

Blue Ridge Mountain Rescue Group, Inc.

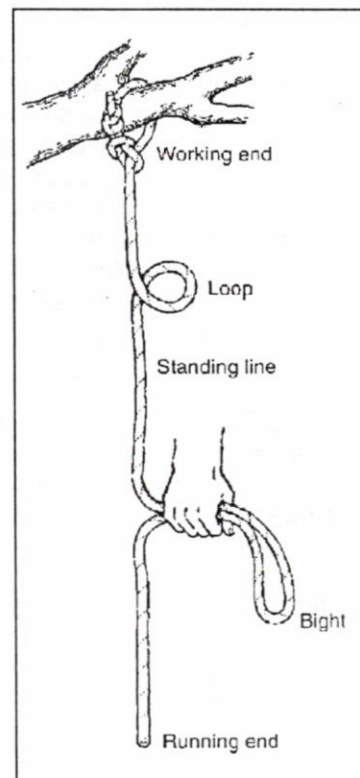
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Common Terms

- Tie – generic term used to describe securing cordage
- Bend – a tie that unites two rope ends
- Hitch – a group of ties that wrap or attach to other objects or ropes
- Knot – a fixed point on cordage made with bends, turns, and tie-offs
- Bight – a doubled section of rope that does not cross itself
- Loop – a turn of rope that crosses itself
- Running End – the free end, not attached to anything
- Standing Part of Rope – all rope not fastened at the rigging point
- Working End – end of the rope used to rig or tie off to something



FTM Knots – Previous Semester

All trainees must continue to show proficiency in the following FTM ties:

- Anchor Knots
 - Bowline
 - Figure Eight
 - Figure Eight Follow Through
 - Figure Eight on a Bight
- Bends
 - Double Overhand Bend
 - Figure Eight Bend
 - Square Knot
 - Water Knot
- Friction Hitches
 - Girth Hitch
 - Prusik Knot
 - Taught-Line Hitch
- Other - ASRC Redundant Seat Harness

Categories of Ties for the FTL

- Anchor Knots (taught in FTM semester)
- Mid-Line Knots (tied in standing part of rope)
 - Bowline-On-A-Coil
 - Butterfly Knot
- Bends (end-to-end tie-offs)
 - Frost Knot
 - One-Way Knot
 - Sheet Bend
- Friction Hitches
 - Load-Releasing Hitch (LRH)
 - Münter Hitch
- Other – Cross-Chest Harness

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Task: To learn the knots required of the ASRC Field Team Leader.

Conditions: Ropes, cord, webbing, and carabiners for students to view and practice with; a knowledgeable instructor and a classroom environment.

Standards: FTL Knots, Hitches, and Bends

ASRC FTL Standards, Section D.7., ASRC Training Manual, version 6.0, August 2001 & additional BRMRG standards

- A) Demonstrate the ability to tie correctly the knots below (in addition to those knots listed in the FTM standards):
- (1) Butterfly Knot;
 - (2) Bowline-On-A-Coil;
 - (3) One-Way Knot;
 - (4) Sheet Bend;
 - (5) Frost Knot;
 - (6) ASRC seat harness (taught at the FTM level);
 - (7) Load-Releasing Hitch;
 - (8) Cross-Chest Harness;
 - (9) Münter Hitch (BRMRG Requirement)

