

LHS PATHFINDER KNOTS



LHS PATHFINDER

KNOTS

CHAPTER 1. KNOTS

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KNOTS

A knot is a fastening made by intertwining or tying pieces of string, cord, rope, or webbing. All knots used by a rappeller are divided into four classes: Class I—joining knots, Class II—anchor knots, Class III—middle rope knots, and Class IV—special knots. These classes of knots are intended only as a general guide since some of the knots discussed herein may be appropriate in more than one class. The skill of knot tying may be lost if it is not used and practiced. With experience and practice, knot tying becomes instinctive and helps the soldier in many situations.

1-1. MILITARY MOUNTAINEERING TERMINOLOGY

The terms explained below are the most commonly used in military mountaineering (Figure 1-1).

- a. A *bight of rope* is a simple bend of rope in which the rope does not cross itself.
- b. A *loop* is a bend of rope in which the rope does cross itself.
- c. A *half hitch* is a loop that runs around an object and locks itself.
- d. The *running end* (working end) of the rope is the free end of the rope that can be used.
- e. The *standing part* of the rope is the part that is static (anchored, coiled); the remaining part of the rope not being used (also called static end).
- f. The *lay* of the rope is the same as the twist of the rope.
- g. A *round turn* is a single complete wrap of the rope around an object providing 360-degree contact. The running end leaves the completed circle in the same direction as the standing part. In a round turn, the rope is wrapped around an object 1 1/2 times.
- h. The *pigtail* is the short length of rope remaining at the end after tying a knot or coiling a rope.
- i. *Back feeding* (or stacking) is taking off one wrap at a time from a coil, and letting it fall naturally to the ground.
- j. *Dress down the knot* is tightening down a knot to its functioning form.
- k. An *overhand* is a loop with the running end pulled through the loop.

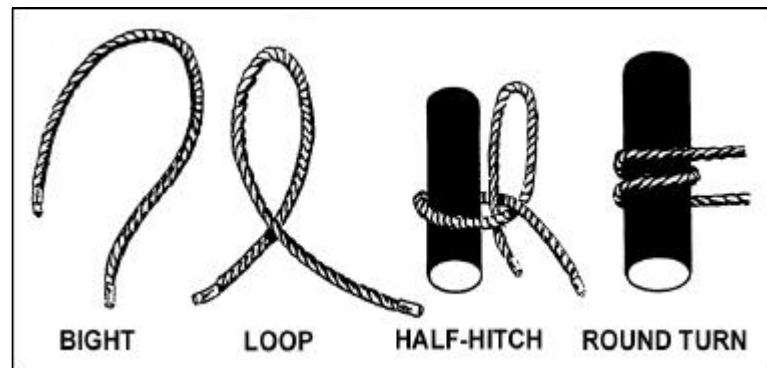


Figure 1-1. Examples of rope terminology.

Section I. JOINING KNOTS

1-2. SQUARE KNOT

The square knot is used to tie the ends of two ropes of equal diameter (Figure 1-2).

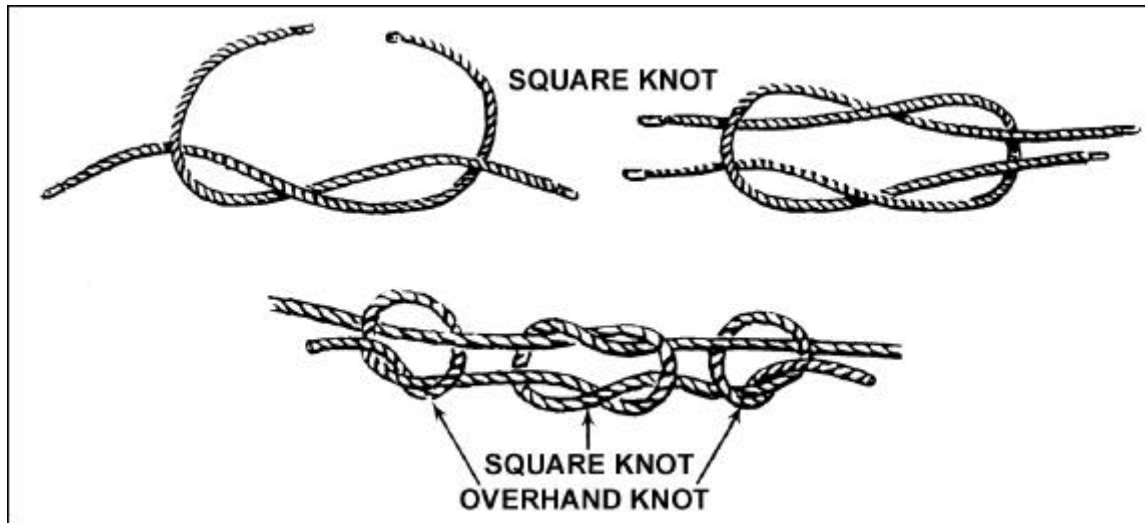


Figure 1-2. Square knot.

a. Tying the Knot.

- STEP 1. Holding one working end in each hand, place the working end in the right hand over the one in the left hand.
- STEP 2. Pull it under and back over the top of the rope in the left hand.
- STEP 3. Place the working end in the left hand over the one in the right hand and repeat STEP 2.
- STEP 4. Dress the knot down and secure it with an overhand knot on each side of the square knot.

b. Checkpoints.

- (1) There are two interlocking bights.
- (2) The standing parts are on the same side and properly secured with overhand knots.

1-3. DOUBLE SHEET BEND KNOT

The double sheet bend knot is used to tie the ends of two or more ropes of equal or unequal diameter (Figure 1-3). When a single rope is tied to a multiple of ropes, the bight is formed with the multiple of ropes.

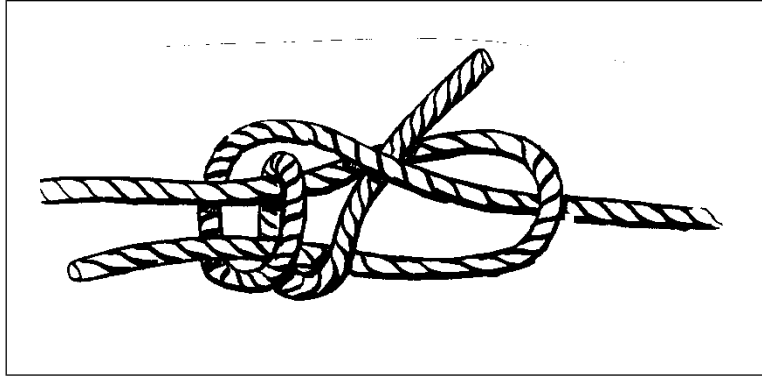


Figure 1-3. Double sheet bend knot.

a. Tying the Knot.

- STEP 1. Form a 30-centimeter (12-inch) bight in the left hand with the rope or ropes. Ensure that the short end of the bight is facing to the inside.
- STEP 2. Place the index finger of the left hand on top of the bight. Bring the rope in the right hand up through the bight and over the index finger of the left hand, so the working end is away from the body.
- STEP 3. Reach through the loop and grasp the working end of the rope and bring it back towards the body. Place it between the index finger and the bight, forming a round turn. Repeat this one more time, wrapping toward the tip of the index finger.
- STEP 4. Remove the finger and dress the knot down.

b. Checkpoints.

- (1) The two wraps around the bight are held in place by a locking bar.
- (2) The two standing parts of the ropes exit parallel and from opposite ends of the knot. The two working ends form an L and exit the knot at a 90-degree angle and on opposite sides of the knot.

