



Jersey Rock Climbing Club

Knots Guide

1. Introduction

Knots are an integral part of climbing. Without adequate knowledge of a knot's applications (when, why, and how to use them), injuries and fatalities would be a common occurrence on the crag. Therefore it is extremely important to be able to tie the most commonly used knots first time, and every time.

This guide is designed to instruct in how to tie the most commonly used knots for rock climbing. It should be used as preliminary information before you attend the JRCC Top Rope Anchors course. By familiarising yourself with all of these knots and practising them at home, you will be more efficient on the top rope course and be able to spend more time on the rock practising other more complex skills. One good option to practice is to get two lengths of Prusik cord (5mm in diameter) cut to 1.3 metres. This way you will be able to practice and will have 2 Prusiks which you can use while climbing.

Every time you tie a knot you are lowering the amount of force the rope can withstand before breaking. In nearly all tests done a rope will break where the knot has been tied (except for a rope being sheared against some sharp object). Thankfully this is no longer a huge issue with modern static and dynamic ropes, as the amount of force they can withstand is much greater than would normally be experienced with a fall in a top rope environment.

2. Knot Terminology

It should be noted that some terminology used in the knots guide is in reference to actual top rope anchors, especially with common knot uses. Do not worry too much if a term is not understood or explained below, as it will be covered in the top rope anchors course.

Sheath: The outside covering of a climbing rope. Its main purpose is to protect the inside of the rope from abrasion and damage. It provides very little strength in terms of absorbing forces when someone falls.

Core: The inside of a climbing rope which is easily able to absorb the forces involved in climbing.

Bight of Rope: A bight of rope is simply grabbing a loop of rope so that the two strands are not crossed over as shown below. It is a common starting point for most knots.



A bight of static rope

Inline Knot: A knot that can be tied in the middle of the rope, between two other knots.

Directional Knot: A knot that can only have load applied in one direction.

Multi- Directional Knot: A knot that can have load applied in all directions.

Static Rope: A type of climbing rope that is not very stretchy and is used to rig top rope belay anchors and set up abseils. Must never be used for belaying a climber. Must be CE (Conformité Européenne) or UIAA (Union Internationale des Associations d'Alpinisme) certified. JRCC typically uses 10.5mm static rope which has an approximate breaking strength of 27 kN.

Dynamic Rope: The only type of climbing rope that is used to belay a climber. This rope stretches to reduce forces in a fall. Must be CE or UIAA certified. Dynamic rope must be able to withstand an 80kg person falling over one and a half times the distance they have climbed up. In a top rope situation this never happens as the climber would hit the ground!

Spectra, Dynema, Dynex: A Kevlar based material used in smaller diameter ropes/ cords and sling (shown below). This material does not stretch and has a low melting temp. That being said, it is three/ four times stronger than nylon and has a greater abrasion resistance against rocks than nylon. The Dynema part of any sling is always white.



Dyneema or Dynex Sling



Spectra Cord (usually 6mm)

Nylon: In the climbing context refers to the wider slings that are sometimes used. They come in many different colours and are great for absorbing force as they stretch up to 15%. They are not as strong as spectra slings (3 to 4 times weaker), and they get damaged over time by UV light.



Nylon slings are normally quite wide and made from many assorted colours

Accessory Cord: Thinner rope or cord that is usually between 5mm and 7mm, depending on the material used. They are normally made of nylon or a Dyneema derivative such as Spectra. If the cord is made of nylon it is normally a larger diameter (7mm) as it is not as strong.



Prusik Cord: A length of accessory cord usually 1.5 metres or shorter, which is joined with a permanent knot to form a loop. It has many rock climbing applications.