Knot Information Review

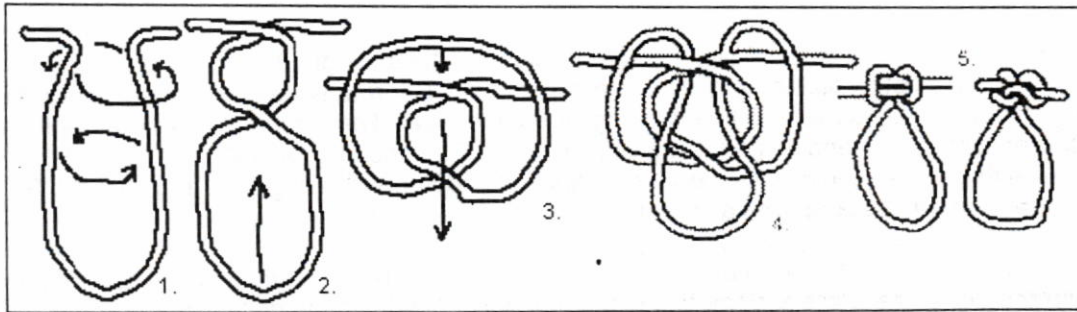
Important Considerations

- Knots reduce the strength of any rope from 50-80% of its original capacity.
- Rope failure rarely occurs in a knot. Rather, failure generally occurs at the point where the line goes into the tie and the loop binds down, pinching the line to the point of failure. Some knots can bind so tightly, like the Prusik, that they can actually melt the main rope apart.
- When finishing a knot, always remember to:
 - (1) Dress the knot – orient all parts so that they are evenly aligned, contoured, and bundled. An 'undressed' knot causes as much as 50% more stress on a rope than a properly tied knot.
 - (2) Set the knot – tighten and remove slack from all parts of the knot. Some knots depend on friction to remain tied and will undo if not set. Back up your knots with half-hitches.

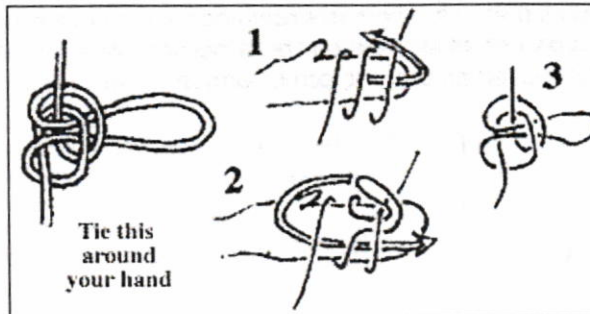
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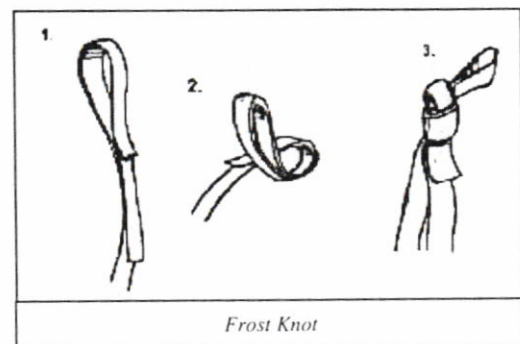


- 2) Form three turns around your hand. Pull the middle turn under the outer turn towards the fingertips. Continue pulling around the outer turn and back towards the wrist, then under all turns towards the fingertips again. Tighten the knot.



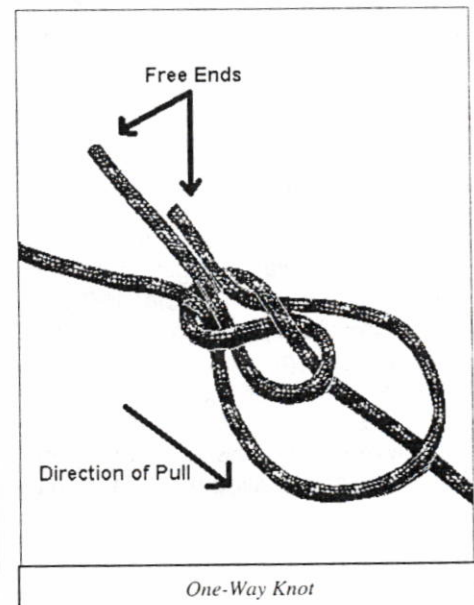
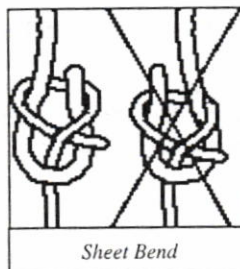
Bends

Frost Knot - used when joining two ends of flat webbing. This is the knot of choice at the head of a hand-tied etrier (webbing ladder) because of its compactness and ease of tying. The frost knot creates a small loop above the knot in the webbing. One end of the webbing remains below the knot and the other is inside the loop. Very similar in strength and design to the Water Knot. Named after Tom Frost, the revolutionary American big wall climber, alpinist, and equipment designer.



