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Essential Knots

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Essential Knots

This chapter introduces the most commonly used knots for climbing and rescue situations. Every climber should be able to recognize, tie and untie the following knots without having to think about it. Remember that you may have to tie them in situations which are far from ideal and you will trust your life to each knot.

Each knot has multiple uses and, in most cases, there are many knots you could tie to achieve the same result. Before choosing a knot, consider the following. In order of importance:

- 1) Is it suitable for the intended use?
- 2) Could it slip or roll?
- 3) Is it easy to untie or adjust?

Dressing

After tying any knot, it is important that you dress it correctly. This means tightening each strand and adjusting the loops and twists so they are perfectly aligned. Your knots should look exactly like the diagrams in this manual. A knot which isn't well dressed could slip or fail.

Webbing and Cord

Webbing (tape) is flat. Cord and ropes are round. Knots which are designed for flat webbing may be useless when tied with rope and vice versa. Make sure you understand what material your knot is for.

Diameter, Flexibility and Surface Friction

The examples given in this manual assume that you are tying identical sections of cord, rope or webbing

together, except of course for prusiks. Knots work best when every rope involved is of the same diameter, flexibility, elasticity and surface friction.

Minor differences are fine. For example, tying a 9.5mm and a 10.2mm dynamic rope end-to-end for abseiling is safe. But tying a 6mm tag

line to a 10.2mm rope with the same knot will probably result in that knot falling apart. Likewise, a knot joining an old, stiff static rope to a slick, flexible dynamic rope is likely to slip, even if they are the same diameter. A simple alternative for joining ropes or cord of different materials or diameters is to tie a figure-8 loop in the end of each and clip them together with a carabiner.

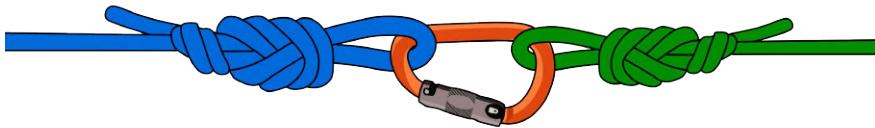


Figure-8 Tie In

Uses

The figure-8 is widely accepted as being the safest knot to tie-in with.

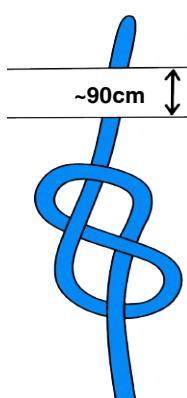
Step 1

Make a loop about a meter from the end of the rope. Wrap the end of the rope around the base of the loop, then push the end through as shown.



Step 2

You should end up with an '8'. Make sure the knot is around 90cm from the end of the rope (the exact length varies with ropes of different diameters).



Step 3

Pass the end of the rope through **both** of the two points on the front centre of your harness — the same ones your belay loop runs through. It is important that the rope goes through your harness in exactly the same way as your belay loop does.



Step 4

Use the end of the rope to re-trace the figure-8. Follow the twists of the rope starting from where it joins your harness.

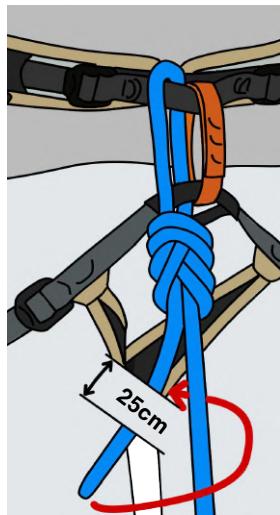
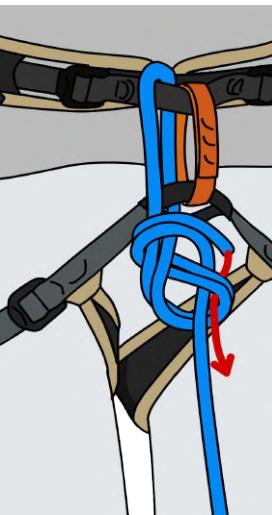
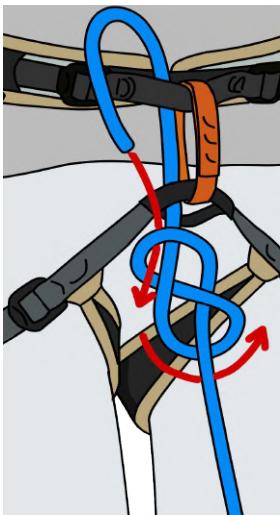
Step 5

Continue following the twists until you end up back at the start of the knot.

Pull the whole thing tight.

Step 6

Make sure the end of the rope is around 25cm long. If it is shorter, you'll have to untie and start again. After this, you will need to tie a stopper knot. Loop the short section of rope around the main length.



Step 7

Do this twice, with the second loop closer to you than the first.

Step 8

Push the end of the rope through these two loops, away from you.

Step 9

Pull this tight too (make sure it's pushed right up to your figure-8 knot).

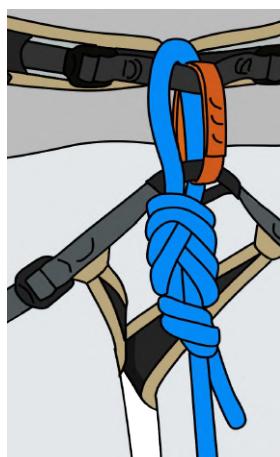
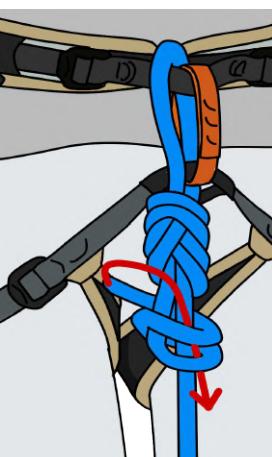
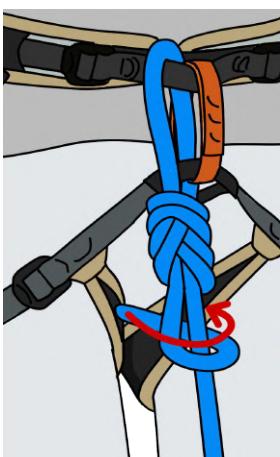


Figure-8 on a Bight

Uses

- Attaching the rope to an anchor.
- Creating a master point in a cordelette or sling.

Step 1

Take a bight of rope and form an '8' shape as shown.



Step 2

Push the end of the rope through the top part of the 8.



Step 3

Pull it tight.



Stopper Knot

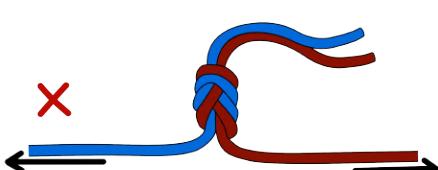
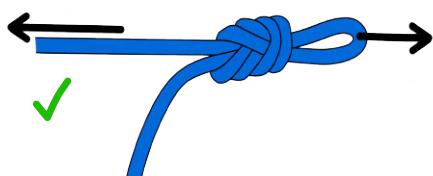
When tying a figure-8 in the end of a rope, make sure to add a stopper knot.



Warning!

Figure-8's should only be end-loaded (pulled along the line of the knot).

