce a solid ringing sound and sharp recoil of the hammer, whereas a pole that produces a hollow sound or dull thud is likely to be affected by heart rot which is decay of the inner most core of the pole. If the hammer actually penetrates the surface of the pole, then there is a good likelihood that the pole contains shell rot. Do not under any circumstances climb poles affected by heart rot or shell rot. Performing a sounding test is the only sure way to determine the condition of the pole prior to the climb.

Figure 4-10 – Sound test.

2.1.1.2 Visual Inspection

Before you begin your pole ascent, perform a visual inspection to locate the high side of the pole and inspect it for nails, knots, and deep splits (cracks).

2.1.1.2.1 Inspect for Knots, Deep Splits, and Nails

A knot is a hard spot or spots on a pole where a stem or a branch once existed. This may signify a weak point on the pole, and at times the gaff may not penetrate these areas. Deep splits found in wooden poles are either vertical or horizontal. Avoid gaffing into vertical splits in the pole to prevent gaffing out.

Horizontal splits contribute to the weakening of the pole and should be considered before climbing. Nails are often placed by persons who use poles to post advertisements for garage sales, missing animals, etc. Remove these nails prior to climbing the pole. Failure to do so can cause you to gaff out while climbing or at the very least damage the gaff should it come in direct contact with the nail. See *Figure 4-11* for examples of inspectable items.

Figure 4 - 11 – Examples of inspectable items.

2.1.1.2.2 Locating High Side of Pole

After inspecting the pole for safe climbing, find the natural ***curvature*** of the pole. Most poles have a natural arc or curve along the entire length. The outside (convex side) of the arc is termed the “High Side” of the pole, and is the best side to climb.

2.1.2 Inspect Climbing Equipment

The importance of inspecting your climbing equipment cannot be overstated. You will inspect the body belt, safety strap, climbers, gloves, and hard hat.

2.1.2.1 Body Belt

Inspection of the body belt will be accomplished before use. All leather parts are inspected for tears, cracks, and cuts. The stitching should be inspected for rotting and broken threads. The “D” rings and rivets should be inspected for rust, breaks, and cracks.

2.1.2.2 Safety Strap

Inspect your strap before each use and every 6 months if stored for a period of time. Like the body belt, safety straps should be inspected for tears, cracks, and cuts. Also inspect the stitching for rotting and broken thread and the buckle for rust, breaks, and cracks. If you discover any of these things on the strap, discard it. If you have any doubt about the serviceability of the strap, discard it.

2.1.2.3 Climbers

Inspect straps for cuts and tears and buckles for rust and cracks. Inspect gaffs for burrs, and ensure they are sharp.

2.1.2.4 Gloves

Inspect gloves for holes and cuts. Also inspect the stitching for rotting and broken threads. If there is any doubt about the serviceability of the gloves, replace them.

2.1.2.5 Hard Hat

Inspect the hard hat shell for dirt, cracks, and burns and check the suspension system for cuts and the chinstrap for elasticity and fraying before use. Replace the hard hat immediately if there any signs of wear, damage, abuse, or environmental degradation.

2.2.0 Ascending Procedures

Once the pole and climbing equipment have been inspected and deemed serviceable, you are ready to don your climbing equipment and climb up (ascend) the pole. See *Figure 4-12* for a demonstration of ascending a utility pole.

Figure 4-12 – Ascending utility pole.

NOTE

Before climbing ensure your arms are protected by rolling down your shirtsleeves. Protect your hands with leather gloves.

When ascending, take short, comfortable steps approximately 8 to 10 inches high. Always take short glances up the pole to determine where you are going and if any obstacles are in your path during the climbing process. On each step, transfer the weight of your body to the lower leg with the knee locked. This procedure should be smooth and rhythmic.

Keep hips, shoulders, and knees at a comfortable distance from pole. It is important to maintain a proper climbing position. Keep your shoulders and hips in a relaxed position. Remember, 8 to 10 inch steps, hand foot coordination, and keep one knee locked at all times. Each time you take a step up, lock the knee of the leg with which you just stepped up.

Use your legs to lift your body during climbing and use your hands for balance only. Novice climbers have a tendency to pull themselves up using their arms. This is a poor practice to get into as arms will tire very quickly.

With the stepping leg, make an inverted “J” with the gaff and plunge it into the pole approximately six inches above the ground. Step up on that gaff by putting your full

weigth on it, while keeping your knee locked and positioned away from the pole. Take another step with the other leg approximately 8 to 10 inches above the first.

Each time you take a step, your gaffs should be directed towards the heart of the pole. In order for your gaff to achieve penetration into the heart of the pole and ensure safe positioning, your feet must be turned out and kept apart. This will ensure that the gaff (and not the side of your foot) will hit the pole. The horizontal distance between your heels is determined by the size of the pole.

Coordination of hand movement is very important. The right hand will move up with the right leg and the left hand will move up with the left leg in a rhythmic motion. Repeat this action until you reach the desired level above ground.

If you follow these simple procedures, you will not have any problems ascending the pole.

2.3.0 Descending Procedures

Descending the pole is nearly the opposite of ascending. Keep a proper climbing position by remaining at a comfortable distance from the pole, relaxing the shoulders, hips and knees. Look down between your legs as you descend. See *Figure 4-13* for an example of descending a utility pole.

Figure 4-13 – Indivdual descending utility pole.

Coordinatin here is very important. The right hand will drop with the right leg and the left hand will drop with the left leg in a rhythmic motion. This is the opposite of how we walk or march and it may take some practice for you to get the hang of it.

Before taking a step down, relax the leg that is in the highest position on the pole. Remove this leg from the pole while at the same time supporting your full weight on the other leg. Allow your leg to hang down towards the ground, and straighten it by locking your knee. This action will enable you to keep the leg straight while you aim the gaff and step (drop) down.

Aim the gaff at the heart (center) of the pole beneath your body. Be sure to point your toes upward when doing this.

Aim and then drop the gaff of the leg removed from the pole into the targeted position that you sighted between your legs. The drop has to be an unrestricted action using your full body weight. Do not ease yourself down onto your gaff, drop with some amount

of force. Easing down on the gaff will prevent full penetration into the wood of the pole and is likely to result in gaffing out. If done correctly the leg that has dropped should support the full weight of your body.

Use the upper leg to gauge how far to drop. If the drop is done correctly, the upper leg will be parallel with the ground. Remove the uppermost leg from the pole by “rolling” the knee to the outside (away from the pole) before taking the next step. Repeat the initial procedure of stepping down after removing the uppermost leg from the pole. Remember coordination and rhythm is very important. You take your last step to the ground at approximately six inches or less from the bottom of the pole to prevent gaffing yourself and/or injuring your knee.

2.4.0 Safety

Safety during both the ascending and descending procedures cannot be over emphasized. The novice climber tends to rush to complete these tasks, forgetting technique. This is a common mistake; take care to avoid it. Follow procedures and concentrate on technique, your speed will develop with time.

Walking with climbers on the ground poses a danger. Adjust your walking by mimicking that of a cowboy walking with spurs on to avoid inadvertently gaffing yourself. To do this, simply consciously keep your feet far apart while walking.

Be aware of your positioning at all times. Stand at least 10 feet away from any pole that has an individual working aloft. Drink plenty of water and concentrate on applying the proper climbing techniques. To do otherwise will result in premature fatigue, needless muscle ache or, in the worst case scenario, physical injury due to a fall from the pole. You will soon learn that climbing is an art form that is totally reliant on technique, not brawn.

2.5.0 Transverse Obstacles

Up to this point, you have been exposed to pole climbing in ideal climbing positions. In the operational world, utility poles will often present numerous obstacles you will have to overcome in order to obtain a good work position. You need to know the proper way to overcome these obstructions in a safe and timely manner.

2.5.1 Purpose

When climbing a utility pole, you may encounter crossarms, transformers, or other objects you will need to climb over (traversed) or around in order to reach a final work position. The techniques associated with traversing obstacles will allow you to overcome situations that prevent you from reaching a final work position in a safe manner. Refer to *Figure 4-14*.

Figure 4-14 – Tranversing obstacles.

2.5.2 Traversing Procedures – To Ascend

The first step prior to any climb should be to plan your climbing route to avoid as many obstacles as possible. Doing so will make the task of ascending the pole easier and possibly eliminate the need to climb over some of the obstacles you may encounter. Even with advanced planning, there may still be obstructions to be traversed. Traversing an obstacle will put all your climbing skills to the test.