1-4. FISHERMAN'S KNOT

The fisherman's knot is used to tie two ropes of similar or dissimilar materials (Figure 1-4).

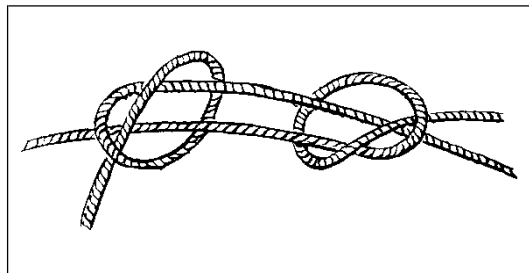


Figure 1-4. Fisherman's knot.

a. Tying the Knot.

STEP 1. Tie an overhand knot in one end of the rope.

STEP 2. Pass the working end of the other rope through the first overhand knot.

Tie an overhand knot around the standing part of the first rope with the working end of the second rope.

STEP 3. Tightly dress down each overhand knot and tightly draw the knots together.

b. Checkpoints.

(1) The two separate overhand knots are tied tightly around the long standing part of the opposing rope.

(2) The two overhand knots are drawn snug.

1-5. DOUBLE FISHERMAN'S KNOT

The double fisherman's knot (also called double English or grapevine) is used to tie two ropes of similar or dissimilar materials (Figure 1-5).

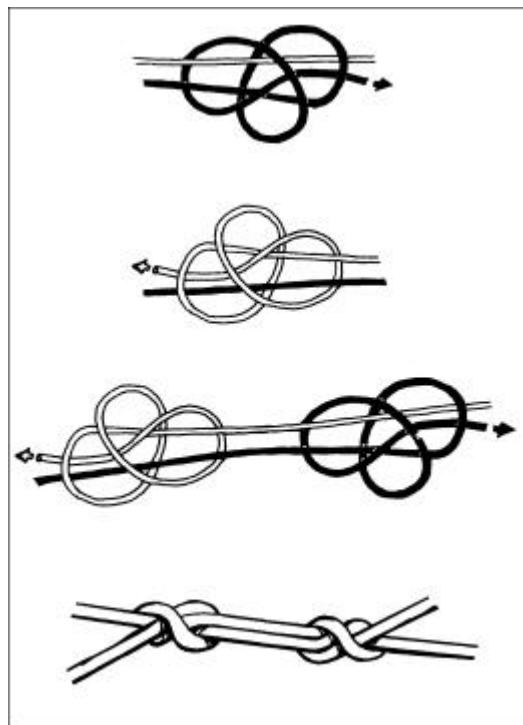


Figure 1-5. Double fisherman's knot.

a. Tying the Knot.

STEP 1. With the working end of one rope, tie two wraps around the standing part of another rope.

STEP 2. Insert the working end (STEP 1) back through the two wraps and draw it tight.

-
- STEP 3. With the working end of the other rope, which contains the standing part (STEPS 1 and 2), tie two wraps around the standing part of the other rope (the working end in STEP 1). Insert the working end back through the two wraps and draw tight.
- STEP 4. Pull on the opposing ends to bring the two knots together.

b. Checkpoints.

- (1) Two wraps with the working end running through and drawn tight.
- (2) Both wraps are drawn together with all the slack out of the knot.

1-6. WATER KNOT

The water knot is used to attach two webbing ends (Figure 1-6). It is also called a ring bend, overhand retrace, or tape knot. It is used in runners and harnesses.

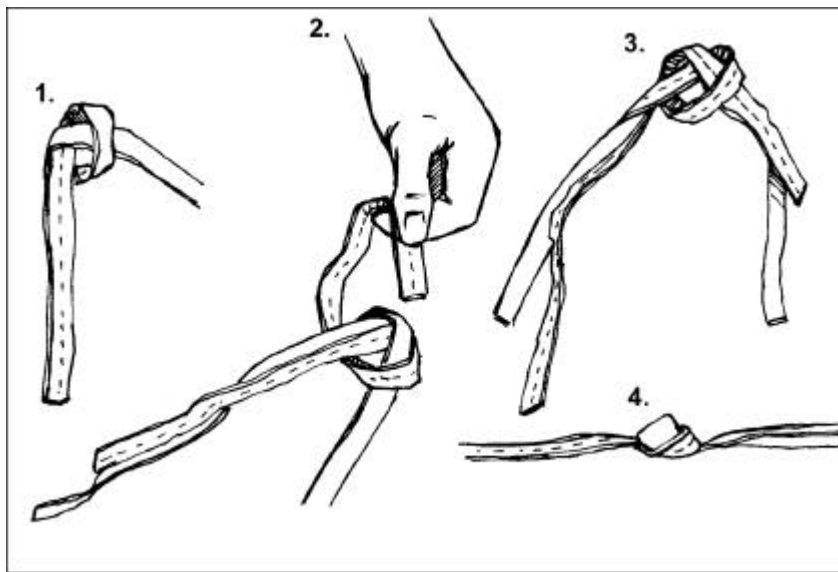


Figure 1-6. Water knot

a. Tying the Knot.

- STEP 1. Tie an overhand knot in one of the ends.
- STEP 2. Feed the other end back through the knot, following the path of the first rope in reverse.

b. Checkpoints.

- (1) There are two overhand knots, one retracing the other.
- (2) There is no slack in the knot, with the working ends coming out of the knot in opposite directions (at least 5 centimeters [2 inches] long).

Section II. ANCHOR KNOTS

1-7. BOWLINE KNOT

The bowline knot is used to tie a single fixed loop in the end of a rope (Figure 1-7). It does not slip under strain and is easily untied. This knot is always used when there is alternating tension. It can also be used to tie the end of a rope to an anchor.

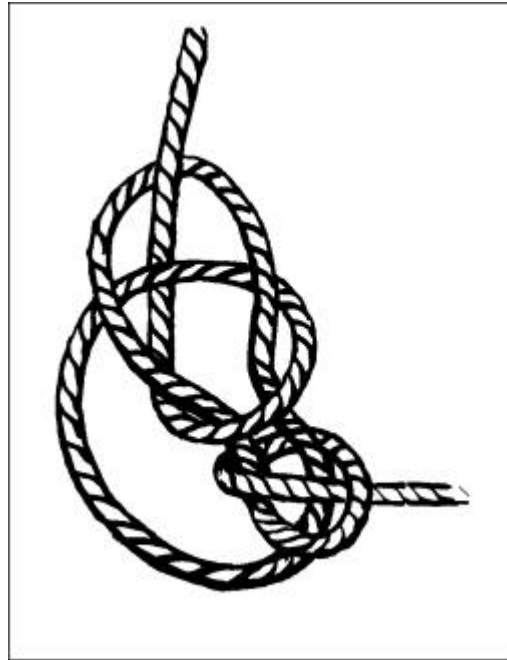


Figure 1-7. Bowline knot.

a. Tying the Knot.

- STEP 1. Bring the working end of the rope around the anchor, from right to left (as the rappeller faces the anchor).
- STEP 2. Form an overhand loop in the standing part of the rope (on the rappeller's right) toward the anchor.
- STEP 3. Reach through the loop and pull up a bight.
- STEP 4. Place the working end of the rope (on the rappeller's left) through the bight, and bring it back onto itself. Dress the knot down.
- STEP 5. Form an overhand knot with the tail from the bight.

b. Checkpoints.