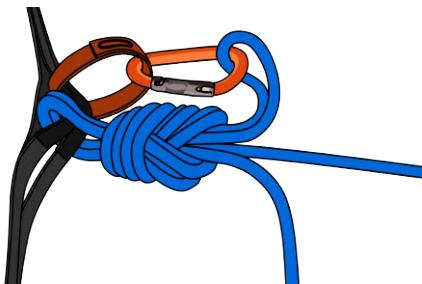
If you load the loop in two opposing directions, the knot can roll over itself and lose strength or fail completely. For this reason, you should never use the figure-8 to join ropes for abseiling.



Tying into the Middle of the Rope

You can use a variation of the figure-8 to tie into the middle of a rope.

Follow steps 1-5 described on pages 127-128, but use a bight of rope instead. Clip the final loop into your belay loop to complete the knot.



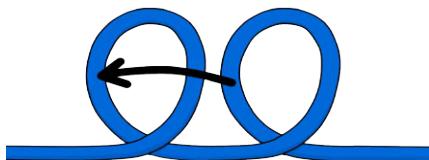
Clovehitch

Uses

- Attaching yourself to the anchor.
- Attaching ropes, cord or slings to carabiners.

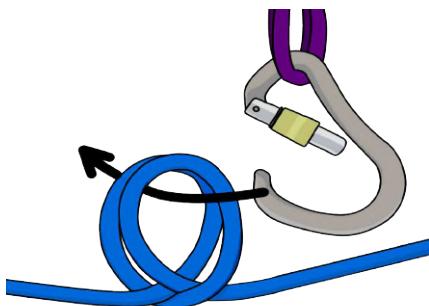
Step 1

Make two identical loops in the rope.
Put the rear loop over the top of the front loop.



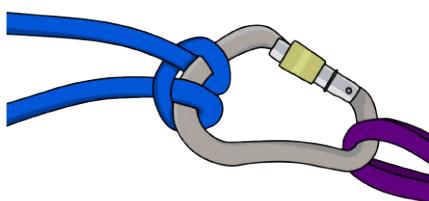
Step 2

Clip a screwgate carabiner (never use a snapgate carabiner) through these two loops.



Step 3

Pull it tight and fasten the screwgate.



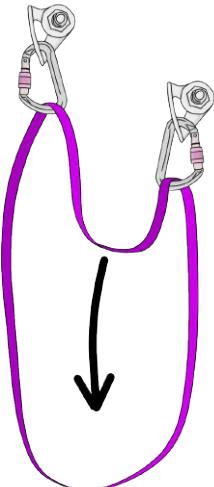
Overhand Loop

Uses

- Creating a master point in a cordelette or sling.

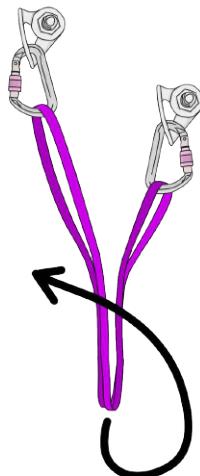
Step 1

Clip the sling to both bolts and pull the strands down so they are equal.



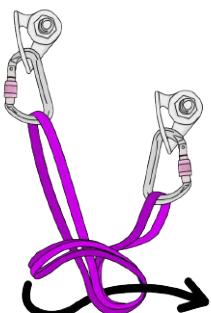
Step 2

Pull the bottom of the sling around to form a loop.



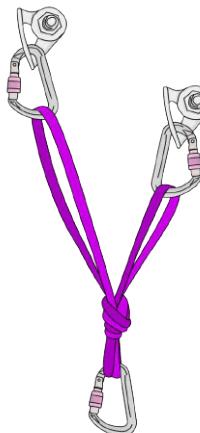
Step 3

Push the end of the sling through the loop as shown. Pull the knot tight.



Step 4

This forms two small loops beneath the overhand knot. Clip a screwgate through both of these loops to form the central point.



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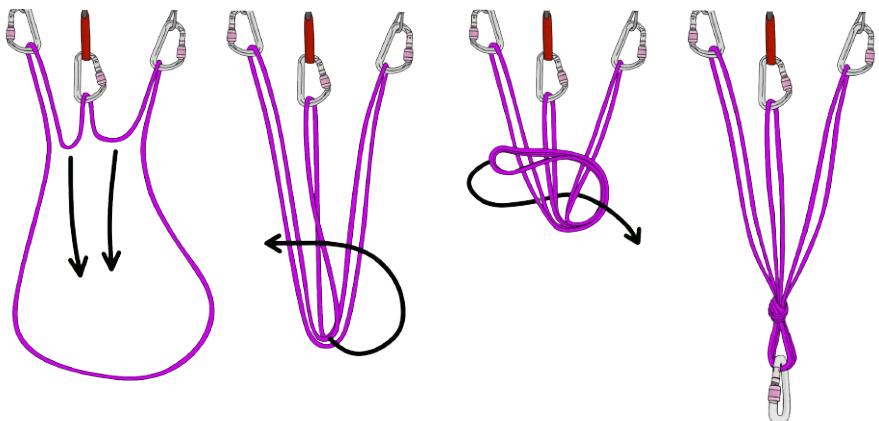
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The same knot can be used to equalize three or more pieces.



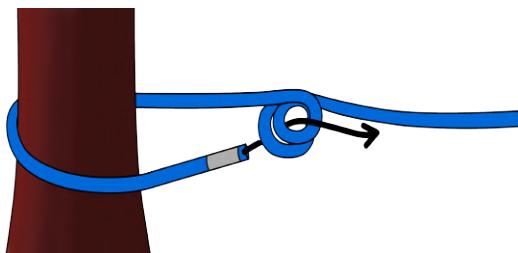
Double Bowline

Uses

- Securing the end of a rope around a large object such as a tree.
- Could also be used to tie the rope to your harness.

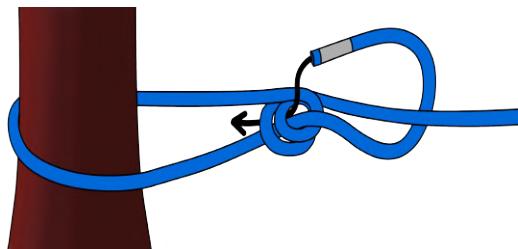
Step 1

Wrap the end of the rope around a tree or other suitable object. Form two loops in the rope as shown.



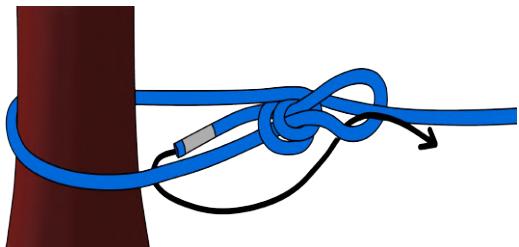
Step 2

Push the end of the rope up through the two loops and around the back of the main strand. Then push the end of the rope back down through the loops.



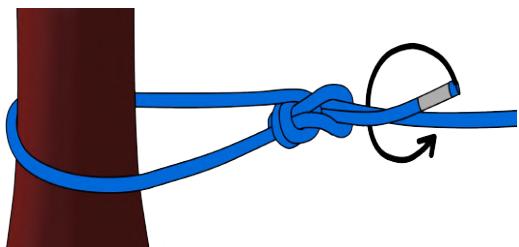
Step 3

Pass the end around the back of the knot and push it up through the new loop as shown.