2.5.2.1 Positioning

One obstacle that requires traversing is the double crossarm. Double crossarms are used when a single arm is not strong enough to support the conductor weight or there is an angle change in the overhead line. Since there is not enough room to climb between the two crossarms, you will need to climb over them. In order to do this, begin by positioning yourself at the base of the pole and position the crossarm over one of your shoulders. Ascend the pole, ensuring that the crossarm remains positioned over your shoulder. Climb until your shoulder is at the same level as the lag screw.

2.5.2.2 Hand Postioning

Grasp the crossarm with one hand and hold onto the pole with the other hand. At this point, check the crossarm's sturdiness. If it feels sturdy, use the crossarm for support and continue to climb up the pole. You can climb onto the crossarm, but gradually apply your weight on it to ensure that it can support you. Be careful not to gaff the crossarm braces, and make certain that your feet do not slip on the arm.

On a pole with a faulty double arm, you need to modify this procedure. Do not use the crossarms for support but climb high enough to grasp the utility pole above the crossarm and continue climbing until your gaffs are close to the braces. Your hands and arms are near the crossarm because they are extended around the backside of the pole; this can be very dangerous. Therefore, take particular care not to grab the crossarm braces or reach between the braces and the pole because should you slip, you could easily lose a finger.

2.5.2.3 Stepping Up

Carefully gaff in between the braces with one leg (above the crossarm lag screw) then step up on that leg, locking it back. Then gaff in above the crossarm with the other leg. For most of us, this is a fairly long step, so be sure your gaffs are set firmly into the pole and ensure that you have a good hold on the pole. This is one of the few times you use your arms to pull yourself up. Once above the crossarm, climb up the pole as usual.

2.5.3 Traversing procedures – To Descend

Climbing down is simply the reverse procedure of climbing up. Apply the techniques you used to ascend only in reverse order.

2.5.3.1 Positioning

Descend the pole until your feet are slightly above the crossarm you are traversing. One foot should be directly above the through bolt nut and the other a few inches farther around the pole. Your body should be at a cross angle with the crossarm so that you can easily see over the crossarm and have a clear sight of the pole between the crossarm braces.

2.5.3.2 Stepping Down

Step down over the crossarm with one foot and drop it firmly into the pole between the braces. This is one of the most uncomfortable feelings you will experience in climbing because it is difficult to see where you are placing the gaff. It is sometimes called the blind drop. After firmly seating the gaff into the pole, step over the crossarm with the other foot and gaff into the pole below the braces. Ensure you aim the gaff at the heart of the pole. Continue to descend until your hands are just above the crossarm.

2.5.3.3 Hand Positioning

Keeping one hand above the crossarm, lower the other hand below the braces and grasp the pole firmly. Take another step down, lowering your other hand below the braces at the same time. You should now be clear of the obstacle and ready to climb the rest of the way down the pole.

2.5.4 Safety

Before climbing, remember to check the pole for heart rot by sounding it with a hammer and ensure you inspect your personal climbing equipment. When ascending or descending, always aim your gaff at the heart of the pole and maintain a 30-degree angle between the leg and the pole. Also ensure you periodically look both up and down the pole in the area between your legs when ascending. This is usually easier than looking from side to side. Of equal importance to proper climbing technique is that you take your time. Rushing through the climbing process will only increase the likelihood of making mental mistakes.

Whenever possible always avoid climbing on the side of a pole with known obstacles. Since gaffs are not intended to penetrate metal, be careful not to set them into braces or risers. On poles with conduit risers, climb with the riser located on the back side of the pole to avoid gaffing into it. Another important consideration is to never put your hands and/or arms in between crossarm braces--if you slip, your hand/arm could get caught with serious consequences. Finally, **ONLY** put your full weight on crossarms and other objects if you are certain that they will support you.

Test your Knowledge (Select the Correct Response)

2. What kind of rot is encountered if during the sound test, the hammer penetrates the wood?

   A. Cancer
   B. Shell
   C. Palm
   D. Butt

3.0.0 RIGGING TOOLS

As an electrician you will use rigging tools during the installation, maintenance and removal of assorted equipment. This equipment, if used as intended, will enable you to perform your work safely, quickly and easily. Without the proper knowledge of rigging tools, you would need to lift heavy objects by hand and climb up and down the pole every time you needed additional tools or materials. For example, the block and tackle is the rigging tool of choice when you need to lift and position heavy equipment and support material, such as crossarms and distribution transformers, to the top of a utility pole; whereas, the hand line allows electricians working at the top of a pole to raise

smaller equipment components, hardware, or tools with little effort. Since these tools are essential to the safe movement of equipment that can be heavy and awkward, it is esstential to maintain and inspect them on a regular basis. The correct and timely maintenance of these items will ensure their long life and reliability. Incorrect maintenance may lead to their failure, which could result in euipment damage or injury to yourself or your co-workers.

3.1.0 Hand Line

The hand line is the simplest rigging tool that you will use in the field. In its simplest form it is just a rope used to raise and lower relatively lightweight tools and equipment. There are basically two types of hand lines, single and continuous. A single hand line is nothing more than a single piece of rope with each end braided so the ends will not unravel. Using this hand line requires the electrician to do all the raising and lowering of equipment needed. Electricians normally use this type of hand line when no other type is available.

The continuous hand line is a rope with the ends spliced together through a single roller sheave block, forming a continuous loop. It may contain a standard hook of not more than four inches in length placed where the rope ends join. The block is attached to the pole by means of an attachment line, referred to as a collar rope. A slipknot is used to tighten the collar rope around the pole, as seen in *Figure 4-15*.

Figure 4-15 – Collar rope.

3.1.1 Pre Use Inspection

If the hand line fails in the middle of a job, serious injury or damage to equipment could result. Always inspect the hand line before using it to ensure the following:

- The rope is free of cuts and extensive fraying.
- The block is not cracked or broken on a continuous hand line.
- The rope glides smoothly through the block.

3.1.2 Procedures to Use

As stated in the introduction, rigging tools are intended to enable you to perform specific types of work in a safe, easy, and timely manner. In order to derive the full benefit of doing a job in a timely manner it is imperative to uncoil and recoil hand lines after each use in a specific manner. Coiling is not just a matter of forming a rope in a series of loops so that it can be stowed. Its main function is to ensure that the rope will be immediately ready to handle, untangled, when needed again. The following paragraphs will provide the specific procedures to uncoil and recoil a hand line.

Procedures to uncoil a continuous hand line are as follows:

1. Secure one end of the rope to a stationary object such as a pole or truck (See *Figure 4-16, Slide 1*).
2. Stretch hand line taut to remove twists and kinks, and to center the hook, splice or knot at the free end of the rope. (See *Figure 4-16, Slide 2*).

Procedures to recoil a hand line after use are as follows:

1. With the free end hanging down over the top of the boot, hold the coil in one hand horizontal at waist level to support the coil (See *Figure 4-17, Slide 1*).
2. Coil the rope neatly with all loops the same length (approximately 3 feet between the waist and top of the boot).
3. At a point 6 to 8 feet from the secured end of the rope, you are ready to wrap the rope around the coil.
4. Place the coil of rope on your wrist (See *Figure 4-17, Slide 2*).
5. Turn the coil with the arm held horizontally. Rotate forearm horizontally at the elbow away from the body.
6. With the other hand, guide the wrap of the remaining rope until approximately 2 feet remain between your coil and where the rope is secured.
7. Grasp the secured rope with the hand that is placed through the coil; pull the rope through the coil (making a loop through the top of the coil as shown in *Figure 4-17, Slide 3*).
8. Give the loop a twist and place over the top of the coil.
9. Snug the loop around the coil or a neatly wrapped rope to be stored (See *Figure 4-17, Slide 4*).

Figure 4-16 – Uncoiling hand line.

Figure 4-17 – Recoiling hand line.

When using a hand line at the top of a pole, the climber carries it aloft. Uncoil hand lines and attach them to the back of the body belt to carry them up a pole. When electricians climb with a hand line, they should take care to prevent the hand line from catching on pole attachments or obstructions. Do not pull hand lines over sharp bends, sharp edges, or surfaces with splinters.