- (1) The loop is locked into place by a bight.
- (2) The short portion of the bight is on the inside and on the loop around the anchor (or inside the fixed loop).

1-8. ROUND TURN AND TWO HALF HITCHES KNOTThe round turn and two half hitches knot is used to tie the end of a rope to an anchor and must have constant tension (Figure 1-8).

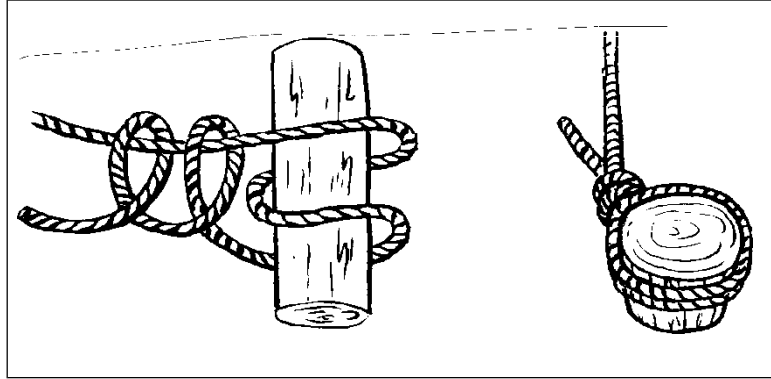


Figure 1-8. Round turn and two half hitches knot.

a. Tying the Knot.

- STEP 1. Route the rope around the anchor from right to left and wrap down (must have two wraps in the rear of the anchor and one in the front). Run the loop around the object to provide 360-degree contact, distributing the load over the anchor.
- STEP 2. Bring the working end of the rope left to right and over the standing part, forming a half hitch (first half hitch).
- STEP 3. Repeat STEP 2 (last half hitch has a 15-centimeter [6-inch] pigtail).
- STEP 4. Dress the knot down.

b. Checkpoints.

- (1) A complete round turn should exist around the anchor with no crosses.
- (2) Two half hitches should be held in place by a locking bar with no less than a 15-centimeter (6-inch) tail remaining.
- (3) When the two half hitches are twisted to the left or the right, they will appear to form a figure eight.
- (4) Looking at the top of the half hitches, the rope should appear to be one continuous rope.

1-9. FIGURE-EIGHT RETRACE KNOT

The figure-eight retrace knot is also called a rerouted figure eight. Although it produces the same result as a figure-eight loop, by tying the knot in a retrace it can be used to fasten the rope to trees or to places where the loop cannot be used (Figure 1-9).

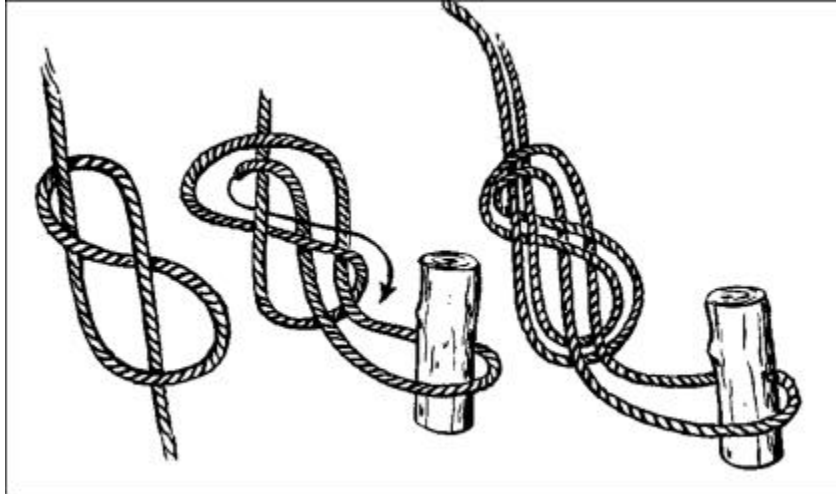


Figure 1-9. Figure-eight retrace.

a. Tying the Knot.

- STEP 1. Use a length of rope long enough to go around the anchor, leaving enough rope to work with.
- STEP 2. Tie a figure-eight knot in the standing part of the rope, leaving enough rope to go around the anchor. To tie a figure-eight knot:
- Form a loop in the rope.
 - Wrap the working end around the standing part.
 - Route the working end through the loop.
 - The finished knot is dressed loosely.
- STEP 3. Place the working end around the anchor point.
- STEP 4. With the working end, insert the rope back through the loop of the knot in reverse.
- STEP 5. Keep the original figure eight as the outside rope and retrace the knot around the wrap and back to the long standing part.
- STEP 6. Safety off with an overhand knot.

b. Checkpoints.

- (1) At least 15 centimeters (6 inches) of rope extends past the figure-eight knot.
- (2) The original figure eight, tied with the standing end, remains as the outermost rope throughout the knot.
- (3) The knot is dressed tightly.

1-10. CLOVE HITCH KNOT

The clove hitch knot can be used in the middle of the rope as well as at the end of the rope (Figure 1-10). The knot must have constant tension on it once tied to prevent slipping. It can be used as either an anchor or middle knot, depending on how it is tied. (Do not use a clove hitch knot on metal except on a picket-hold-fast.)

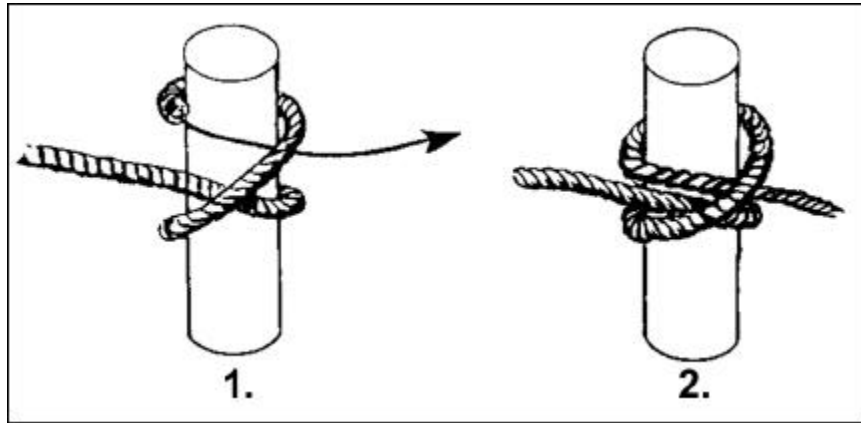


Figure 1-10. Clove hitch knot.

a. Tying the Knot.

(1) If there is access over the top of the anchor, the knot is tied as follows:

- STEP 1. Hold rope in both hands, palms down with hands together. Slide the left hand to the left from 20 to 25 centimeters (8 to 10 inches).
- STEP 2. Form a loop away from and back toward the right.
- STEP 3. Slide the right hand from 20 to 25 centimeters (8 to 10 inches) to the right. Form a loop inward and back to the left hand.
- STEP 4. Place the left loop on top of the right loop. Place both loops over the anchor and pull both ends of the rope in opposite directions to complete the knot.

(2) If the clove hitch knot must go around the anchor, tie the knot as follows (for instructional purposes, assume that the anchor is horizontal):

- STEP 1. Place 76 centimeters (30 inches) of rope over the top of the anchor. Hold the standing end in the left hand. With the right hand, reach under the horizontal anchor, grasp the working end, and bring it inward.
- STEP 2. Place the working end of the rope over the standing end (to form a loop). Hold the loop in the left hand. Place the working end over the anchor from 20 to 25 centimeters (8 to 10 inches) to the left of the loop.
- STEP 3. With the right hand, reach down to the left-hand side of the loop under the anchor. Grasp the working end of the rope and bring it up and outward.