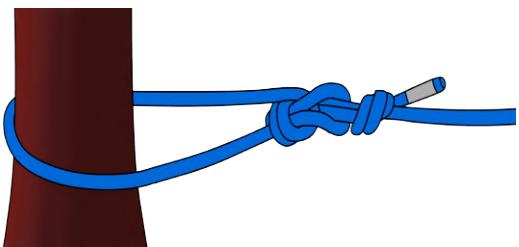
Step 4

The double bowline is now tied, but needs a stopper knot to be complete. Pass the end of the rope around the main strand twice.



Step 5

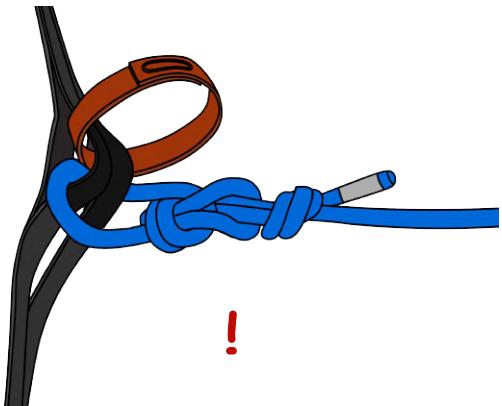
Finish the stopper knot to complete the double bowline.



Warning!

The double bowline is great for tying around a tree or boulder as part of a top-rope anchor.

Some climbers also use the double bowline for tying in because it's easy to untie after multiple falls. However, it has been known to untie itself, especially if the rope is stiff. This is due to lots of movement in the rope as you climb. The figure-8 is recommended as a much safer alternative for tying into your harness.



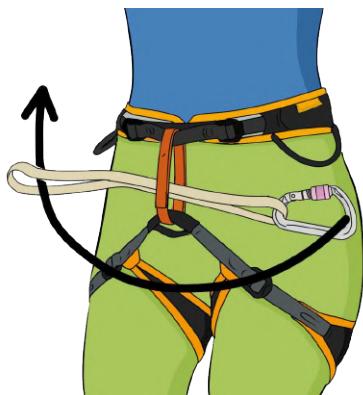
Girth Hitch (Lark's Foot)

Uses

- Attaching slings to your belay loop.
- Attaching slings together.
- Fastening a sling around a tree.
- Connecting a sling to a carabiner without opening the gate.

Step 1

Feed a sling through your belay loop.



Step 2

Put one end of the sling through the other.



Step 3

Pull it tight.



Strop Bend

You can also link two slings together using these same steps.

Arrange the girth hitch as shown below to create a strop bend. This is basically a neater version of the girth hitch.



Water (Tape) Knot

Uses

- Joining flat or tubular nylon webbing of equal width.

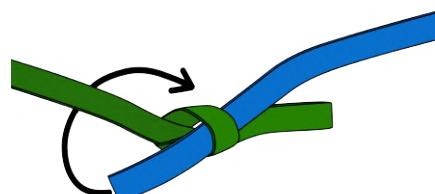
Step 1

Tie a loose overhand knot near one end of the webbing.



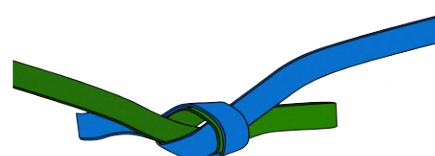
Step 2

Thread the other end into the knot as shown.



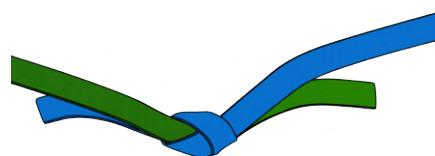
Step 3

Retrace the original knot, making sure it lies flat at all times.



Step 4

Cinch the knot tight. The tails should be at least 10cm long.



Warnings!

- * The water knot should never be used to join:
 - Dyneema webbing
 - Any webbing of unequal width
 - Rope/cord to webbing

In these cases, the knot is very weak and prone to slipping.

- * The water knot can untie itself over time with repeated loading and unloading. Make sure the knot is tight and the tails are at least 10cm long each time you use it.

- * Some climbers duck-tape the tails to keep them neat and to help prevent creeping. If you do this, leave the ends of the webbing in view so you can see them.

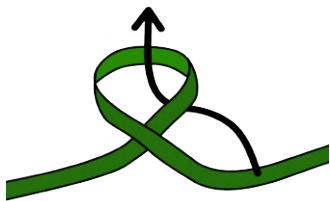
Slip Knot

Uses

- Tying off pitons, tree stumps or other poor gear in order to reduce leverage.

Step 1

Form a loop in a sling (thin Dyneema works better than nylon).



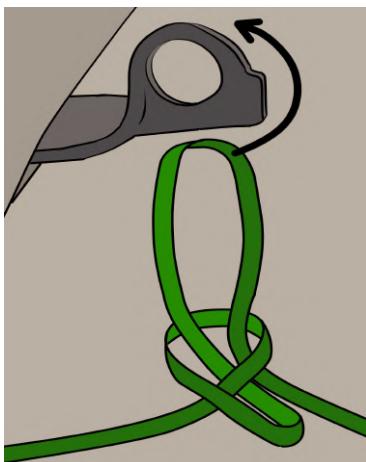
Step 2

Pull a bight through this loop as shown.



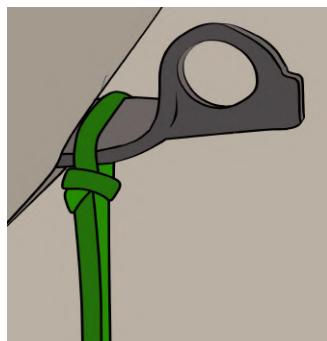
Step 3

Slip this bight over the piece of gear.



Step 4

Cinch it tight and push it as close to the rock as possible. This reduces leverage on the piece, therefore making it a stronger piece of protection.



Munter Hitch

Uses

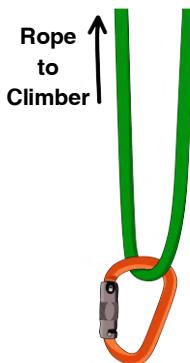
- Belaying without a belay device.
- Abseiling without a belay device.
- Creating a releasable knot when escaping the belay.

Note

The munter hitch tends to 'kink' the rope when used for abseiling or belaying. It can also cause slight abrasion to the rope's sheath, especially if the leader falls. It is a useful skill to know, but is not intended for long-term use.

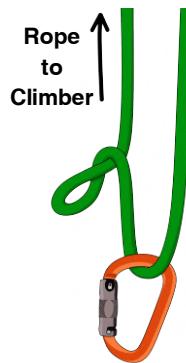
Step 1

Clip the rope through a large, pear-shaped (HMS) screwgate. Smaller screwgates work too, but will make belaying more difficult.



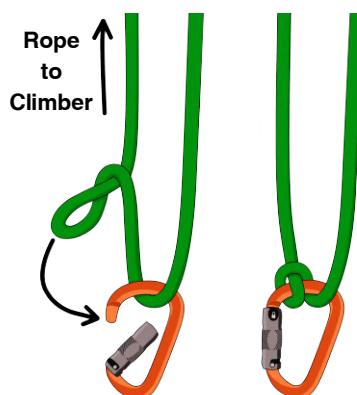
Step 2

Twist a loop in the climber's end of the rope as shown.