One-Way Knot - used to attach two ropes together with a knot that can pass in one direction through a pulley. This knot is stronger than the Sheet Bend and Double Sheet Bend Knots, but weaker than the Double Fisherman's Knot. A Figure-Eight Knot is tied near the end of one rope. The end of the other rope is threaded through one of the Figure-Eight loops so both rope ends face away from the direction of movement through the pulley, minimizing the risk snagging as they move in the direction of pull.

Sheet Bend - best for connecting two ropes of different diameters. The knot can easily work loose and is stronger when tied in the right direction. Both standing ends should be on the same side of the knot. The Sheet Bend is not used in climbing or rescue situations where safety of the load is a concern (i.e. joining two ropes to lower a person). A stronger alternative is the Double Sheet Bend - simply a Sheet Bend with an extra turn made by the rope going around the bite or the Double-Overhand Bend (a.k.a. Double English, Grapevine, and Double Fisherman's Knots).



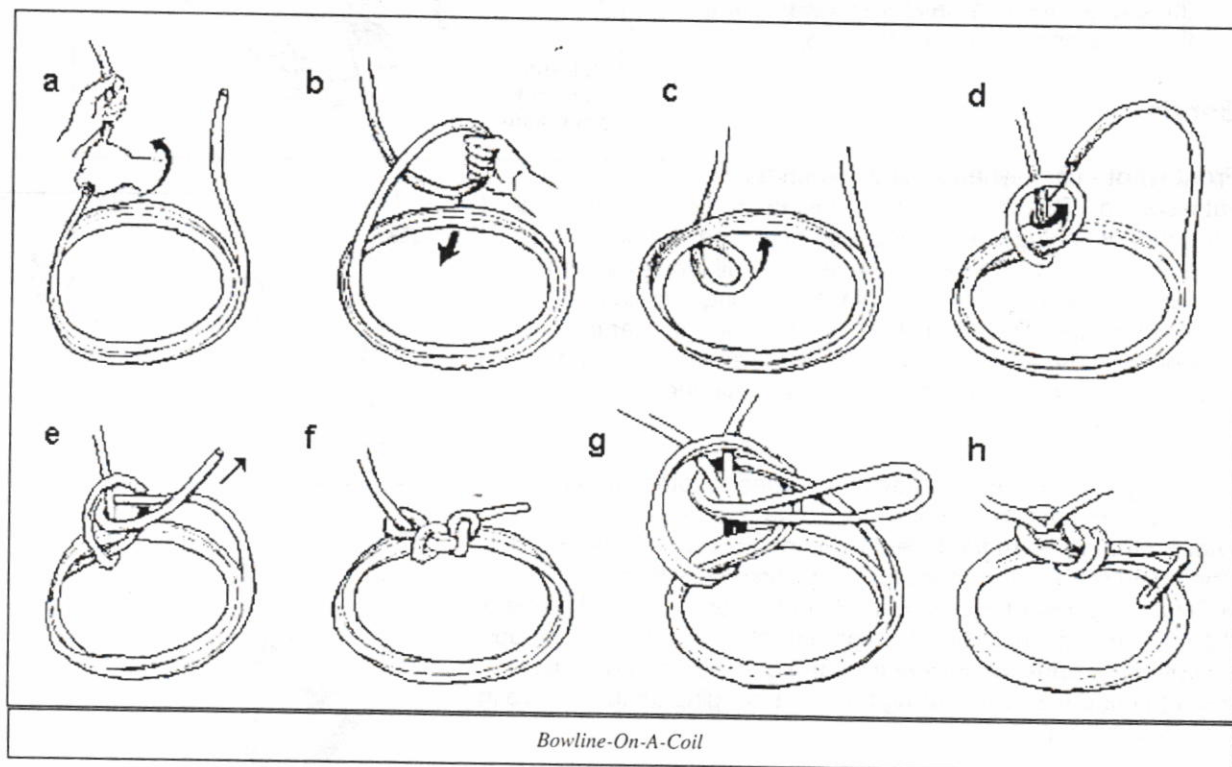


Mid-Line Knots

Bowline-On-A-Coil - a quick tie-in either in the middle or at the ends of a rope in an emergency when a climbing harness is not available. A minimum of three wraps is formed around a person to create more surface area and a loop is made in the standing part of the rope. The loop is pulled up through the inside of the coil, ensuring the standing part is against the body. Turn the loop over the coil around the waist. Wrap the tail through the loop, going over the near side, under the standing part, and over the far side of the loop. Tighten and back up with a Half Hitch.