STEP 4. Dress down the knot.

b. Checkpoints.

- (1) The knot has two round turns around the anchor with locking bar.
- (2) The locking bar is facing 90 degrees from the direction of pull.
- (3) The ends exit 180 degrees from each other.
- (4) The knot has more than a 15-centimeter (6-inch) pigtail remaining.

SECTION III. MIDDLE ROPE KNOTS

1-11. WIREMAN'S KNOT

The wireman's knot forms a single, fixed loop in the middle of the rope (Figure 1-11).

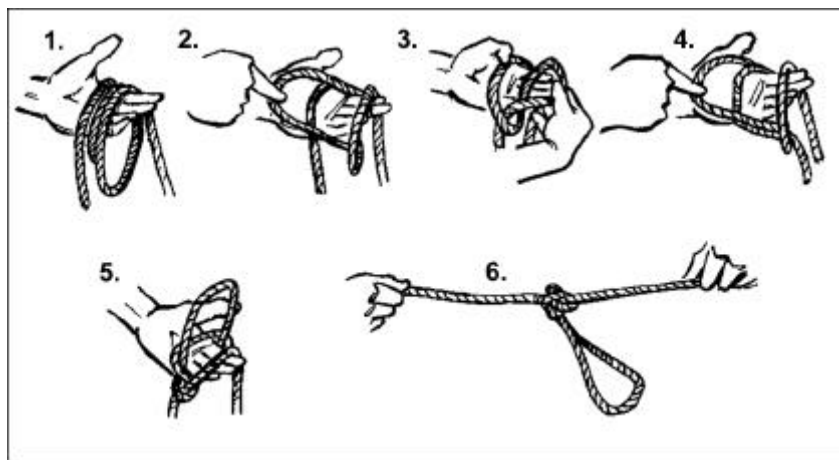


Figure 1-11. Wireman's knot.

a. Tying the Knot.

- STEP 1. When tying this knot, face the anchor that the tie-off system will be tied to. Take up the slack from the anchor, and wrap two turns around the left hand (palm up) from left to right.
- STEP 2. Take up a loop of 30 centimeters (12 inches) in the second round turn to create the fixed loop of the knot.
- STEP 3. Name the wraps from the palm to the fingertips: heel, palm, and fingertip.
- STEP 4. Grasp the palm wrap with the right thumb and forefinger, and place it over the heel wrap.
- STEP 5. Grasp the heel wrap and place it over the fingertip wrap.
- STEP 6. Grasp the fingertip wrap and place it over the palm wrap.
- STEP 7. Grasp the palm wrap and pull up to form a fixed loop.
- STEP 8. Dress the knot down by pulling on the fixed loop and the two working ends.
- STEP 9. Pull the working ends apart to finish the knot.

b. Checkpoints.

(1) The completed knot should have four separate bights locking down on themselves with the fixed loop exiting from the top of the knot and laying toward the near side anchor point.

(2) Both ends should exit opposite each other without any bends.

1-12. DIRECTIONAL FIGURE-EIGHT KNOT

The directional figure-eight knot forms a single, fixed loop in the middle of the rope that lays back along the standing part of the rope (Figure 1-12).

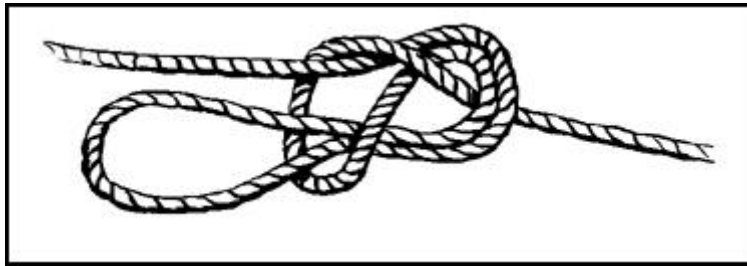


Figure 1-12. Directional figure-eight knot.

a. Tying the Knot.

- STEP 1. Face the far side anchor so that when the knot is tied, it lays inward.
- STEP 2. Lay the rope from the far side anchor over the left palm. Make one wrap around the palm.
- STEP 3. With the wrap thus formed, tie a figure-eight knot around the standing part that leads to the far side anchor.
- STEP 4. Dress the knot down with the tail and the bight together.

b. Checkpoints.

- (1) The loop should be large enough to accept a snaplink but no larger than a helmet-size loop.
- (2) The tail and bight must be together.
- (3) The figure eight is tied tightly.
- (4) The bight in the knot faces back toward the near side.

1-13. BOWLINE-ON-A-BIGHT KNOT

The bowline-on-a-bight knot is used to form two fixed loops in the middle of a rope (Figure 1-13).

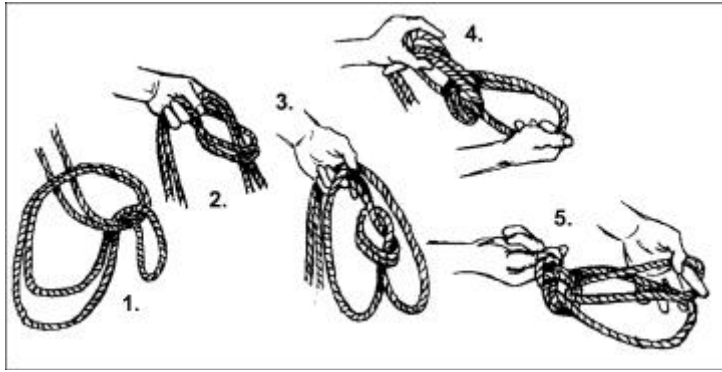


Figure 1-13. Bowline-on-a-bight knot.

a. Tying the Knot.

- STEP 1. Form a bight in the rope about twice as long as the finished loops will be.
- STEP 2. Tie an overhand knot on a bight.
- STEP 3. Hold the overhand knot in the left hand so that the bight is running down and outward.
- STEP 4. Grasp the bight with the right hand, fold it back over the overhand knot so that the overhand knot goes through the bight.
- STEP 5. From the end (apex) of the bight, follow the bight back to where it forms the cross in the overhand knot. Grasp the two ropes that run down and outward and pull up, forming two loops.
- STEP 6. Pull the two ropes out of the overhand knot and dress the knot down.
- STEP 7. A final dress is required: grasp the ends of the two fixed loops and pull, spreading them apart to ensure the loops do not slip.

b. Checkpoints.

- (1) There are two fixed loops that will not slip.
- (2) There are no twists in the knot.
- (3) A double loop is held in place by a bight.

1-14. FIGURE-EIGHT-ON-A-BIGHT KNOT

The figure-eight-on-a-bight knot is used to form two fixed loops in the middle of a rope . (Figure 1-14).

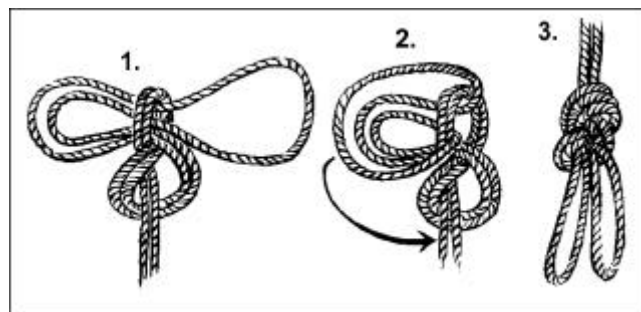


Figure 1-14. Figure-eight-on-a-bight knot.

a. Tying the Knot.