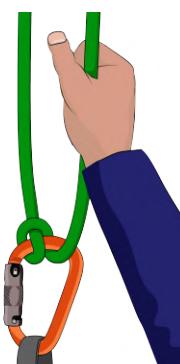
Step 3

Clip the loop into the screwgate.



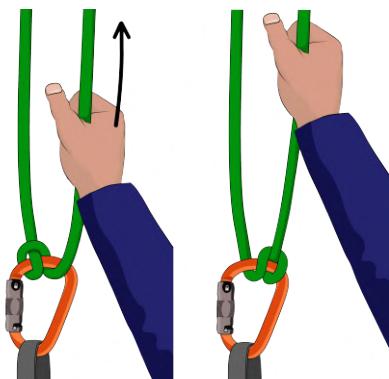
Step 4

Clip the carabiner to your belay loop and fasten the screwgate.



Step 5

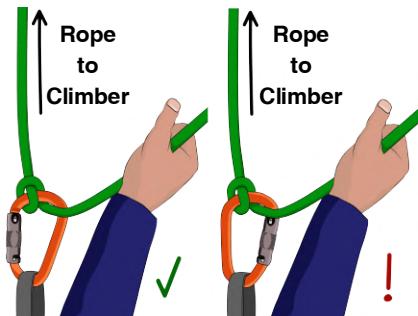
Test the knot by pulling tight on either end of the rope. The knot should flip through the carabiner easily both ways.



Warning!

Make sure the brake strand is on the 'spine' of the screwgate.

If the brake strand is on the 'gate' side, it could rub against the gate and potentially open it.



Belaying with a Munter Hitch

The main difference when belaying with a munter hitch (as oppose to an ATC) is that you 'lock-off' in the opposite direction (see next page). This goes against a climber's natural reaction, so make sure to practise this technique well before using it.

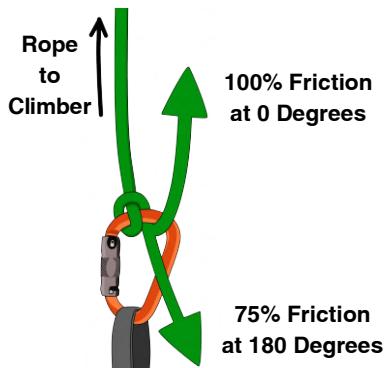
When bringing up the second on a munter hitch, it's easier to belay directly from the anchor (if your anchor setup allows), rather than from your harness.

Whichever method you choose, you must keep hold of the brake rope at all times.



To Lock Off

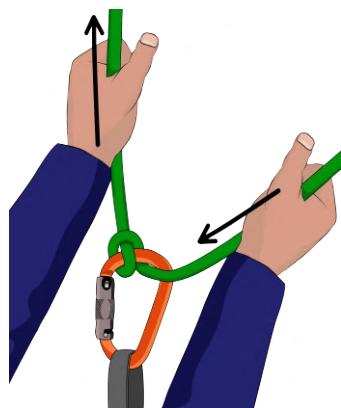
The munter hitch creates a lot of friction. Depending on the situation (rope thickness, weight of climber, rope drag, etc..), it can be locked off in any direction. However, for maximum friction, you must hold the brake rope forward (so that both strands of rope are parallel to each other).



To Give Slack

Hold the brake rope loosely and pull through slack rope, similar to giving slack with an ATC.

Rope to Climber



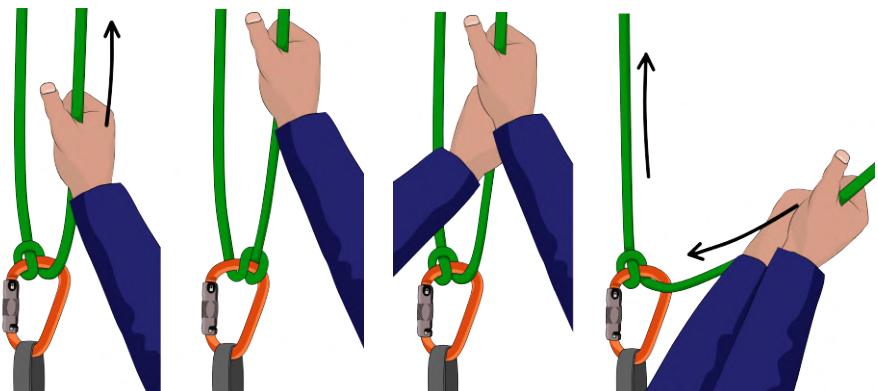
To Take In

Pull the brake rope so that the knot 'flips'.

More rope can now be taken in by continuing to pull rope through forwards.

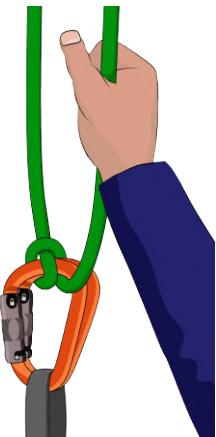
To Lower

Lock the rope off in the maximum friction position. Slowly move the rope back and lower as you would with an ATC. It can be tricky to find the 'sweet spot', so make sure to move position slowly.

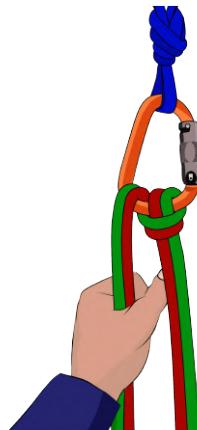


Belaying with a Munter Hitch – Top Tips

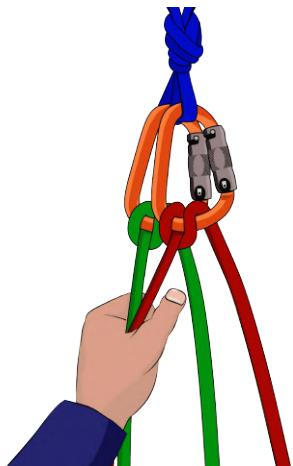
When using a small diameter rope, it's worth using two carabiners to increase belay friction.



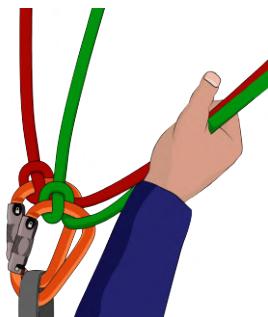
To belay the second with half ropes, you can treat them as one and tie them together in the same munter hitch.



If you need to pull one rope through faster than the other, you should use two separate knots instead.



To lead belay with half ropes, you'll need to use two separate screwgates with a munter hitch on each. This can be difficult at first, especially giving slack on one rope while simultaneously taking in the other. Practice well before you use this technique.