3.1.3 Care and Storage

If the hand line you work with is to give safe and dependable service, you must make a special effort to ensure that it is handled and cared for properly. Keep hand lines free of oil, grease, acids and sharp objects. Never store hand lines wet. Store them in a clean, dry environment away from direct heat and hung up where the capability exists. Additional precautions and procedures for the care of hand line are as follows:

- Do not carry hand line in a truck bin with sharp edged tools.
- Inspect all rope for surface and interior imperfections before using.
- Be thoroughly familiar with the proper methods of making knots and hitches. Faulty knots or hitches, when placed under strain, may damage the ropes or let go, causing serious accidents.
- Avoid twists and kinks in rope, they make the rope difficult to work with and substantially weaken it.
- When moving from one place to another, do not drag the rope on the ground. The mud, sand and grit gradually work between the fibers and weaken the rope.
- Avoid making sudden jerks in raising or lowering a load, it tends to weaken and break some of the fibers that make up the rope.
- Do not use frozen rope, this can cause the fibers to break.
- Select a reasonably smooth, rounded surface when tying off a hand line.

3.1.4 Safety

Hand lines are used for raising and lowering lightweight material and tools. When hand lines lack the mechanical advantage to lift loads safely and easily, use a block and tackle or a chain hoist. As a general rule, hand lines should be made of rope at least 1/2 inch in diameter. This practice enables electricians to use the rope for pole top and manhole rescues if the need ever arises. Specific safety practices relating to the use of hand lines are as follows:

- Never wrap the hand line around your arm or wrist when holding or hauling on the rope. If a load becomes uncontrollable, a serious injury can result because you cannot free yourself from the rope.
- Wear gloves when handling rope to avoid injury from slivers, rope burn, or direct skin contact with rope that may have been treated with pesticides.
- Do not stand unnecessarily close to, and never straddle, a hand line under tension.
- Never use wet or damp fiber or wire rope around high voltage wires, the moisture makes the rope conductive.
- As with any other tool, proper care extends the life of the rope, making it easier and safer to use.

3.2.0 Block and Tackle

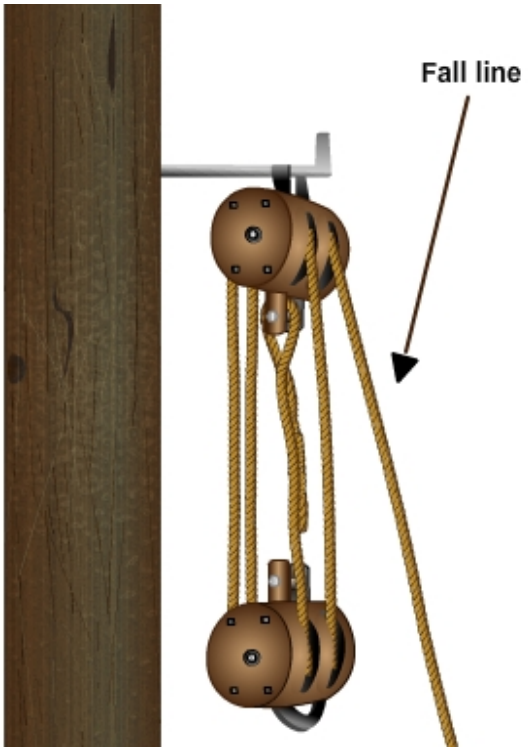

Figure 4-18 – Block and Tackle.

Whenever the load exceeds the limits of a hand line, a block and tackle must be used. It will allow you to lift the object safely and with little effort. A block and tackle arrangement is a combination of blocks and ropes by which an object or load can be lifted or moved in a desired direction. Blocks are designated by the length of the shell in inches and by the number of sheaves. Blocks with one, two, three, or four sheaves are called single, double, triple, and quadruple blocks respectively. The size of the sheave and the depth of the groove in the sheave usually determine the largest size rope for any block. Frames of the blocks can be made of wood, metal, or a combination of both. *Figure 4-18* shows an example of a double sheaved block and tackle.

3.2.1 Pre Use Inspection

Before using a block and tackle, inspect it to ensure it will do the job you require of it and that it will not fail, causing equipment damage and possible injury. When you inspect it, ensure the following:

- The ropes are not cut or frayed.
- The blocks are not cracked or broken.
- The rope glides smoothly through the block.

3.2.2 Procedures to Use

The block and tackle offers a mechanical advantage when lifting or pulling a load. It does this by trading distance for force. As a result, when you pull on the fall line, you must pull a great deal of rope to move the blocks a small distance. This allows a person to lift much more than the actual force exerted. *Figure 4-18* illustrates the common method of using a block and tackle on a utility pole. Ensure the block with the fall line is always positioned as the uppermost block.

Sometimes it is necessary to hold a load for a length of time. If there is no place available to tie off the fall line, which is also known as the running end of the rope, a simple and convenient way to fasten blocks is to jam a bight of the fall line under the rope at the adjacent sheave as shown in *Figure 4-19*.

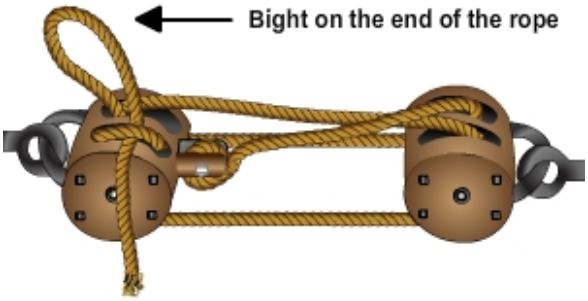

Figure 4-19 – Holding a line.

3.2.3 Care and Storage

If the block and tackle you work with is to give safe and dependable service, you must make a special effort to handle and care for it properly. Like the hand lines previously discussed, block and tackle must be kept out of dirt and protected from extreme weather elements whenever possible. Wipe down the wooden parts of a block and tackle with linseed oil and give the metal parts a light coat of oil. Ropes that may have gotten wet during their use must be dried prior to storage to avoid rotting. Keep storage clean and dry, and where possible, support the block and tackle off the floor to keep them free from dirt, entanglement with other equipment, and exposure to rodents. The same precautions and procedures discussed under “Care and Storage” of hand line also apply to block and tackle, since rope is an essential component of a block and tackle.

3.3.0 Chain Hoist

Chain hoists come in a variety of designs and rated lifting capacities. They are made of steel or aluminum alloy and range from 1/2 to 12 – ton lifting capacities. As an electrician, you will use hand chain hoists that are generally rated at 1 1/2 to 3 tons. You will use these hoists in support of various maintenance and construction applications. The chain hoist in *Figure 4-20* is typical of what you will use in the career field. It is designed to easily lift or move heavy weights and for applying tension to utility pole guying systems. The chain hoist consists of a hoist mechanism, two hooks, a ratchet lever, a selector lever and a handwheel. The hooks generally have a safety snap so that the load can’t accidentally come off the hook. The selector lever is to select up or down movement. The handwheel is used to quickly take take up the slack in the chain before actual lifting begins. Hand chain hoists have been designed with built-in safety features that indicate when a hoist has exceeded its safe

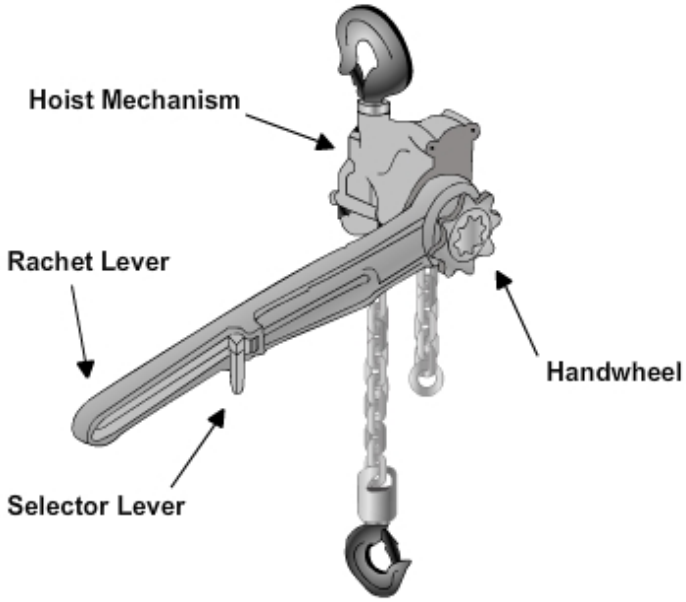

Figure 4-20 – Chain hoist.

working capacity. If you use a hoist in a manner that exceeds its rated design limit, the hooks or the ratchet lever will begin to bend. This bending signals impending failure. Because of the damage that will be done to the hoist, it is important to ensure that you never exceed the lifting capacity.