- STEP 1. Using the doubled rope, form a 46-centimeter (18-inch) bight in the left hand with the running end facing to the left.
- STEP 2. Grasp the bight with the right hand and make a 360-degree turn around the standing end in a counterclockwise direction.
- STEP 3. With the working end, form another bight and place that bight through the loop just formed in the left hand.
- STEP 4. Hold the bight with the left hand, and place the original bight (moving toward the left hand) over the knot.
- STEP 5. Dress the knot down.

b. Checkpoints.

- (1) There is a double figure eight with two loops.
- (2) The knot will not slip.

1-15. OVERHAND LOOP KNOT

The overhand loop knot forms a single loop in the middle of a rope. It should not be used in a transport tightening system (Figure 1-15).

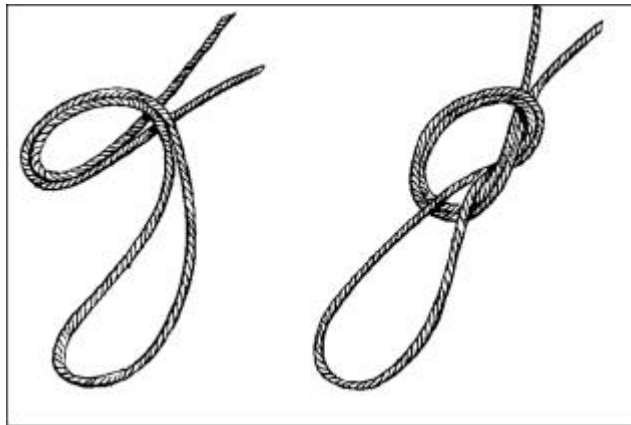


Figure 1-15. Overhand loop knot

a. Tying the Knot.

- STEP 1. Form a bight in the rope about as long as the loop needed.
- STEP 2. With the bight, form an overhand knot using the bight as the working end. Dress the knot tightly.

b. Checkpoints.

- (1) The loop is the desired size.
- (2) The ropes in the overhand knot are parallel and do not cross over each other.
- (3) The knot is tightly dressed.

1-16. FIGURE-EIGHT LOOP KNOT

The figure-eight loop knot is a variation of the overhand loop and is easy to untie after it has held weight (Figure 1-16).

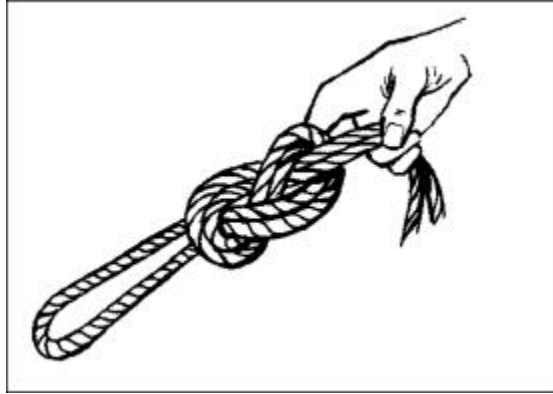


Figure 1-16. Figure eight loop knot.

a. Tying the Knot.

- STEP 1. Form a bight in the rope about as large as the diameter of the desired loop.
- STEP 2. With the bight as the working end, form a loop in rope (standing part).
- STEP 3. Wrap the working end around the standing part 360 degrees and feed the working end through the loop. Dress the knot tightly.

b. Checkpoints.

- (1) The loop is the desired size.
- (2) The ropes in the loop are parallel and do not cross over each other.
- (3) The knot is tightly dressed.

SECTION IV. SPECIAL KNOTS

1-17. SINGLE BUTTERFLY KNOT

The single butterfly knot is used to form a single, fixed loop in the middle of the rope without using the ends (Figure 1-17). The butterfly can be used for the middle man in a rope party as well as in a transport tightening system. The knot can be hard to untie when heavy weight has been placed on it for extended periods.

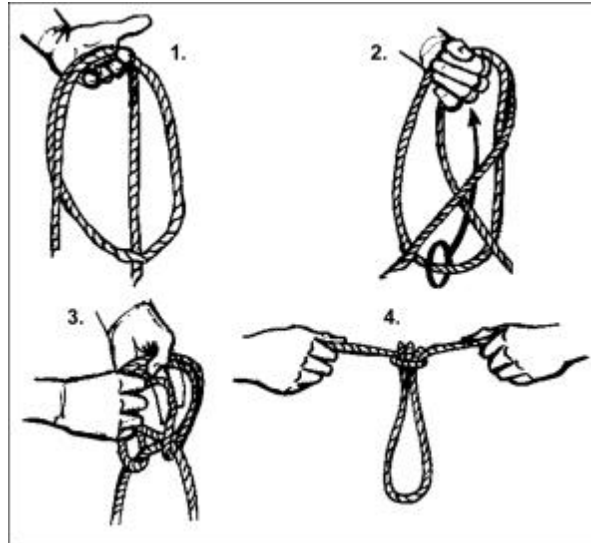


Figure 1-17. Single butterfly knot.

a. Tying the Knot.

- STEP 1. Form a loop over the palm of the left hand.
- STEP 2. With the right hand, cross the two long-standing ends; reach under and grasp the bottom of the loop formed in STEP 1.
- STEP 3. Route the bottom of the loop over the crossed standing ends and back through the top of the loop.
- STEP 4. Hold the newly formed loop and dress the knot down, removing all of the slack out of the knot.

b. Checkpoints.

- (1) The wings of the knot are dressed down tightly and as close together as possible.
- (2) The ropes between the wings are parallel with no crossovers.
- (3) The loop is no larger than a helmet but large enough to accept a snaplink.
- (4) All ropes in the knot are tightly dressed.

1-18. PRUSIK KNOT

The prusik knot is used to put a moveable rope on a fixed rope such as a prusik ascent or a tightening system. This knot can be tied as a middle, finger, or end knot.

a. Tying the Knot.

(1) *First method.* The prusik knot is tied at the middle or end of a rope; there are many ways to do this (Figure 1-18). The middle-of-the-rope prusik knot can be tied with a short rope to a long rope as follows:

- STEP 1. Double the short rope, forming a bight, with the working ends even. Lay it over the long rope so that the closed end of the bight is 30 centimeters (12 inches) below the long rope and the remaining part of the rope (working ends) is the closest to the rappeller; spread the working end apart.

-
- STEP 2. Reach down through the 30-centimeter (12-inch) bight. Pull up both of the working ends and lay them over the long rope. Repeat this process making sure that the working ends pass in the middle of the first two wraps. Now there are four wraps and a locking bar working across them on the long rope.
- STEP 3. Dress the wraps and locking bar down to ensure they are tight and not twisted. Tie an overhand knot with both ropes to prevent the knot from slipping during periods of variable tension.