Munter-Mule-Overhand

Uses

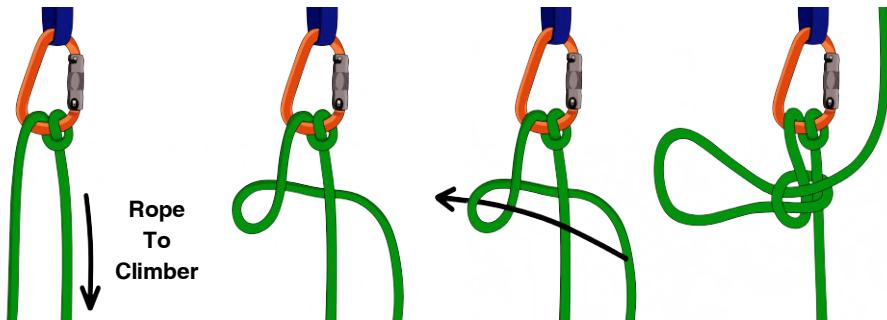
- Tying off a munter hitch when belaying or escaping the system.

Step 1

Form a loop in the brake-strand of rope.

Step 2

Feed a bight of the brake rope around the climber's rope and through the loop as shown.



Step 4

To complete the knot, you must back it up. One way of doing this is to tie an overhand around the climber's strand of rope. To start, wrap the loop around the back of the rope.

Step 3

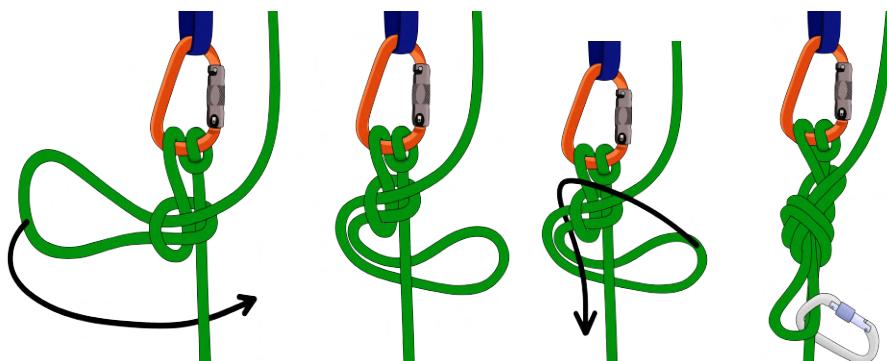
Pull the knot tight, either by easing the climber's weight onto the rope if they are weighting it, or by pulling on the climber's strand of rope if they're not weighting it. This is now a munter-mule, which is tied-off, but not backed-up.

Step 5

Then feed it back through as shown.

Step 6

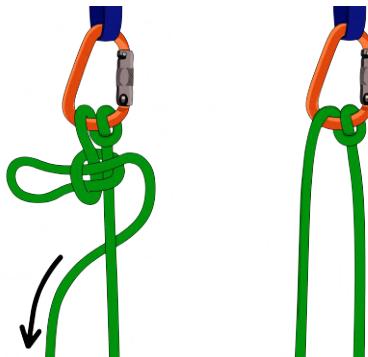
A carabiner completes the hands-free munter-mule-overhand.



To Release

Unfasten the overhand knot. Then pull forwards on the brake strand of rope until the knot pops free.

If the rope is weighted, you can expect a few centimetres of rope to slip through the munter hitch. Prepare for this by holding the brake strand tight with both hands.

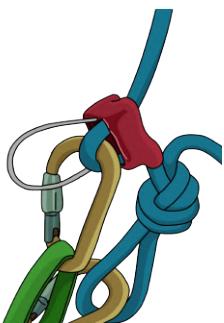


Tying Off a Belay Device – The Mule Overhand

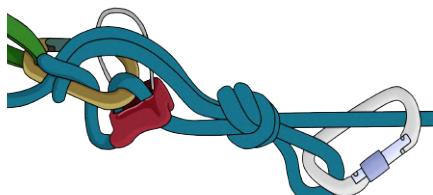
Times when you may need to have both hands free when using an ATC include:

- Switching gear on a multi-pitch
- Sorting out a rope tangle when belaying
- Passing a knot when abseiling
- Escaping the belay in an emergency situation

In situations where the rope isn't weighted, a simple overhand knot backed up to your belay loop (as shown below) will work. However, if the rope becomes weighted when using this method (e.g. if the leader falls), it will be almost impossible to release the tie-off.



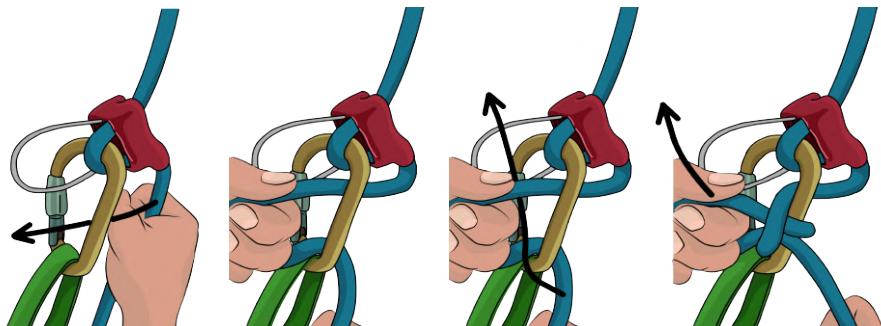
If there is any chance of this happening, you should instead use the mule-overhand method (described on the following pages). This allows you to tie-off your belay device while the leader is weighting the rope, and also release the tie-off when it's weighted.



Step 1

Pass a loop of the slack rope through your screwgate carabiner with one hand while keeping hold of the rope with your brake hand.

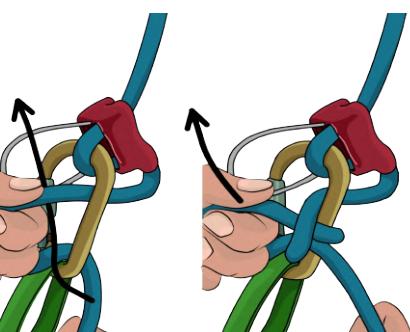
This can be difficult when heavily weighted — you'll need to pinch the rope tight.



Step 2

Pass a loop from the opposite side through the first loop so that a mule knot is formed around the spine of the carabiner.

Do not tie this knot around the gate of the carabiner.

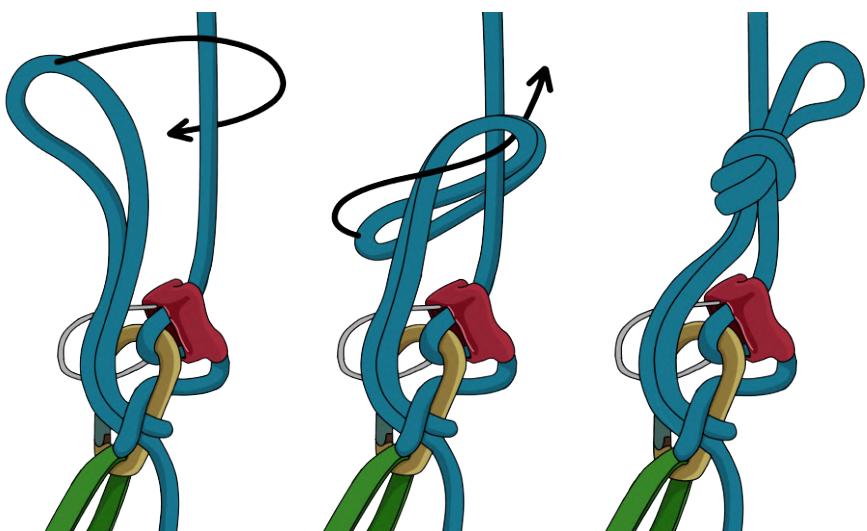


Step 3

Make sure the second loop is around 60cm long. Pull it tight.