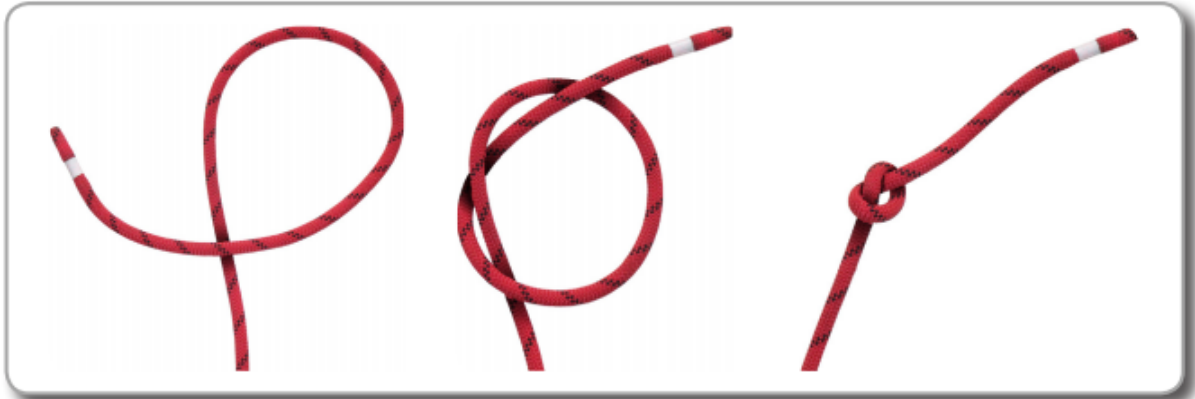


Blue Prusik Cord

3. Knots

3.1 Basic knots:

3.1.a Overhand knot



The overhand knot is the simplest knot you can tie. It is rarely used by itself but mainly used as a backup to another knot.

Knot Strength: Weakens rope by 15%, Static rope strength reduced to 23 kN.

Type of Knot: Inline.

Uses: Can be used to shorten the length of a Prusik, which is sometimes called a thumb Knot.

3.1.b Stopper knot



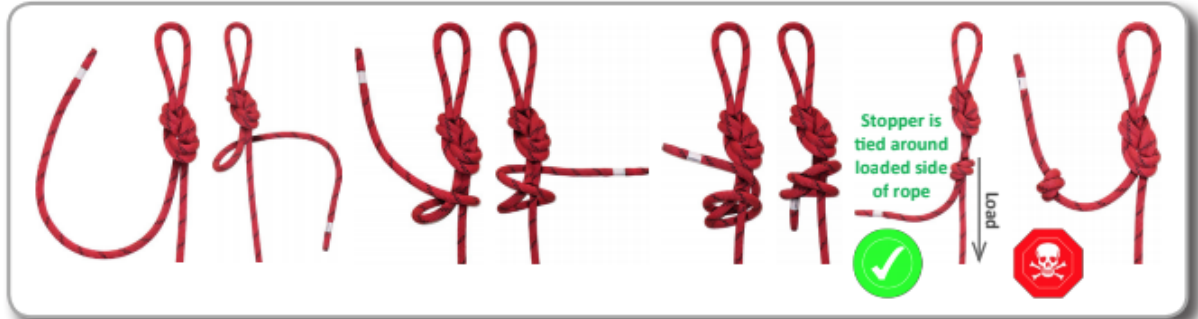
The stopper knot is used to prevent someone abseiling off the rope. It should ALWAYS be tied at the end of both ropes when abseiling. Multiple coils (wrapping around the rope, similar to the second image) can be done, provided the knot is pulled tightly afterwards.

Knot Strength: Weakens Rope by 20%, Static Rope strength reduced to 21.6 kN.

Type of Knot: Inline.

Uses: At the end of both ends of the rope when abseiling, to prevent another knot from slipping.

3.1.c Stopper After Another Knot



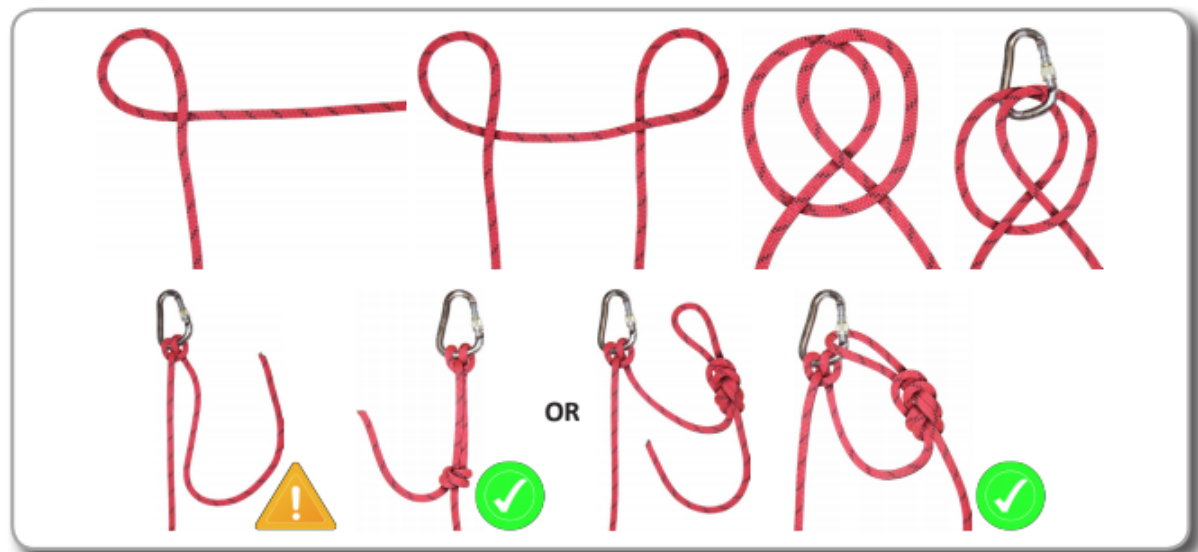
A stopper after another knot prevents the first knot from coming loose and slipping. It should be tied after a clove hitch, Eight on a bight, Bunny Ears when near the end of the rope. It must **ALWAYS** be tied after a bowline without exception.