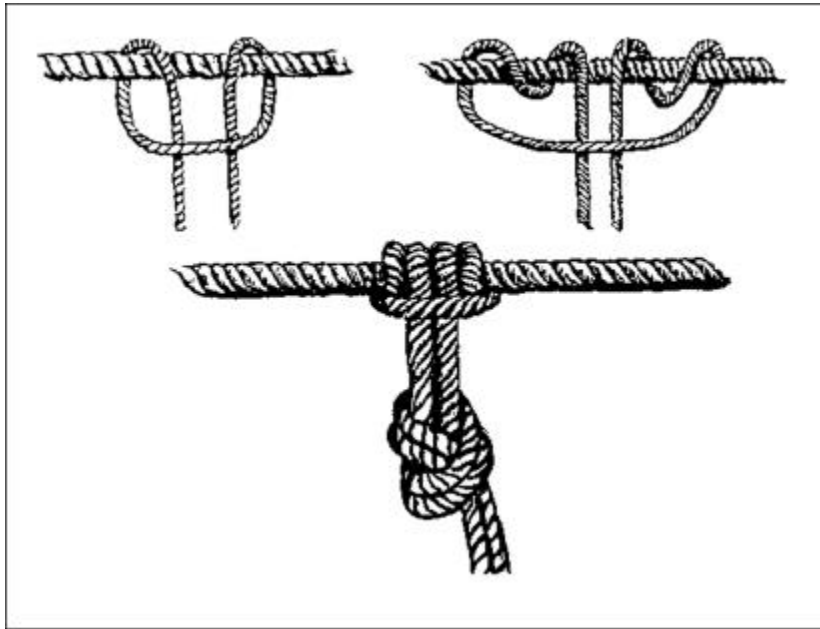


Figure 1-18. Middle-of-the-rope prusik knot.

(2) *Second method.* Another way of tying the prusik knot is the finger prusik (Figure 1-19).

- STEP 1. Lay the rope across the thumb and index finger of the left hand.
- STEP 2. Wrap the rope around the index finger twice (wrapping away from the rappeller). Wrap the rope around the thumb twice (wrapping towards the rappeller).
- STEP 3. Place the thumb and index finger tip to tip. Push the wraps together so that the prusik is on the left thumb. Four wraps and a locking bar should be across them.
- STEP 4. Pass the running end of the rope through the wraps of the prusik knot.
- STEP 5. Dress the wraps and locking bar down to ensure they are tight and not twisted.

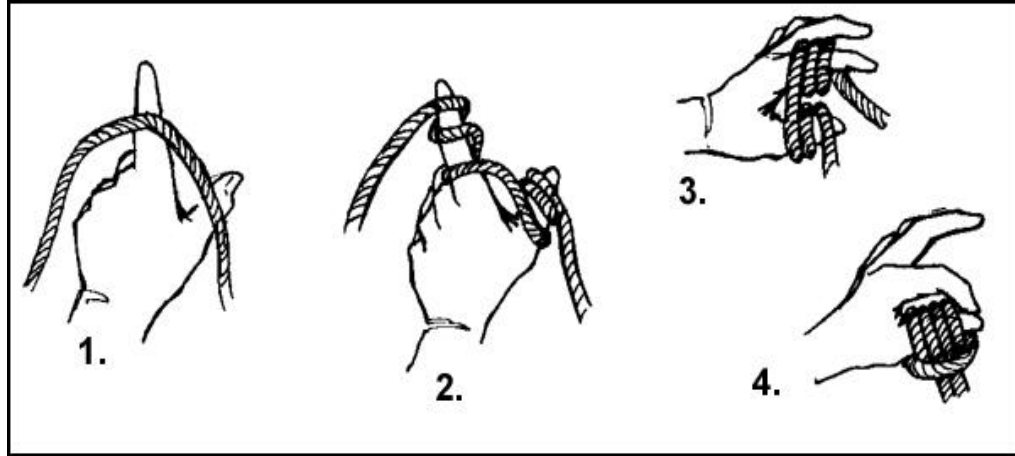


Figure 1-19. Finger prusik knot.

(3) *Third method.* Another way of tying a prusik knot is the end-of-the-rope knot (Figure 1-20).

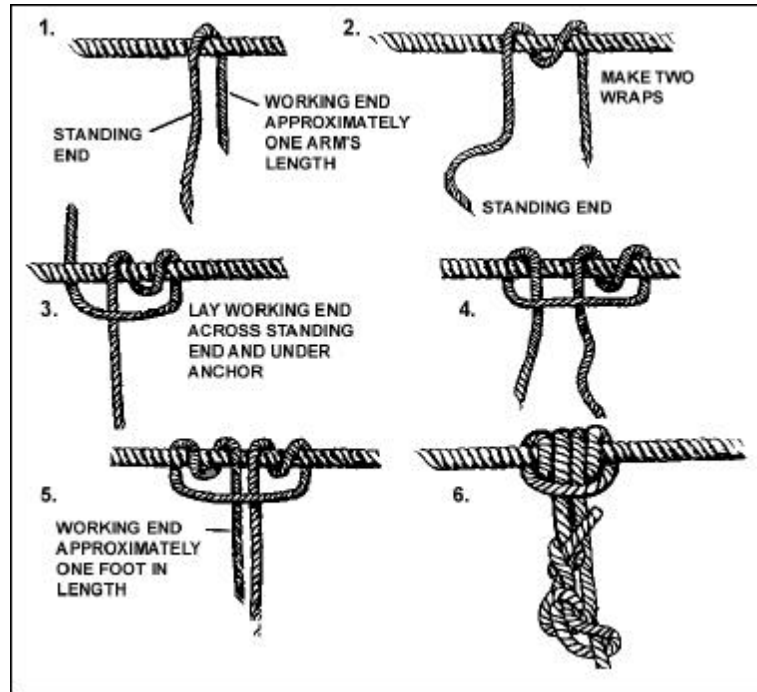


Figure 1-20. End-of-the-rope prusik knot.

- STEP 1. Using an arm's length of rope, place it over the long rope.
- STEP 2. Form a complete round turn in the rope.
- STEP 3. Cross over the standing part of the short rope with the working end of the short rope.
- STEP 4. Lay the working end under the long rope.
- STEP 5. Form a complete round turn in the rope, working back toward the middle of the knot.

-
- STEP 6. Four wraps and a locking bar should run across them on the long rope. Dress the wraps and locking bar down. Ensure they are tight, parallel, and not twisted.
- STEP 7. Finish the knot with a bowline to ensure that the prusik knot will not slip out during periods of varying tension.

b. Checkpoints.

- (1) Four wraps with a locking bar.
- (2) The locking bar faces the rappeller.
- (3) The knot is tight and dressed down with no ropes twisted or crossed.
- (4) Other than a finger prusik, the knot should contain an overhand or bowline to prevent slipping.

1-19. BACHMAN KNOT

The bachman knot provides a means of using a makeshift mechanized ascender (Figure 1-21).

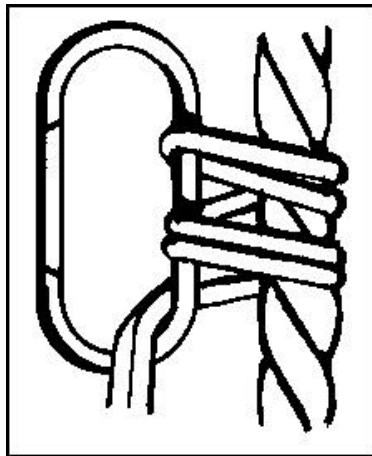


Figure 1-21. Bachman knot.

a. Tying the Knot.

- STEP 1. Find the middle of a utility rope and insert it into a snaplink.
- STEP 2. Place the snaplink and utility rope next to a long climbing rope.
- STEP 3. With the two ropes parallel from the snaplink, make two or more wraps around the climbing rope and through the inside portion of the snaplink.