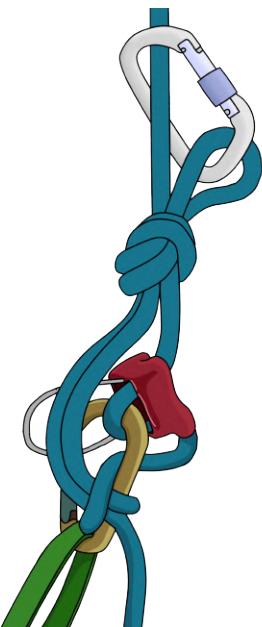
Step 4

Tie an overhand knot around the tensioned rope as shown.



Step 5

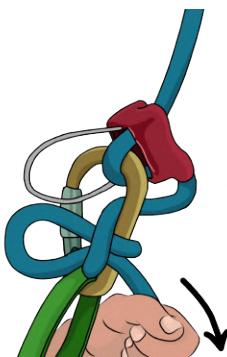
A carabiner completes the hands-free mule-overhand knot.



Step 6 — Releasing Under Load

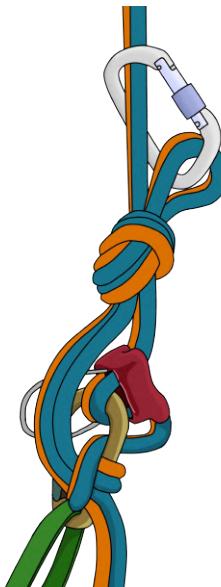
To release the tie-off with the rope loaded, first untie the overhand knot. Then holding the slack rope securely with both hands, simply pull down to release the mule knot.

You should be ready to expect a few centimetres of rope to slip through. Keep a firm grip so you do not lose control of the belay device. You can now belay or lower the climber as normal.



Top Tips

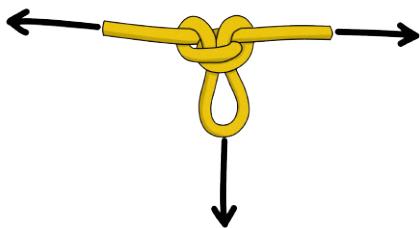
- * If you are belaying with two ropes, simply treat them as one rope and follow the same steps.
- * Make sure to communicate with your partner so they know not to continue climbing while tied-off.



Alpine Butterfly

Uses

- Equalizing a two-bolt belay.
- Isolating a damaged section of rope.
- Forming a fixed loop in the middle of a rope. This provides a clip-in point which can be loaded in 2 or 3 directions.

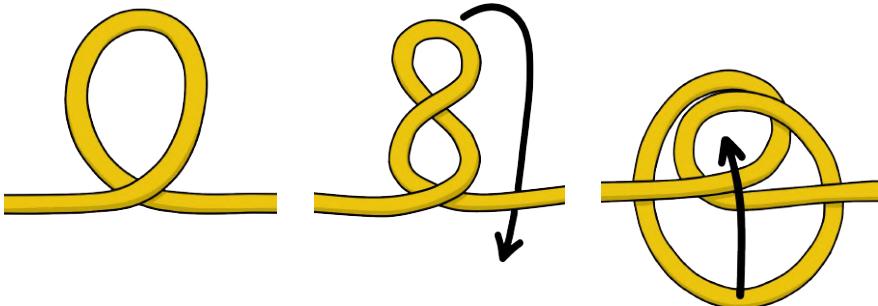


Step 1

Form a loop in the rope.

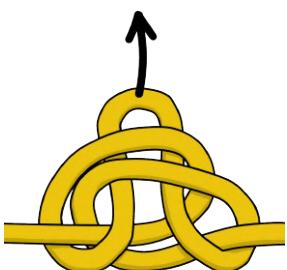
Step 2

Twist the loop so it becomes two loops. Then pull the top of the upper loop behind and underneath the line of the rope.

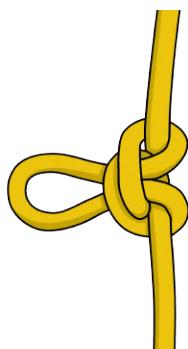


Step 4

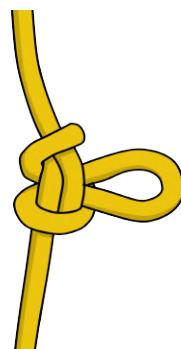
Pull it tight.



View From Front



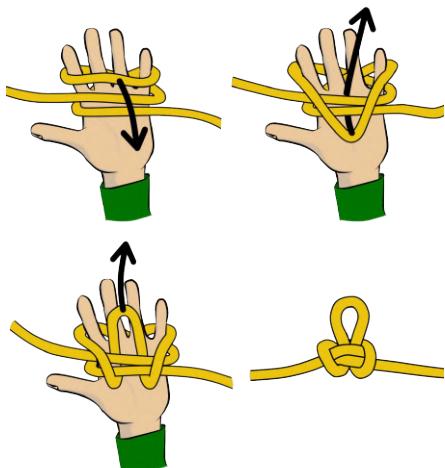
View From Back



Alternative Method

An alternative way to tie the alpine butterfly is to wrap it around your hand three times as shown.

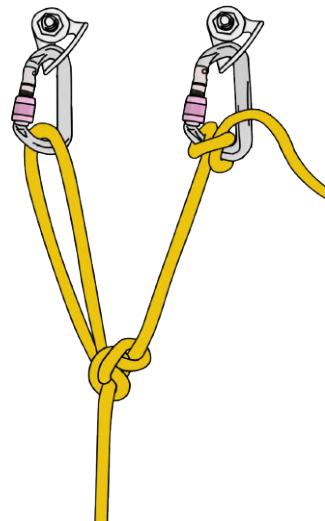
Pull the top wrap down over the other two, then back up behind them.



Equalizing a Two-Bolt Belay

Tie a large-looped alpine butterfly to one screwgate and a clovehitch to the other.

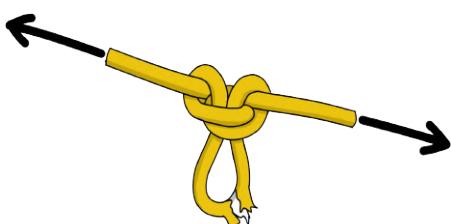
You can adjust the size of the loop once the alpine butterfly is tied. Then adjust the clovehitch to fine tune the equalization.



Isolating a Damaged Section

This is useful when using your rope as a fixed line or in a situation where the rope will not pass through any carabiners.

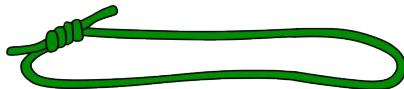
Obviously, you will not be able to lead climb with a knot in your rope!



Double Fisherman's Bend

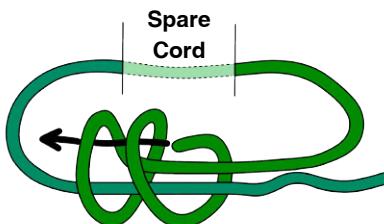
Uses

- Tying two ends of cord together to make a prusik or cordelette.