3.3.1 Pre – Use Inspection

The following parts of a chain hoist should be inspected prior to each use:

Braking Mechanism - check for slipping brakes.

Chain - check for worn, broken or cracked links. Check for any dirt or grit, which could be carried into the hoist mechanism. Check for proper lubrication.

Hooks - check for cracks, chemical damage or deformation. Hooks should swivel freely. If equipped with spring-loaded keepers, they should be functional.

Ratchet Lever - check for cracks, chemical damage or deformation.

3.3.2 Procedures to Use

Attach hooks to equipment being hoisted or accessory tools used in tensioning. Place the selector lever in neutral position and use the hand wheel to remove slack from the chain. Adjust the selector lever to the desired position (take up or release). Push the ratchet lever all the way up until you hear a click then pull the ratchet lever all the way down until you hear another click. Continue the ratcheting action until the object has been moved to the desired position.

3.3.3 Care and Storage

Lightly coat the chain hoist with machine oil to keep it from rusting. Store the chain hoist in a dry location off the floor. Never drop or throw a chain hoist from a pole. Always use a hand line to lower it. Make every effort to keep it out of direct contact with the ground and protected from adverse weather.

3.3.4 Safety

A visual inspection and serviceability test are imperative prior to using any chain hoist. The weights and tensions with which you will be working will be potentially lethal should the equipment fail. Avoid pinch points when using the various mechanisms and ensure that the hooks are firmly attached to items being lifted or tensioned. Do not stand or allow others to stand under or between any object being supported or moved by the chain hoist.

Test Your Knowledge (Select the Correct Response)

3. How should a chain hoist be stored?

   A. Shipping container
   B. Tool box
   C. Dry location off floor
   D. Canvas bag

4.0.0 KNOTS AND HITCHES

In the previous section you learned about rope and how it can be used to aid in the performance of any number of Construction Electrician job tasks. You also learned that rope is intended to be used to secure, transport, raise, and lower tools and equipment in

a safe and efficient manner. In order to ensure that you use rope properly in the performance of your duties you must have some knowledge of where to apply and how to tie the various knots and hitches for a given situation. You will use this knowledge and skill throughout your Seabee career. Your failure to master any portion of knot or hitch tying will result in needless work delays and, in a worst case scenario, may result in damage to equipment or injury to yourself or fellow team members. An improperly tied knot or hitch may cause a rope to loosen and slip, resulting in death or injury to personnel. An important thing to know is like pole climbing, proficiency and speed in know tying requires much practice. You will need to step up to the challenge and demonstrate initiative in acquiring and maintaining your knot tying skills. In this section you will learn common terminology used in working with rope and how to tie the half hitch, clove hitch, timber-hitch, lineman's hitch, overhand, square, and bowline knots.

4.1.0 Purpose and Terminology

4.1.1 Purpose

Knots and hitches are used to fasten rope to objects or to join two ends of a rope or two separate ropes together. More specifically, hitches are used to attach secondary ropes to main ropes at points other than at the rope ends or to attach the free end of a rope to its standing part or other object, and knots are the principal fasteners of rigging equipment. A properly tied knot or hitch must hold the strain applied without damage to the rope or the load and be able to be tied and untied quickly.

4.1.2 Terminology

To make sure everyone speaks a common language when referring to rope, knots, and hitches you must know the following terms and definitions:

Knot - tightly interlaced combination of bights and turns.

Hitch - attachment of a rope to an object in such a way that it can be detached easily.

(**Note**: All knots and hitches are made using one or a combination of the following rope configurations: the loop, the bight, and the round turn.)

Loop - a turn on a rope with ends extending in opposite directions.

Bight - a section of rope turned back on itself.

Round turn - any turn in a rope around itself or other object with ends extending in the same direction.

Standing part - The standing part of the rope is that part of the rope that is stationary while the running end is passed around it. It is also that part of the rope that holds the load.

4.2.0 Procedures to Tie Knots and Hitches

4.2.1 Overhand Knot

The overhand hand knot has no holding value and is used to temporarily prevent the end of a rope from unraveling, when means of permanently securing the loose end are not available. To tie the overhand knot, as shown in *Figure 4-21*, simply form a loop and bring an end through it.

Figure 4-21 – Overhand knot.

4.2.2 Square Knot

The square knot is used to tie together two ropes of the same diameter. As a Construction Electrician you will use the square knot to bind light loads, lash poles together during pole changeover, to form a sling to raise/lower transformers, and for attaching block and tackle to poles and crossarms. The square knot is characterized by its ability to avoid slipping under tension and by being easy to untie after being placed under a heavy strain. To tie a square knot, pass left end (a) over right end (b) and under, then pass right end (b) over left end (a) and under then pull the running end tight as shown in *Figure 4-22*. Take care that the standing and running parts of each rope pass through the loop of the other in the same direction, i.e., from above, downward, or vice versa; otherwise you will make a granny or thief knot, which will not hold under tension.

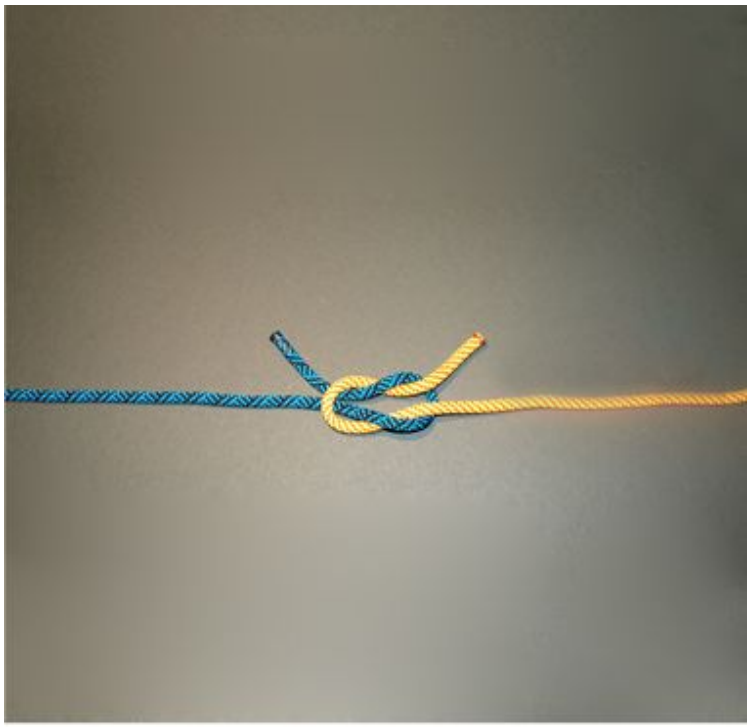

Figure 4-22 – Square knot.

NOTE

Take extreme care not to accidentally tie a granny or a thief knot, as shown in *Figures 4-23* and *4-24*. These knots have no holding power and are frequently the result of an incorrectly tied square knot. They are poor knots and examples of what not to do.

Figure 4-23 – Granny knot.

Figure 4-24 – Thief knot.

4.2.3 Half Hitch

The half hitch is used to form a part of many other knots. It has no holding power by itself, but does afford holding power when used with a combination of other knots. The half-hitch is a turn in a rope taken around a section of the same rope, another rope, or another object. Form a half hitch by placing a loop over an object. *Figure 4-25* shows the configuration of a half hitch by itself and one placed on top of the other for better security.

Figure 4-25 – Half hitch.

4.2.4 Clove Hitch

The clove hitch is commonly used to tie objects, such as crossarms and hand tools onto a hand line in order to raise or lower them on a pole. The clove hitch is characterized by the ability to avoid slipping lengthwise along the object. *Figure 4-26* shows a completed clove hitch. Make the clove hitch as follows:

Figure 4-26 – Clove hitch.

1. Make a loop in the rope.
2. Make a second loop next to the first loop.

NOTE

Be sure to make the second loop in the same direction as the first loop.

3. Place the loop of Step 1 over the loop of Step 2.
4. Place both loops over the object and pull the rope taut.

4.2.5 Timber Hitch

The timber hitch is used to guide heavy objects, such as a distribution transformer, away from the pole and for lifting or moving heavy timbers. The timber hitch is made in the same manner as the half hitch, except you give the short end two or more twists about the loop. Note that the timber hitch is made with the turns around the running end and not the standing part of the rope. If not tied in this manner, the knot will not tighten against the pull and the turns will not hold. Place the half hitch near the source of tension as shown in *Figure 4-27*. Make the timber hitch as follows:

Figure 4-27 – Timber hitch.