Note: The rope can be tied into an etrier (stirrup) and used as a prusik-friction principal ascender.

b. Checkpoints.

- (1) The bight of the climbing rope is at the top of the snaplink.
- (2) The two ropes run parallel without twisting or crossing.

(3) Two or more wraps are made around the long climbing rope and through the inside portion of the snap link.

1-20. BOWLINE-ON-A-COIL KNOT

The bowline-on-a-coil knot is an expedient tie-in used by rappellers in two- and three-man party climbs when a climbing harness is not available (Figure 1-22).

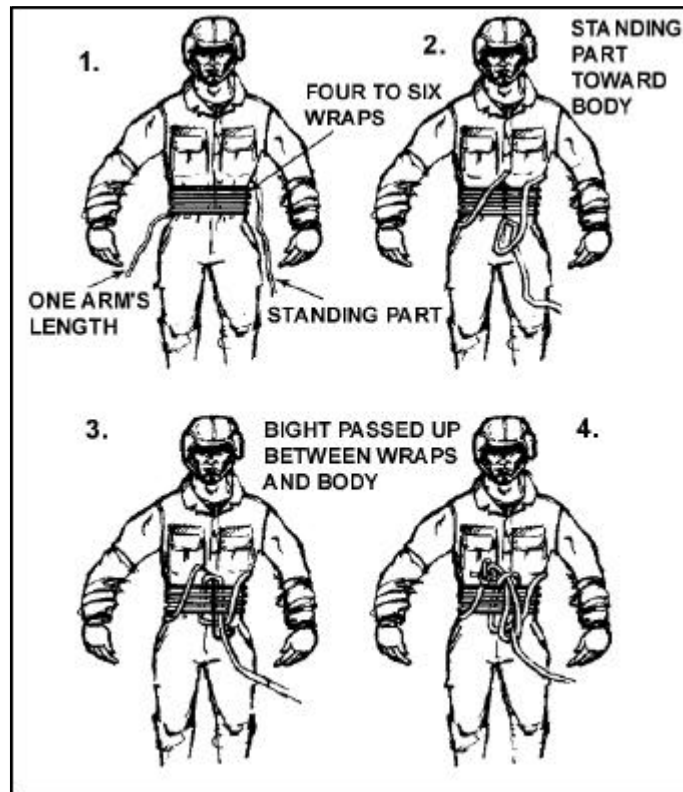


Figure 1-22. Bowline-on-a-coil knot.

Note: A safer tie in, when possible, is a swiss seat and figure eight around the shoulder, to avoid damaging the ribs if the climber falls.

a. Tying the Knot.

- STEP 1. To tie a bowline-on-a-coil knot, start the same as tying a bowline around the waist. (The waist of the rappeller is the anchor point. The rappeller has about 40 centimeters [16 inches] of rope in the right hand. The standing end is coming from the remainder of the rope in his left hand.)
- STEP 2. Draw slack from the standing end of the rope in the left hand, wrapping enough coils around the body to complete a minimum of four (but no more than six) coils.
- STEP 3. With the rope in the left hand, make a loop inward with the standing end.

-
- STEP 4. Slide the loop up between the horizontal wraps and the body, ensuring that the loop does not come uncrossed.
- STEP 5. Bring a bight up through the loop. Bring the working end of the rope in the right hand through the bight and back onto itself.

OR

Insert the short working end to the right through the loop (just passed through the wraps). Pass the working end around the long standing end and back on itself, forming a bight.

- STEP 6. Dress the knot down.
- STEP 7. Safety off with an overhand knot against the knot formed on the top single coil. From 10 to 15 centimeters (4 to 6 inches) of rope should be left (standing part).

b. Checkpoints.

- (1) There are a minimum of four (maximum of six) parallel wraps; the top and bottom ropes cross forward of the hips.
- (2) The loop must be underneath all wraps.
- (3) Other checkpoints are the same as the bowline.

1-21. THREE-LOOP BOWLINE KNOT

The three-loop bowline knot is used to form three fixed loops in the middle of a rope (Figure 1-23). It is used in a self-equalizing anchor system.

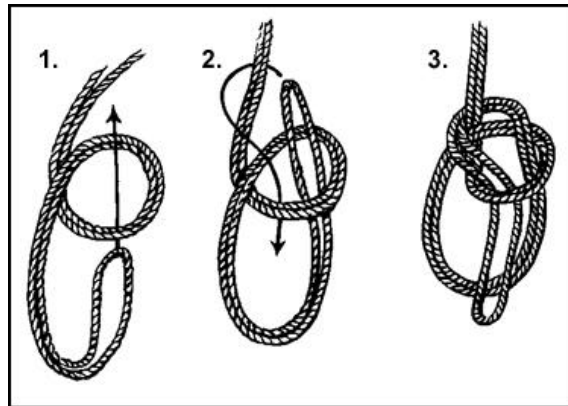


Figure 1-23. Three-loop bowline knot.

a. Tying the Knot.

- STEP 1. Form about a 60 centimeter (24-inch) bight in the rope, laying it across the left hand, palm up, with the bight to the front.
- STEP 2. With the right hand, form a loop with both ropes. Hold it in the left hand.
- STEP 3. With the right hand, bring the long bight through the loop (formed in STEP 2) and around and around the two standing ends.

STEP 4. Follow the bight around the standing ends and back down into the loop.

STEP 5. Hold all three loops in the left hand. With the right hand, grasp both standing ropes and pull while dressing up the bowline.

b. Checkpoints.

(1) Checkpoints are the same as a regular bowline, except that it is tied with two ropes.

(2) An overhand knot must be tied if the third loop is not to be used as a secondary anchor.

1-22. FIGURE-EIGHT SLIP KNOT

The figure-eight slip knot forms an adjustable bight in a rope (Figure 1-24).

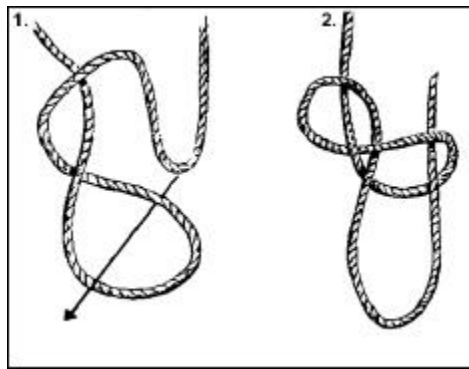


Figure 1-24. Figure-eight slip knot.

a. Tying the Knot.

STEP 1. Form a 30-centimeter (12-inch) bight in the end of the rope.

STEP 2. Hold the center of the bight in the right hand. Hold the two parallel ropes from the bight in the left hand about 30 centimeters (12 inches) up the rope.

STEP 3. With the center of the bight in the right hand, twist two complete turns clockwise.

STEP 4. Reach through the bight and grasp the long standing end of the rope. Pull another bight (from the long standing end) back through the original bight.

STEP 5. Pull down on the short working end of the rope and dress the knot down.

STEP 6. If the knot is to be used in a transport tightening system, take the working end of the rope and form a half hitch around the loop of the figure-eight knot.

b. Checkpoints.

(1) The knot is in the shape of a figure eight.

(2) The sliding portion of the rope is the long working end of the rope.

Section V. SPECIAL-PURPOSE KNOTS

1-23. KLEIMHIEST KNOT

The kleimhiest knot provides a moveable, easily adjustable, high-tension knot capable of holding extremely heavy loads while being pulled tight (Figure 1-25). This system requires a six-man pulling team when used in a transport tightening system.