A person should not be suspended by this knot for any extended period of time; the wraps around the body will compress a person's abdomen and after the onset of fatigue the diaphragm will cease to function as part of the normal breathing process, ultimately leading to suffocation. It is critical that the initial loop used around the coil is formed so that the standing part of the rope is against the body. If it is not, a proper bowline is not formed and the knot will slip, tightening against the body when weighted.

Figures a-f: for a person at the end of a rope; g-h: for the middleman.



Bowline-On-A-Coil

Butterfly Knot - forms a single, fixed loop in the middle of the rope without using the ends. This knot is good for re-belays, rigging in the middle of a rope, or tying rub points out of a rope. Since the ends of the rope emerge from the knot 180 degrees to one another, this knot does not weaken the rope like many other middle-rope knots. The butterfly knot is difficult to untie when heavy weight has been placed on it for extended periods. a.k.a. Alpine Butterfly Knot, Harness Loop, and Lineman's Loop.

There are two easy methods for tying this knot:

- 1) Make two twists in a bite of rope to form two loops. Pull the bottom loop up, over, and underneath the first loop, pulling through from behind. Tighten the knot.

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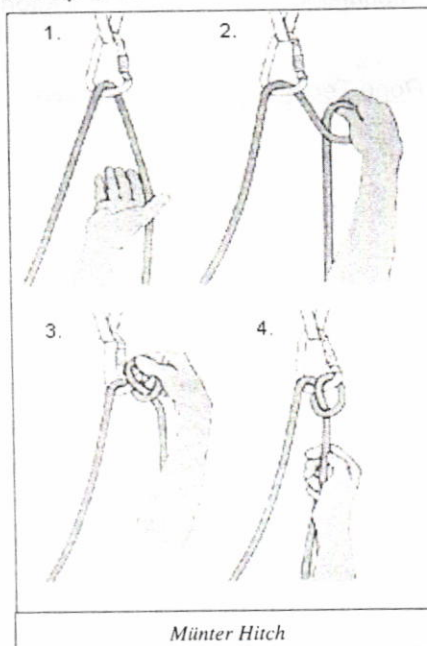
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Friction Hitches

Load-Releasing Hitch - used to transfer a loaded rope from a belay device to an anchor, allowing the belayer to escape the system, or in rescue as part of a tandem-Prusik belay.

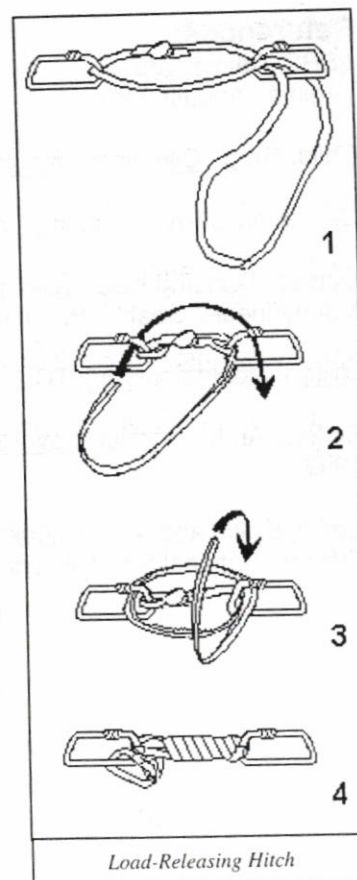
The BRMRG method shown here uses approximately twenty feet (20') of 1-inch tubular webbing. Begin by forming a large loop using a Water Knot. Twist the loop to form two smaller loops and put a locking carabiner on one end. Clip another locking carabiner into the 'X' formed between the two smaller loops, ensuring to clip through properly or the webbing will slip. Run the free end of webbing from the lower carabiner and 'X' back up and through the first carabiner, then down through the second. Wrap the remaining webbing around the standing webbing and knot up toward the first carabiner. Six wraps should be sufficient. Pull the excess through the loops and secure with a third carabiner attached to the first carabiner.