1. Pass the rope around the timber or pole.
2. Make a half hitch about the standing part of the rope.

3. Pass the free end once more between the standing part of the rope and the timber or pole.

4.2.6 Lineman's Hitch

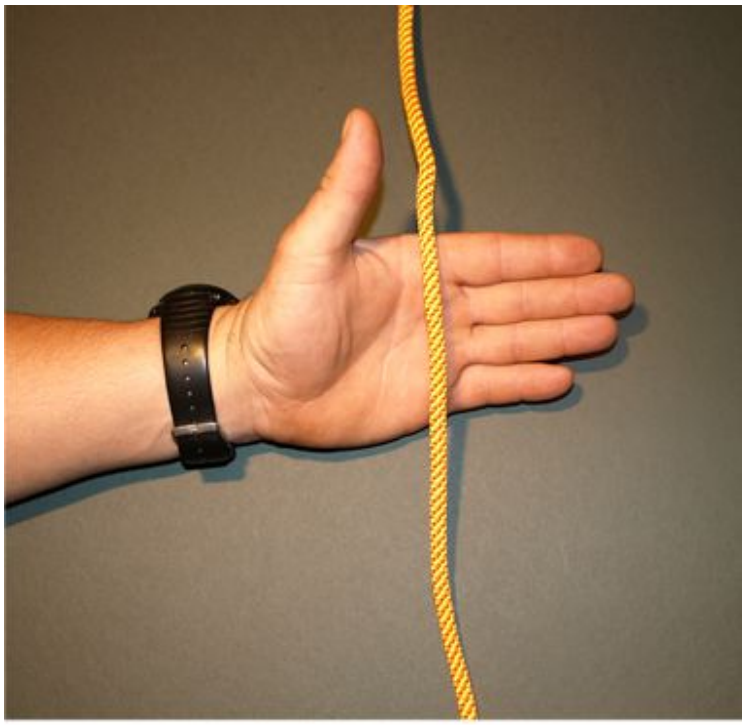

Figure 4-28 – Lineman's hitch.

The lineman's hitch is used to secure tools and equipment to a hand line in such a manner that the ground worker can untie the hitch for the electrician working on the pole. To tie a lineman's hitch refer to *Figure 4-28*. Start by forming a bight in the fall line. Next, form a half hitch in the standing part of the rope and place the half hitch over the bight. Finally, apply tension to the standing part of the rope by pulling up on it so that the half hitch tightens around the bight. Raise the tool or equipment to the desired height on the pole and verify that the electrician on the pole is ready to receive the load. Once the electrician is ready the ground person unties the lineman's hitch by pulling straight down on the fall line.

4.2.7 Bowline Knot

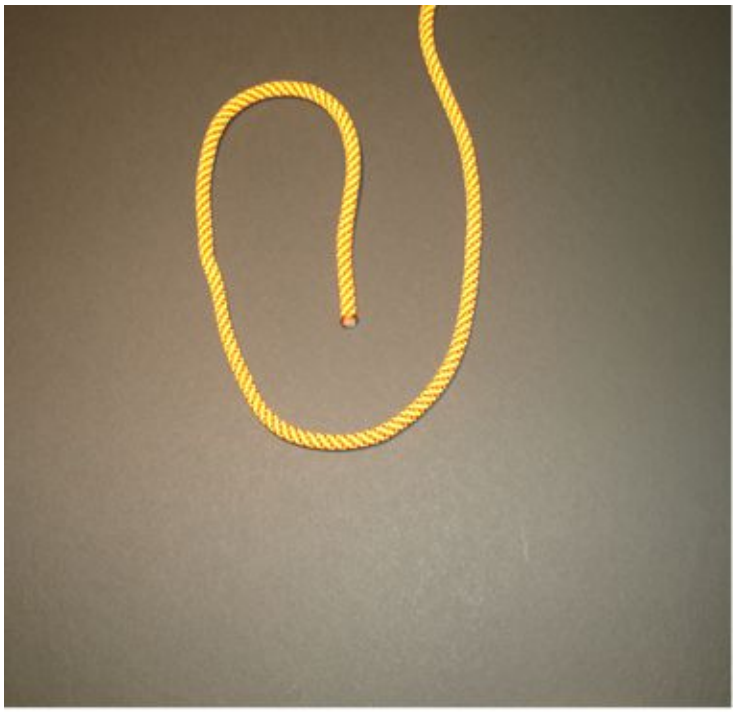

Figure 4-29 – Bowline knot.

The bowline is a knot of universal use; it is the best known method for forming a bight that will not slip under tension and can be easily untied. The bowline knot is used to attach a rope to the hook of a block or to an eye or ring. The bowline knot is sometimes referred to as the "king of knots" due to the large number of variations in which it can be tied. It is used in making knots of all sorts along different parts of a rope and is formed in various ways, depending upon the condition under which work is being done. Refer to *Figure 4-29*. For your purpose, you will only need to know how to tie the basic bowline knot. Make the bowline knot as follows:

1. Make a single loop in one end of the rope.

2. Pass the free end of the rope up through the loop, around the standing part of the rope and back down through the loop.
3. Tighten the loop around the standing part of the rope.

4.3.0 Safety

To ensure the safety of personnel and equipment you must be able to determine and properly tie knots and hitches for any job situation being undertaken. Knowing what and how to tie knots and hitches will be of little consequence if you fail to inspect and take care of the rope you are using for the job. Make sure that you choose the right size and quality of rope for the job. Avoid jerking or placing sudden strains on a rope as it may cause failure. A steady, even pull will assure full strength of the rope is maintained and enable you to see if the knot or hitch is holding as intended.

Test your Knowledge (Select the Correct Response)

4. Which of the following is defined as a section of rope turned back on itself?

   A. Loop
   B. Bight
   C. Round Turn
   D. Knot

5.0.0 CLIMBING TECHNIQUES

Knowing how to ascend and descend a pole safely is an important skill all Construction Electricians must have, but the reason you are going up the pole is to complete a job. This section will explain how to maintain position on the utility pole while leaving both hands free to work.

5.1.0 Belting – In

5.1.1 Purpose

A Construction Electrician must develop the necessary skills and confidence to climb utility poles, but the physical ability to climb a utility pole is of no consequence if you are unable to perform work while you are on it. In order to perform work in a safe and efficient manner, you will need the use of both your hands. You will free up your hands with the technique of belting-in using the body belt and safety strap.

5.1.2 Pre – Climb Actions

Perform all of the necessary pre-climb actions that you have learned about previously. Visually inspect the pole for rot, defects, and obstacles. Inspect your immediate climbing area for any unsafe conditions, and look over all of your personal climbing equipment. In additional to the standard pre-climb actions you will need to size and adjust your body belt and safety strap while you are still on the ground. If you are to work in comfort it is essential that you fit the body belt so that it does not ride up onto your lower back.

Having your belt too high will make it hard to bend and flex. This will cause your back to tire quickly. Having the belt too tight will keep you from twisting properly and can also reduce circulation to your legs, making them numb. It should fit loosely enough to sit low on your hips and act like a sling and not a back support.

You will need to size the safety strap to allow you to maintain a safe body distance from the pole when you lean out in the body belt.

5.1.3 Single Person Belting – In Procedures

In order to properly belt-in around a pole, the Construction Electrician must follow several steps. There must always be one leg low and locked. The proper leg to keep low and locked is dictated by where on the body belt the electrician carries his safety strap. If the strap is carried on the left side, then the left leg is low and locked.

If the strap is carried on the right side of the body belt, then the right leg is low and locked. Keep knees and hips a safe distance from the pole to avoid breaking your minimum safe distance. It is very important to remember that no matter what you are doing on the pole, you must always keep your knees and hips a safe distance away from the pole. To do otherwise is likely to result in gaffing out, causing needless injury to yourself or fellow crew members.

The single end (as opposed to the double or looped end) of the safety strap is to be removed from the D-ring and passed around the pole. Never pass the double or looped end around the pole because there is a danger of getting your hands caught in the loop or on some obstacle that is not visible on the back side of the pole. When you pass the single end around the pole, you must reattach it with the open end of the keeper facing out. At this time, both keepers should be facing out away from the pole and be securely fastened to the D-rings. (**Note**: Always ensure that you actually see the keeper engage the D-ring; do not fall into the habit of relying on hearing it engage. The strap should lay flat on the pole, untwisted. Only now will it be safe to lean back and release your hands from the pole. Refer to *Figure 4-30* for an example of belting in.