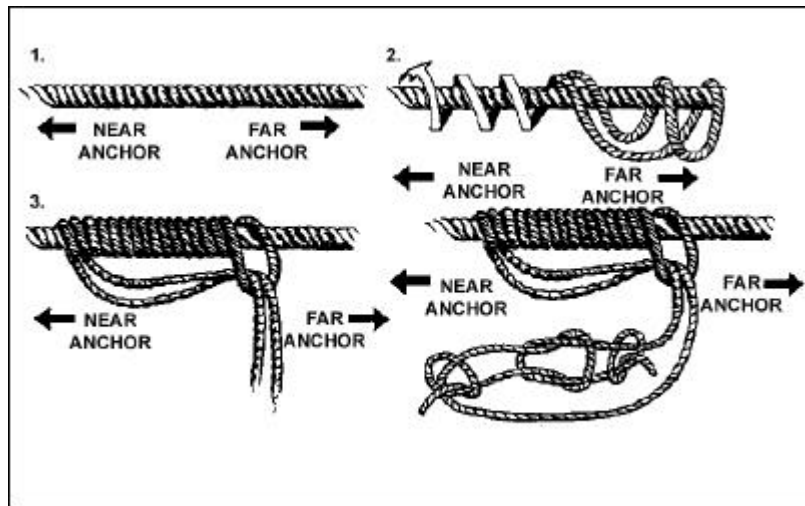


Figure 1-25. Kleimhiest knot.

a. Tying the Knot.

- STEP 1. Using a utility rope, offset the ends by 30 centimeters (12 inches). With the ends offset, find the center of the rope and form a bight. Lay the bight over a horizontal rope near the far side anchor.
- STEP 2. Wrap the tails of the utility rope around the horizontal rope back toward the near side anchor. Wrap at least four complete turns.
- STEP 3. Pass the remaining tails of the utility rope through the bight (see STEP 1).
- STEP 4. Join the two ends of the tail with a joining knot (square knot with overhand safety knots).
- STEP 5. Dress the knot down tightly so that all wraps are touching. Insert two snap links (opposing gates) into the large loop tied with the tails.

b. Checkpoints.

- (1) The bight is closest to the far side anchor.
- (2) All wraps are tight and touching.
- (3) The ends of the utility rope are properly secured with the adjoining knot.

1-24. OVERHAND KNOT

The overhand knot (Figure 1-26) is used to make a knotted rope for a handline, to secure the ends of other knots, and to make stirrups in direct-aid climbing. This knot can also be used to temporarily whip the end of a rope. It is used with other knots.

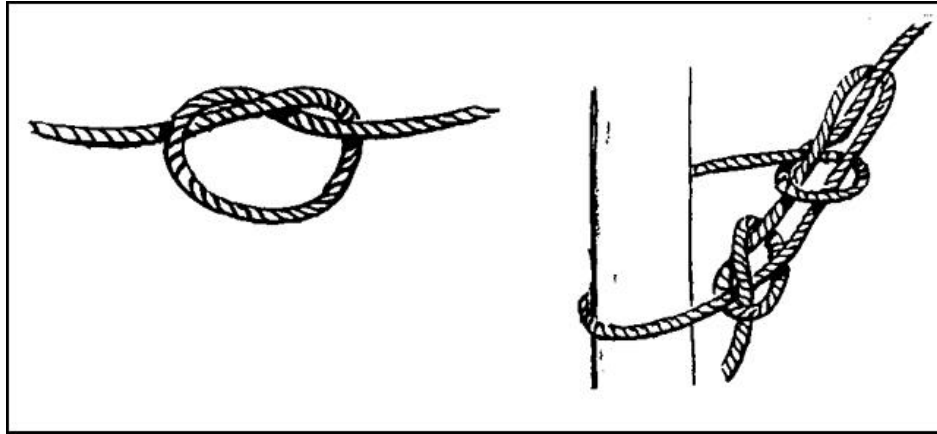


Figure 1-26. Overhand knot.

a. Tying the Knot.

- STEP 1. Make a loop in the rope.
- STEP 2. Pass the working end of the rope through the loop.
- STEP 3. Dress down the knot.

b. Checkpoints.

- (1) Running ends exit the loop in opposite directions.
- (2) The knot is dressed down tightly.

1-25. FROST KNOT

The frost knot is used when working with flat webbing (Figure 1-27). It holds better than a standard overhand knot or square knot.

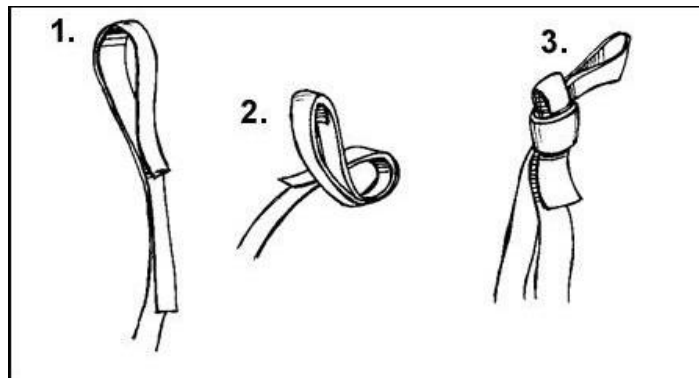


Figure 1-27. Frost knot.

a. Tying the Knot.

- STEP 1. Lap one end (a bight) of webbing over the other (about 25 to 30 centimeters [10 to 12 inches]).
- STEP 2. Tie an overhandknot with the newly formed triple-strand webbing; dress tightly.

b. Checkpoints.

- (1) The tails of the webbing run in opposite directions.
- (2) Three strands of webbing are formed into a tight overhand knot.
- (3) A bight and tail exit the top of the overhand knot.

1-26. GIRTH HITCH KNOT

The girth hitch knot is used in tying a runner to a partly driven piton (Figure 1-28).

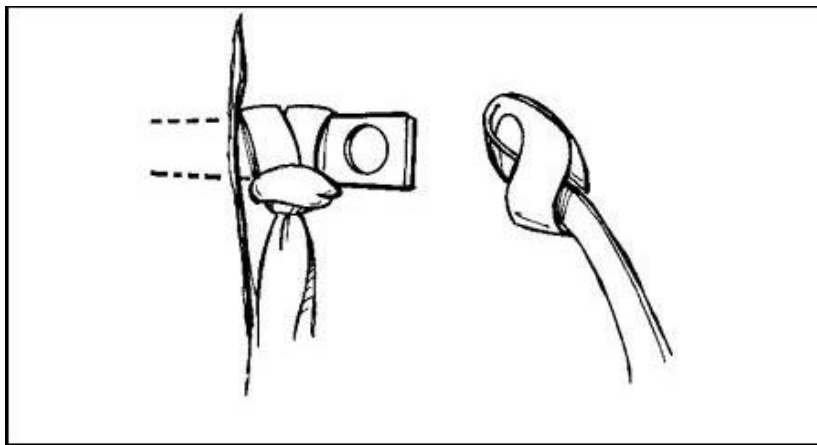


Figure 1-28. Girth hitch knot.

a. Tying the Knot.

- STEP 1. Bring the standing ends back through the bight of a length of rope or webbing.
- STEP 2. Dress the knot tightly.

b. Checkpoints.

- (1) Two wraps exist with a locking bar running across the wraps.
- (2) The knot is dressed tightly