Step 1

Loop one end of the cord around twice as shown to create two loops. Then push the end through these loops.



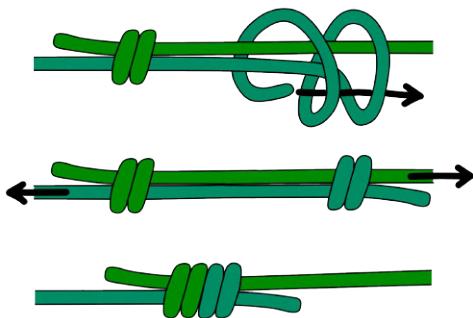
Step 2

Pull it tight and do the same with the other end of the cord.



Step 3

Pull it all tight so that the two knots jam together. Make sure the tails are at least 10 times the diameter of the cord (e.g: 5cm tails for a 5mm prusik cord).



Triple Fisherman's Bend

Add an extra coil to make a triple fisherman's bend.



Some slippery cords (such as dyneema) require a triple so they don't slide apart under load — check the manufacturer's recommendations.

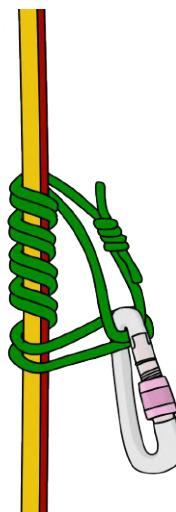
Prusik Knots: Different Types Explained

A prusik (also known as a friction hitch) is a short piece of cord which can be wrapped around your climbing rope to add friction. They can slide up and down easily, but lock around the rope when weighted.

Prusiks are most commonly used for abseiling but are also incredibly useful in a variety of emergency situations such as ascending a rope or escaping the system.

Four types of prusik knot are described on the following pages:

- Classic
- Autoblock (French)
- Klemheist
- Bachmann



Prusik Cords: Size and Material

Size

The diameter of your cord should be 60% to 80% of the rope's diameter, whether you are using the prusik on one rope or two.

If you use a cord that is too thin, it will cinch tight around the rope when weighted and be difficult to move freely. If you use a cord that is too thick, it won't have enough friction to lock up when you need it to.

In general, 6mm cord works well on 10mm ropes, whereas 5mm cord is better for 8mm ropes.

The cord length should be 1.2m - 1.5m.

Material

Prusiks are usually made out of nylon cord, tied together with a double fisherman's bend.

If the cord is too stiff, it won't lock properly around the rope. The stiffness may also make it difficult to create the knot itself. Test your cord before you take it climbing so you can be sure that it works.

If you are planning to use your prusiks frequently, you should consider buying some pre-sewn prusik loops. These come in a variety of forms, either without a bulky knot or with the knot sewn together and covered by a plastic sleeve.

Prusik Types: The Classic Prusik

Advantages

- Very secure when loaded.
- Locks in both directions.

Disadvantages

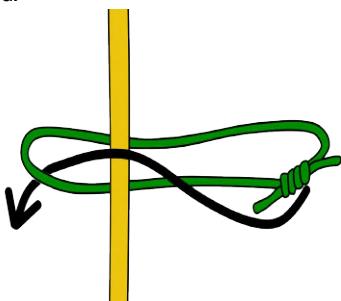
- Often difficult to release when tightly loaded.

Best Uses

- In situations where you don't need to keep sliding the prusik (e.g; escaping the system).

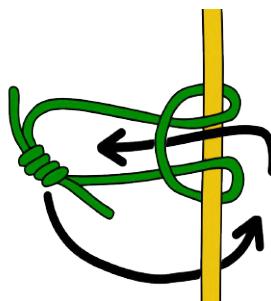
Step 1

Pass the cord around the rope and through itself as shown, making sure the double fisherman's bend is at the end.



Step 2

Pass the cord around the rope and through itself again.



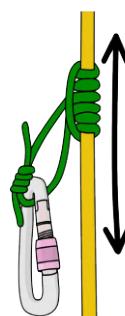
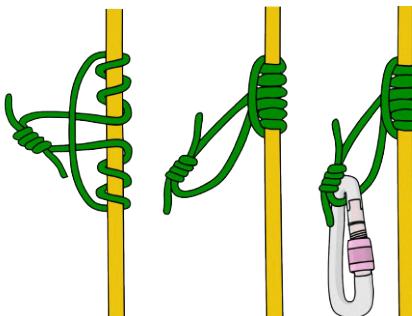
Step 3

Make at least three wraps around the rope, pull the cord tight and clip a carabiner through the loop.

Make sure the knot is neat.

Step 4

Weight the knot in either direction to lock it. Pinch the knot to loosen it. This allows you to move it up or down the rope. If the knot gets stuck, you can push some cord in from the center of the knot to loosen it.



Prusik Types: The Autoblock (French)

Advantages

- Easy to tie and untie.
- Can be released under load.

Best Uses

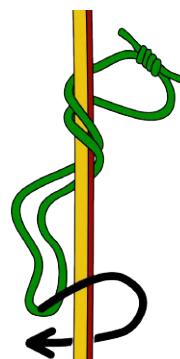
- As a back-up when abseiling.

Disadvantages

- Tends to slip when used to ascend ropes.

Step 1

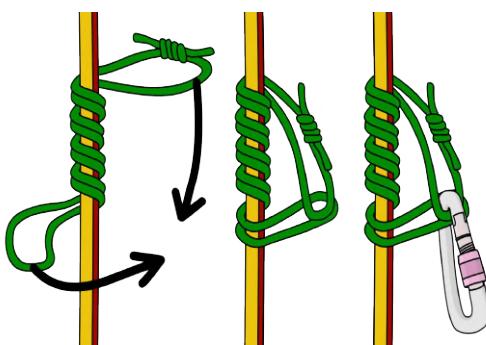
Wrap the prusik neatly around the rope a few times as shown.



Step 2

Clip the ends together with a carabiner. More wraps will create more friction around the ropes, though four wraps are generally enough.

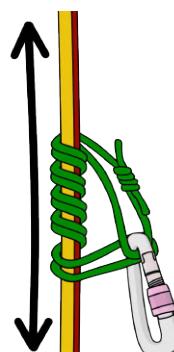
Make sure the autoblock is neat and the double fisherman's bend is away from the ropes.



Step 3

Pinch the knot to loosen it. This allows you to move it down the rope.

Weight the knot to lock it. The autoblock locks in both directions, but the double fisherman's bend tends to wrap itself into the prusik when the direction is switched, making it much less effective.



Prusik Types: The Klemheist Knot

Advantages

- Easy to release after being loaded.
- Can be tied with webbing.

Best Uses

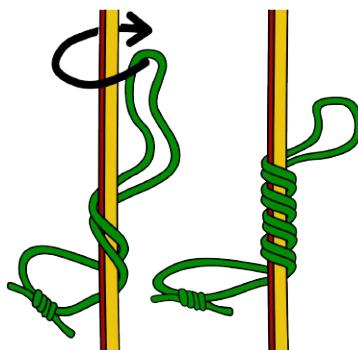
- Ascending a rope.

Disadvantages

- Only works in one direction.