Figure 4-30 – Belting In procedure.

5.1.4 Unbelting Procedures

The process of unbelting is the opposite of belting-in. One leg must be low and locked at all times; it is the same leg that was low and locked when belting-in. Remember to keep knees and hips a safe distance form the pole. Then remove the single-end keeper from the D-ring and pass it back around the pole to its original position (As seen in *Figure 4-31*). It should be snapped back onto the D-ring facing out making sure the safety strap has a natural loop and is not twisted in any way.

Figure 4-31 – Unbelting procedure.

5.1.5 Safety

It is very important to inspect your equipment before you begin to climb. Have the base of the pole cleared for a minimum of 10 feet. Once you begin your climb it is important to know approximately where you intend to belt-in. As a general rule, always belt-in below the area to be worked and never above any equipment or protruding hardware that may prove to be an obstruction or impale you should you happen to gaff out. When belting or unbelting, always look, listen and feel to ensure that the keeper is securely fastened to the D-ring. On those occasions you are working with other electricians on the same pole, it is essential to have clear communications between each climber and that each provides assistance to the other as necessary. To do otherwise may result in an incident or accident that could be avoided with effective team work.

5.2.0 Circling

Circling is a very important part of working on a utility pole. You will soon learn that you cannot do all of the work required to be done on a pole from the same place on the pole and that you must be able to move around the pole in order to complete the job at hand. This section will introduce you to the pole climbing technique of circling. It is the first of three techniques that will enable you to obtain safe, comfortable, and efficient work positions on a pole. Mastery of this technique will go a long way to building confidence and ensuring you are able to move around a pole in a timely manner.

5.2.1 Purpose

Obviously, the equipment you will be working on will not all be conveniently located on the same side of the utility pole, you must also climb past any obstacles mounted to the utility pole. For these reasons, it is important to be able to move around the pole by circling.

5.2.2 Pre – Climb Actions

Remember to perform all of the necessary pre-climb actions discussed in previous pole climbing sections. Inspect the pole for rot, defects, and obstacles. Inspect the immediate area around the pole for any unsafe conditions, and always inspect your personal climbing equipment prior to engaging in any climbing activity.

5.2.3 Circling Procedures

5.2.3.1 Circle Right

When circling to the right, position the right leg so that it is low and locked with the left foot about 6 inches higher than the right. Also, ensure that there is approximately 1 inch of space between the heels of both feet as you look down between your legs. Position the safety strap so that it is approximately 10 degrees higher than parallel to the ground. Shorten the safety strap on the right side by shifting your hips to the right and pulling on the left side of the safety strap slightly so that your right hip is closer to the pole than your left hip. This action will create a slight pull to the right to help you swing in that direction. As you step up on the left foot (locking the left knee), the right gaff will come out of the pole and your body will swing to the right.

At this point, both knees should be locked. Allow your right foot to swing approximately three to four inches to the right, unlock your left knee, and drop onto your right gaff.

NOTE

Taking larger than three to four inch steps could cause your left gaff to come out of the pole. Also, it is crucial that you **DROP YOUR FULL BODY WEIGHT** when you lower the right gaff. Severe consequences in the form of gaffing out are likely to occur if you attempt to lower your weight to set the gaff.

Check the position of the safety strap to ensure that it is still at approximately 10 degrees higher than parallel to the ground. If the strap's position has changed then you have either dropped farther than the initial 6 inches you had placed between the right and left foot or less than the 6 inches. In either case, you need to make a mental note to correct the deficiency; otherwise you will find yourself corkscrewing up or down the pole, as the case may be, during subsequent steps (Refer to *Figure 4-32*).

Figure 4-32 – Circling right.

Continue the process of positioning the right foot, shortening your safety strap, stepping up onto the left foot, swinging to the right, and dropping onto a locked right leg until you have reached your desired position. If you do this procedure correctly, you should remain at the same height on the pole.

5.3.2.2 Circle Left

Figure 4-33 – Circling left.

Circle to the left using the exact same procedures for circling to the right (Refer to *Figure 4-33*), except the left leg needs to be lowered and locked. Bring the right foot close to the left and about six inches higher. Shorten your safety strap on the left side, step up on the right foot, and swing to the left keeping the gaff aimed at the heart of the pole, and drop down onto the locked left leg.

5.3.3 Two Person Circling

Two-person circling procedures are the same as those for one person, but there are a couple of things you should know. Only one person moves at a time, and both move in the same direction around the pole. Communication is the most important thing to remember. You must communicate with one another to let each other know when and how far you are moving.

5.3.4 Safety

Use proper climbing, belting-in, and circling procedures. Never get in a hurry to get any where on a pole, and make sure you communicate effectively if there is anyone else on the pole. Do not become complacent and overconfident. To do so will almost certainly cost you, if not today, then tomorrow.

5.4.0 Hitchhiking

While working on a pole, you may need to move up or down for short distances. Since belting-in and unbelting every time would be inconvenient, you may use the hitchhiking technique. In this section you will learn the required procedures to perform this technique. Mastery of it will pay big dividends in terms of ablity to get to the desired position on a pole in a safe and timely manner.

5.4.1 Purpose

The purpose of hitchhiking is to move up or down a pole for very short distances in order to reach your work. Hitchhiking will allow you to quickly, yet safely, reach a desired position on a pole without having to exert unnecessary energy in unbelting and climbing up or down and then belting back in. While the technique is very beneficial when used as intended (very short distances), use it sparingly. Do not get in the habit of using it in place of free climbing the entire length of poles while attending this school. Your climbing proficiency must be based on sound climbing practices and demonstrated confidence.

5.4.2 Pre – Climb Actions

Inspect the immediate work area and pole for any unsafe conditions. Perform a preliminary climbing survey to determine if any deviation from the normal unobstructed free climb is warranted. Communicate with co-workers if more than one climber is to be working on the pole, so that everyone knows what position each will be in prior to the climb.

5.4.3 Hitchhiking Procedures

The first thing you will do is climb to a height just below where you will be working. More often than not, your work will be done on equipment mounted on or near crossarms. In this case you will only climb to a height that is eye level with the lag screw and belt-in. You will then use the technique of hitchhiking to get you to the height where you will be able to work comfortably from.

To hitchhike up a pole, start by flipping your safety strap up the pole approximately 1 1/2 to 2 inches above parallel from the ground. Do this by slightly moving your hips toward the pole and flipping the strap with your hands. When you are doing this, it is imperative that you have at least one leg low and locked at all times. With the safety strap angled up, take two small steps up. These steps will be smaller than normal climbing steps, but will still require you to lock your leg back when stepping up. As was the case with circling, you will reference the position of the safety strap to determine if your steps are of the correct length. If your safety strap has returned to being approximately parallel with the ground, then the total length of your steps is exactly where they should be. If your safety strap is still above parallel or below parallel to the ground then your steps are either to short or to long respectively. In either case you will need to make a mental note to correct the deficiency during subsequent steps. If you fail to make the necessary correction, you will find yourself taking forever to get to where you need to be or in a very awkward unstable position as will be the case when the safety strap is below parallel from the ground.

Remember, the main procedures are:

1. Flip the safety strap approximately 1 1/2 to 2 inches above parallel from the ground.
2. Take two small steps up, check the position of the safety strap.
3. Make adjustments to subsequent steps as necessary.
4. Repeat these procedures in a coordinated rhythmic manner until you reach the proper height.

To hitchhike down, you will use essentially the same techniques that you used to hitchhike up, but with a few exceptions. First, flip the safety strap down to where it is approximately parallel or slightly below parallel to the ground. Do this by moving your hips in and using your hands to flip the belt. The belt will naturally fall down when pressure is taken off. Take one smaller than normal step down, allowing your weight to drive the gaff into the pole. Check the position of the safety strap to determine if your step down was of a suitable length. If you have done it correctly, you should be comfortably balanced and the safety strap will be approximately 10 degrees above parallel to the ground.

NOTE

DROP YOUR FULL BODY WEIGHT when taking the smaller than normal step down. The likely result of doing otherwise is gaffing out or at the very least becoming unsure of

yourself in setting up for the next step down. Repeat the procedures until you reach the proper height.