Münter Hitch

To release tension, unclip the third carabiner and S-L-O-W-L-Y unwrap the webbing until the hitch slips to catch the load. Alternate methods involve using perlon and a Münter Hitch and will be discussed in greater detail during Vertical Rescue.

Münter Hitch - a simple hitch formed on a large pear-shaped locking carabiner (HMS-style carabiner) to create friction on the rope for belaying or rappelling. The hitch is reversible (can be pulled by either end through the carabiner) but creates more twists in the rope than other rappel methods. This hitch should not be used to belay heavy loads, but can adequately lower or belay a single person if the user is well versed in the hitch's proper use. a.k.a. Italian Hitch.

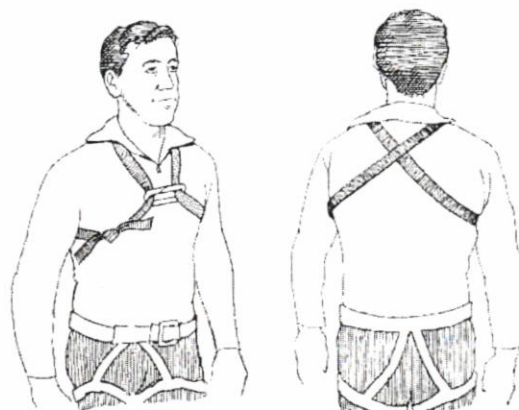


Load-Releasing Hitch

Other

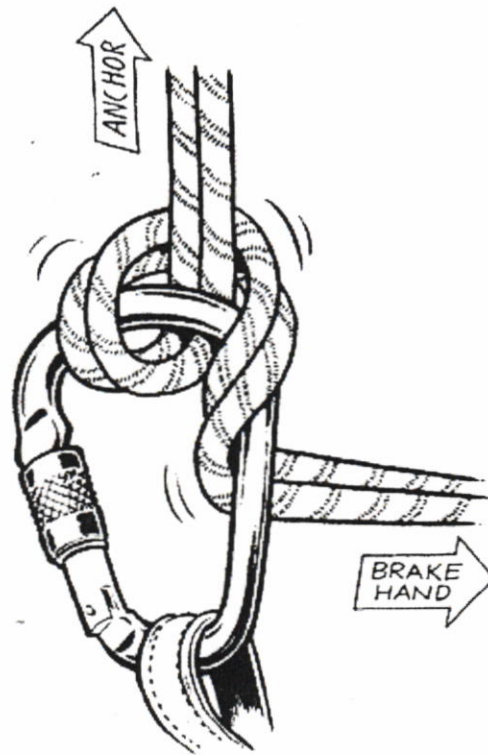
Cross-Chest Harness - a simple improvised chest harness made from nine-and-one-half to twelve feet (9½ - 12') of one-inch (1") tubular nylon webbing. Begin by forming a large loop using the Water Knot to tie the ends of the webbing together. Give the loop a half twist, creating two temporary loops, and push an arm through each. Lift the crossed section over the head and let it drop against the back. Connect the two sides together in the front with a carabiner across the chest. a.k.a. Carabiner Chest Harness.

A chest harness is designed to keep a person upright while hanging from a rope (either after a fall, when using solo climbing devices, or while ascending). When using it in conjunction with a seat harness, keep the tie-in knot to the seat harness short so the knot won't get caught in the chest harness. For similar reasons, keep the chest harness tight and never knot the rope into the chest harness. Otherwise, the chest harness may ride up and strangle the climber/rescuer during a fall.



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FTL Knots, Hitches, and Bends

January 29, 2003

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