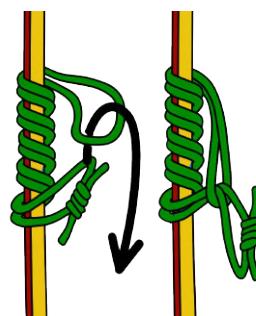
Step 1

Wrap the prusik neatly around the rope a few times as shown.



Step 2

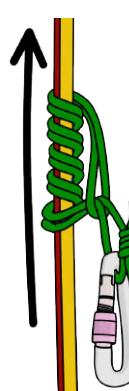
Pass the end of the cord through the loop.



Step 3

Attach a carabiner.

Weight the knot downwards to lock it, or push it upwards to release.



Prusik Types: The Bachmann Knot

Advantages

- Easy to operate when wearing gloves.

Best Uses

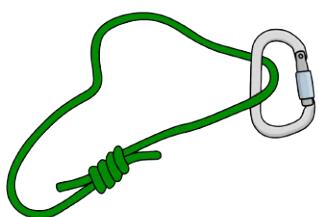
Ascending ropes when wearing bulky gloves.

Disadvantages

- Not good on icy or slick ropes.
- Doesn't grip as well as other types of prusik.

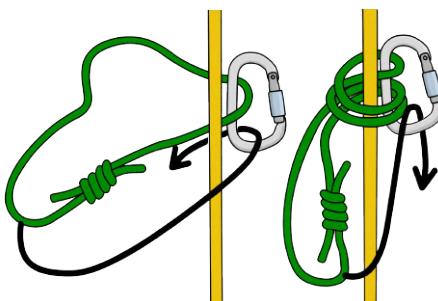
Step 1

Clip the cord through a large carabiner. This will be the 'handle' carabiner.



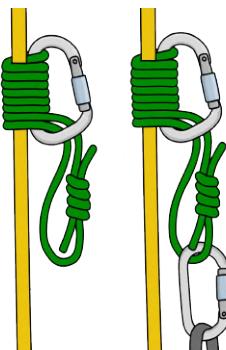
Step 2

Wrap the cord around the rope, feeding it through the carabiner each time. Keep the wraps snug to each other.



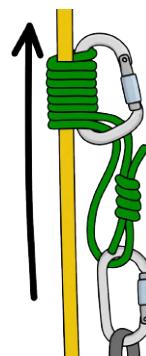
Step 3

Allow the end of the cord to hang down through the carabiner. Clip your load to this end. Do not clip your load to the carabiner which functions as the handle — this will release the knot!



Step 4

Push the handle carabiner up the rope to release the knot. Weight the lower carabiner to lock it.



Prusik Cord Tips

- * Prusiks are not full-strength attachment points. Always have a back-up so you're attached to the rope 'properly'.
- * The number of wraps should be increased or decreased depending on the cord stiffness, cord diameter and moisture conditions, with three wraps as a minimum. Before using any prusik knot, test it to see if it grips and releases well.
- * If you don't have a prusik cord, you can use a sling instead. Slings don't work quite as well but it'll help you get out of a tricky situation. A narrow nylon sling is better than Dyneema (Spectra). Don't use a sling for anything except a prusik after using it once as a prusik.
- * Make sure not to wrap the double fisherman's bend into any friction hitch. This will greatly decrease the knot's effectiveness.
- * If using prusiks in conditions where they might fail (e.g; prusiking up a wet or icy rope), it's better to use two different types of prusik (and a full strength back-up, of course). If conditions exist to cause one to slip or fail, the likelihood is that the other prusik would not fail under the same conditions.
- * Check your prusik cord for wear and tear regularly. Make sure the double fisherman's bend isn't slipping and the cord isn't abraded. When it's looking worn, retire it and get a new one — cord is cheap.

Garda Hitch (Alpine Clutch)

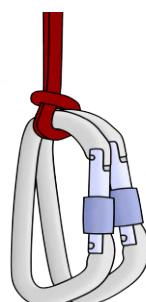
The garda hitch uses two parallel carabiners to create a system where a loaded rope can move in one direction but not the other.

Uses

- As an improvised ratchet pulley for hauling.

Step 1

Secure two D-shaped carabiners together with a girth hitch so they lie parallel with the gates on the same side.

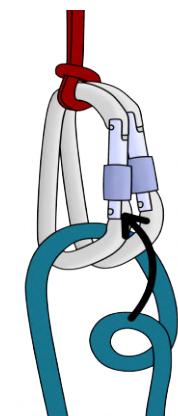


Step 2

Clip the rope through both carabiners.

Step 3

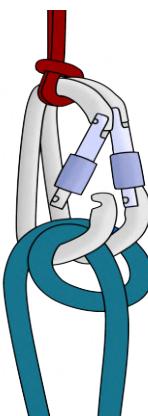
Form a loop in the non-loaded strand as shown.



Loaded Strand

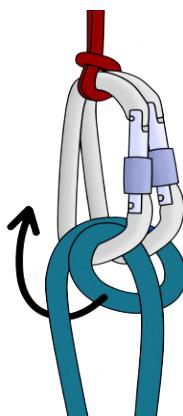
Step 4

Clip this loop through the left carabiner and fasten the screwgates.



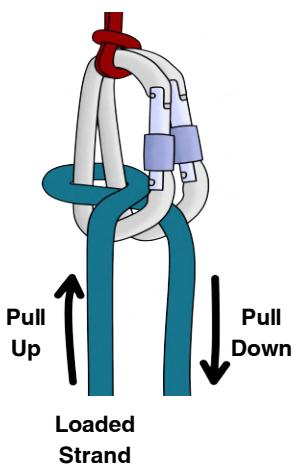
Step 5

Pull the loop back so it sits around the spine of the carabiners.



Step 6

The garda hitch is now complete. You will be able to pull rope through in one direction only. Make sure you have it the right way around.



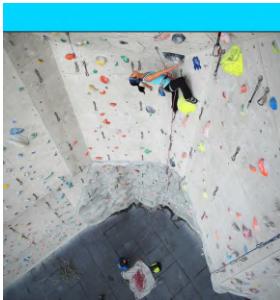
Warning!

* The garda hitch is a one-direction knot — it cannot be released under load. Be careful how you employ it.

* It's vital that you use D-shaped carabiners. A garda hitch tied on HMS or oval carabiners is prone to slipping down which causes the knot to fail.

* You must girth hitch the two carabiners together as shown in step 1. If you simply clip the carabiners through a sling or another carabiner, the garda hitch will not function correctly.

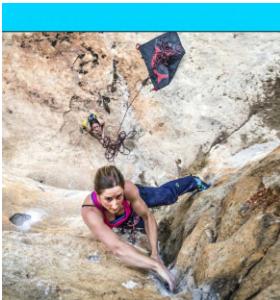
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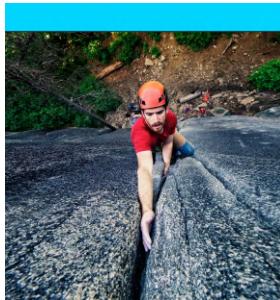
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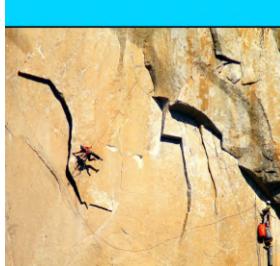


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