5.4.4 Two Person Hitchhiking Procedures

When two people on a pole are going to hitchhike, communication between them is imperative. Only one person moves at a time, and they must alternate their movements. Make sure not to gaff into the other person's safety strap. All the other steps remain the same.

5.4.5 Safety

As you are probably pretty aware by now, climbing will be an essential part of your job as a Construction Electrician. Practicing all the techniques presented to you up to this point will help you to become skilled in positioning yourself on a pole and make you a valued crew member. Always make sure you are aware of your surroundings both on and off the pole. Avoid stepping into cracks, knots or any obstacles on the pole. Keep a positive attitude and always respect the kind of work you do and be aware of its inherent dangers.

5.5.0 Work Positions

While pole climbing is a critical skill for electricians to master, it is only transportation to where the actual work is done. After climbing the pole and properly belting in, you must be able to circle, hitchhike, and finally get into a good work position so that you can complete the job. More often than not, the work you must do on a pole will not be located directly in front of you. There will be times when you will need to reach out as far as possible to get the work done, and this is where the technique of getting into a good work position will serve you well.

5.5.1 Importance of Proper Work Positioning

A good work position allows you to work on pole components in a safe and comfortable manner. It will enable you to use both hands, which is essential to getting the work done in an effective way without jeopardizing your safety or causing needless stress on your body. See *Figure 4-34.*

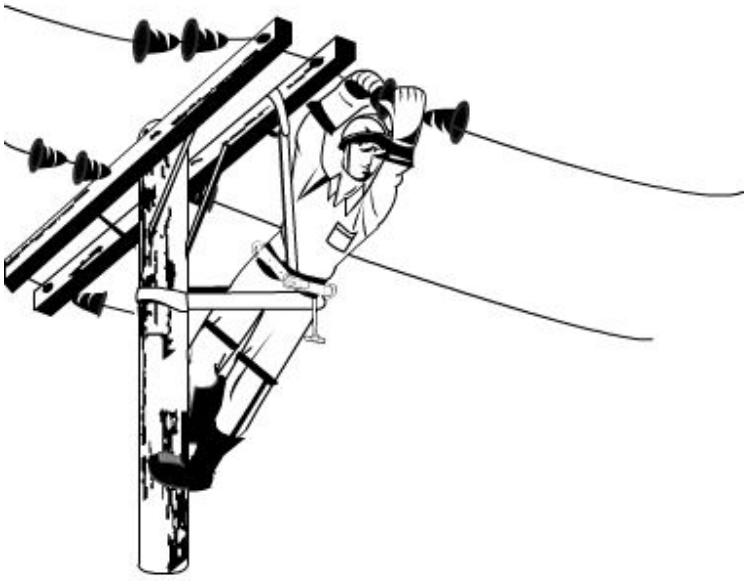

Figure 4-34 – Work position.

5.5.2 Pre – Climb Actions

As stated in previous sections, you must perform all of the necessary pre-climb actions. Inspect the utility poles you will work on for rot, defects, or any obstacles that might cause you to gaff out or might hinder your ability to ascend or descend the pole safely. Be sure to cordon off the immediate work area to prevent unsuspecting or improperly safety equipped personnel from entering a known

hard hat work area. And finally, make sure that your personal climbing equipment, as well as any hand line, block and tackle, chain hoist etc., are in good order.

In additional to the standard pre-climb actions you will also want to pre-size and adjust your body belt and safety strap while you are still on the ground. If you are to work in comfort and be able to assume a good work position without much effort you must fit the body belt so that it is loose enough to easily turn your hips within it. Let out the safety strap to enable you to extend your reach yet still maintain a safe body distance from the pole.

5.5.3 Work Position Procedures

5.5.3.1 To the Right

Since you will more often than not use the work position technique to access hardware and equipment on or above a crossarm, the following procedures will enable you to do just that. After climbing the pole and belting-in below the work location, you will have to circle and hitchhike high enough to complete the work comfortably. (In order to work comfortably your arms should be approximately chest high to the hardware or equipment on which you are working.) To get into a work position to the right, first lower and lock your right leg. Next, lengthen your safety strap slightly to the right by pulling on it with the right hand while simultaneously shifting your hips to the right in your body belt. If you have done it correctly, your body belt's tongue and buckle should be facing square with the pole, your upper body should be parallel with the crossarm, and the metal body belt tag between the tool loops should be on your right hip. All of your weight will be on your right foot. You will not use the left leg except to help you maintain balance, so position it any way you feel comfortable. Lean out away from the pole to the work area.

5.5.3.2 To The Left

The procedures for a left work position are the same as the procedures for the right except that everything is done to the left side of the body with the left leg low and locked and all weight concentrated on the left foot.

5.5.4 Safety

As always, inspect the pole and your climbing equipment. Use proper climbing, belting-in, circling, and hitchhiking procedures. Remember to keep the body belt low on the back and the proper leg for the position you are working lowered and locked at all times.

6.0.0 POLE TOP RESCUE

Electrical shock is one of the hazards associated with working on a pole that carries energized conductors. If a safety or life threatening event occur, your speed, rescue method, and knowledge of first aid may save a life. This unit of instruction will provide you with the necessary knowledge to perform a pole-top rescue if the need should ever arise.

6.1.0 Reasons for Rescue

The purpose of pole top rescue is to quickly and safely remove an individual who has become incapacitated while working on a utility pole. There are many reasons why a rescue may become necessary. Some of the more likely reasons are:

- Electrocution

- Heart attack
- Heat exhaustion
- Heat stroke
- Physical injury
- Equipment failure

No matter what the reason, when a co-worker is unable to come down on his or her own power, you will need to perform a pole top rescue.

6.2.0 Tool and Equipment Requirements

The equipment needed for a pole top rescue should be readily available whenever personnel climb utility poles. Equipment should include, but is not limited to:

- Personal climbing equipment.
- Rescue rope that is at least 1/2 inch in diameter and twice the height of the highest crossarm on base plus ten feet.
- Knife for cutting the safety strap.
- Rubber protective equipment or hot line tools (In cases where work is being done on poles supporting energized equipment or conductors).

6.3.0 Rescue Procedures

EVALUATE THE SITUATION. This is always the first step in any rescue. Call out to the victim: "Hey, Do You Need Any Help! Are You O.K.?" If there is no response or if the victim seems stunned or dazed, prepare to do a rescue. At this point, **TIME IS EXTREMELY IMPORTANT!** While calling to the victim, observe the pole for splits, cracks, or fire. If the victim is in contact with an energized conductor, clear the victim using rubber goods or a hot stick. When evaluating the scene, look at the whole scene and not just the victim.

PROVIDE FOR PERSONAL PROTECTION. Your safety is very important to the rescue mission. Without you, there will be no rescue. This means your personal climbing equipment and personal rubber goods need to be in serviceable condition. Hot line tools should be ready in case they are needed and the physical condition of the pole should be surveyed.

Note - Consider turning off the electricity, but do not waste time looking for a switch.

You should plan your route to the victim, treating the pole as energized unless it is confirmed otherwise. Always leap onto the pole, making sure that no part of your body touches the pole and the earth at the same time. This prevents your body from providing an alternate path to ground for electricity should the pole remain energized. Never take any unnecessary chances that may make you a victim as well.

CLIMB TO RESCUE POSITION. Prior to ascending the pole, secure one end of the rescue rope to your body belt, and be sure you have a sharp knife in your possession. While climbing to the rescue position, be sure to climb carefully and belt in just slightly above and to one side of the victim. This is normally the best position for checking and working with the victim and is known as the rescue position. If necessary, clear the victim from energized conductors using insulated work items, then re-position yourself and determine the victim's condition. Refer to *Figure 4-35*.

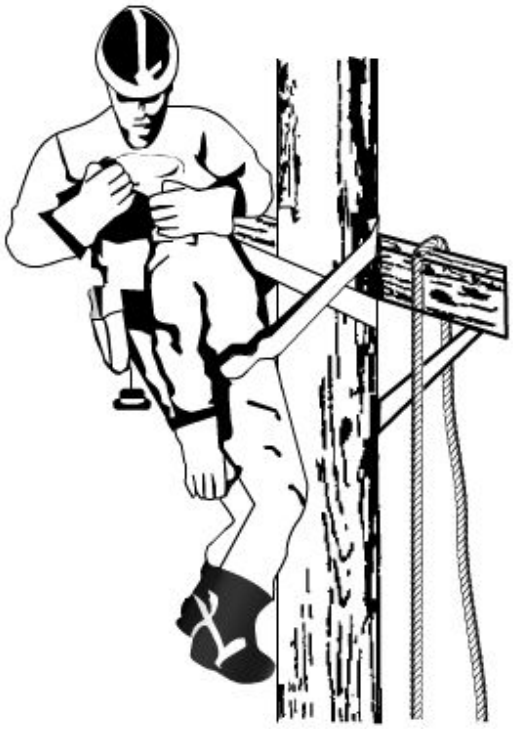

Figure 4-35 – Rescue position.

DETERMINE VICTIM'S CONDITION. How fast you need to move is determined by the victim's condition. You may be able to determine that condition from the ground; if not, once you are face-to-face, it should be obvious.

6.3.1 Responsive

The rescue time is not as crucial if the victim is conscious. A responsive victim should be able to tell you what the problem is, and you can then act accordingly. Your next step is to secure the victim with the rescue rope.

6.3.2 Un – Responsive

You may encounter an unconscious non-breathing victim at some point. In this case, once you are in the rescue position, give two slow breaths, as shown in *Figure 4-36*. Then secure the victim with the rescue rope.

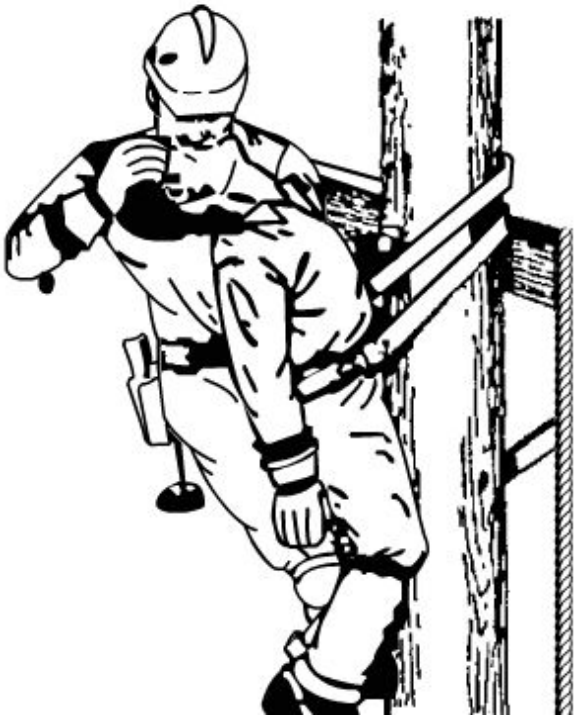

Figure 4-36 – Providing care in the rescue position.

SECURE THE ROPE TO VICTIM. Once in the rescue position, remove the rescue rope from your belt and position it over the crossarm or another part of the structure. Do not throw the free end of the rope over the crossarm, as there may be energized conductors present. Instead, pass the rope over the crossarm from one hand to the other, maintaining control.

Place the rescue rope over the crossarm or structure at a distance of two to three feet from the pole;

this prevents the victim from hitting the pole when being lowered. The rope may be positioned on either end of the crossarm; however, use the end that allows for a clear descent around obstructions such as transformers, streetlights, etc. Then wrap the free end of the rope around itself twice, pass it around the victim's chest, and tie it with three half hitches. *See Figure 4-37*.

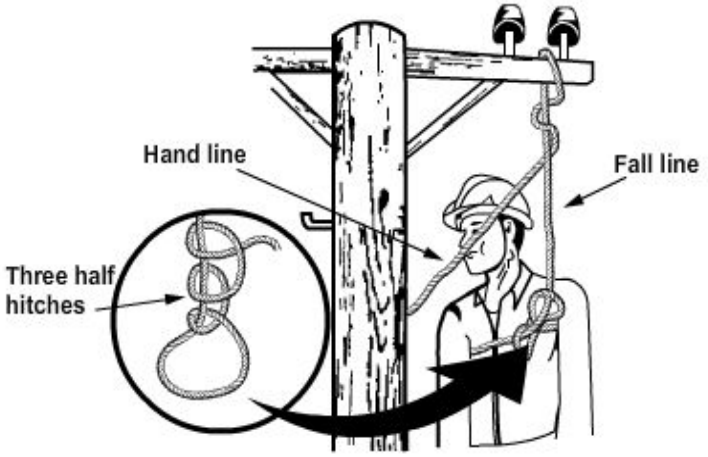

Figure 4-37 – Rescue line position.

Remove any slack in the rope between the victim and the crossarm. If there is too much slack, the victim will drop too far when you cut the safety strap. Remove slack by pulling on the rope. Take a firm grip on the fall line and with the other hand cut the victim’s safety strap. Cut the victim’s strap on the side opposite of the desired swing, being sure not to cut your own strap.

LOWER VICTIM. As you lower the victim, control the descent by tightening or loosening the two twists around the fall line. With one hand, control the rate of descent; and with the other, guide the rope and the victim around any obstructions. When the victim is on the ground, descend as quickly as possible. Call for help and give first aid as necessary (in that order).

PROVIDE FIRST AID. Lay the victim on his or her back. If the victim is unconscious and not breathing, provide an open airway, give two full breaths, and then look, listen, and feel for breathing and administer CPR as required.

Refer to *Figure 4-38* for demonstration of pole top rescue.

Figure 4-38 — Pole top rescue.

6.4.0 Safety

Although time is extremely important in performing a pole top rescue, your own protection (safety) is also vital to the rescue. Provide for your protection after evaluating the situation. Try to get the lines or equipment de-energized if possible. Otherwise, ensure you have the necessary hot line tools and rubber goods to protect yourself. Remember to check the condition of the pole prior to climbing and **DO NOT** cut your own safety strap or the rescue rope.

Summary

Your knowledge and use of the proper pole climbing equipment is essential for the safe conduct of your job as a Construction Electrician. Climbing equipment includes the lineman's body belt, safety strap, climbers, gloves, and hard hat. It is not only important to know how to use this equipment, but also be knowledgeable of the care and maintenance of these items, to ensure safety and longevity of equipment. Another important factor concerning pole climbing is the pre climb actions you must take prior to ascending a pole; this includes pole and equipment inspections. As a Construction Electrician, you need the knowledge of how to ascend and descend a pole, and how to position yourself in a safe and comfortable manner; this is done by performing ascending, descending, belting in, hitchhiking, transversing, circling, and work position achievement. In the event of an accident, you must also be aware of pole top rescue procedures employed. During your career as a Construction Electrician, you need the knowledge and experience dealing with different auxiliary pieces of equipment such as, block and tackle and hoists. To ensure safety and work item transportation up and down a pole, a definite knowledge of knots and hitches is also needed. All of these items are an integral part of each day on a construction project. You need solid pole climbing skills, to ensure the safe and efficient accomplishment of the job.

Additional Resources and References

This chapter is intended to present thorough resources for task training. The following reference works are suggested for further study. This is optional material for continued education rather than for task training.

Unified Facilities Criteria (**UFC**) 3-560-01 (Electrical Safety, Operation and Maintenance)

OSHA Regulations (Standards – 29 CFR)

American National Standards Institute (ANSI Z89.2-1971)

Tools and Their Uses. NAVEDTRA 14256. June 1992.

Hazard Communication, Code of Federal Regulations, 29 CFR 1910.1200, 1991.

Naval Construction Force Manual, NAVFAC P-315, Naval Facilities Engineering Command, Washington, D.C., 1985.

Safety and Health Requirements Manual, EM-385-1-1, Department of the Army,

U.S. Army Corps of Engineers, Washington, DC, 1992.

Use of Wire Rope Slings and Rigging Hardware in the Naval Construction Force, COMSECOND/COMTHIRDNCBINST 11200.11, Department of the Navy, Naval Construction Battalions, U.S. Pacific Fleet, Pearl Harbor, Hawaii, Naval Construction Battalions, U.S. Atlantic Fleet, Naval Amphibious Base, Little Creek, Norfolk, VA, 1988.

Wire and Fiber Rope and Rigging, Naval Ship's Technical Manual, NAVSEA S9086-UU-STM-000/CH-613, Chapter 613, Commander, Naval Sea System Command, Washington, DC, 1978.

Cranes and Attachments 1, SCBT 540.1, Naval Construction Training Center, Gulfport, MS, 1988.

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