Knot Strength: Does not weaken the rope when used this way.

Type of Knot: Directional, since it must be tied around the loaded side of a rope.

Uses: To prevent another knot from slipping. Must **ALWAYS** be tied after a bowline.

3.1.d Clove Hitch



The Clove Hitch is a versatile knot that can be used in an inline situation (assuming the new anchor is inline with the original anchor, i.e. the rope doesn't bend), as a finishing knot (with a stopper) or to divide a figure of eight on a bight into two separate anchors by tying clove hitches on each anchor with slack in between. It is very easy to tie and adjust, however can be prone to slippage so a stopper knot should be used. If the clove hitch is tied near the end of the rope, ensure a stopper knot is correctly tied around the rope that is loaded (6th image). If there is more than two metres of excess rope an "Eight on a bight" can be tied, and CLIPPED INTO THE BINER that the clove hitch is tied into (Images 7 and 8). The clove hitch should always be tightened on the basket of the carabiner.

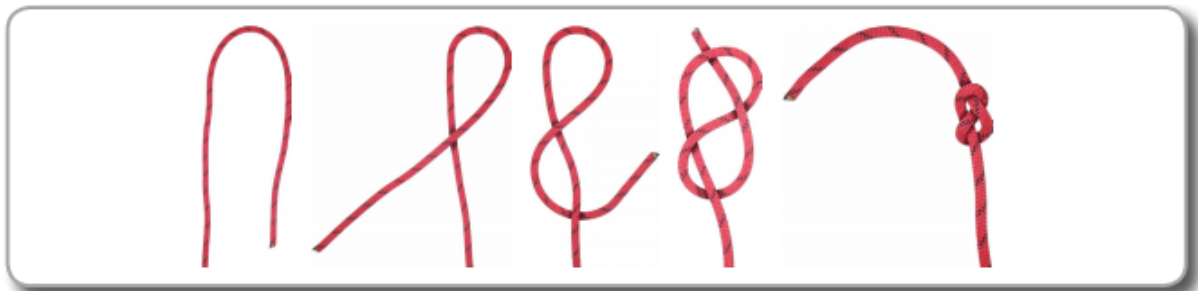
Knot Strength: Weakens Rope by 35- 40%, Static Rope strength reduced to 16.2 kN.

Type of Knot: Inline and Multi-Directional (both strands can be loaded).

Uses: Where adjustment (of rope length) may be needed when connecting to a piece of protection, As an inline knot (not recommended as it can be tricky to adjust correctly), Can be used at the end of the rope provided a stopper knot is tied around the rope that is loaded (Image 6).

Unsuitable For: Tying at the end of a rope without a stopper knot, Using instead of a figure eight on a bight at the focal point of an anchor, anywhere where knot slippage could adversely affect equalisation of the anchor system.

3.1.e Figure Eight



The Figure eight knot can sometimes be used as a stopper knot at the end of an abseil line, but more commonly left on the end of the climbing side of a top rope, making it easier for beginner climbers to tie in.

Knot Strength: Weakens Rope by 21%, Static Rope strength reduced to 21 kN.

Type of Knot: Inline.

Uses: Left on the climbing side of a top rope, for people to tie in quickly.

3.2 Forming Loops

3.2.a Figure Eight on a Bight



You can almost get by with just this knot, so make sure you learn it well. Always used at the focal point of a top rope, and usually used near the end of the rope to attach to a carabiner. Always make sure there is enough tail of rope left over to be able to tie a stopper knot, the same way as when climbing (6th image).

“How much tail after an eight?”

“Enough to tie a stopper knot.”

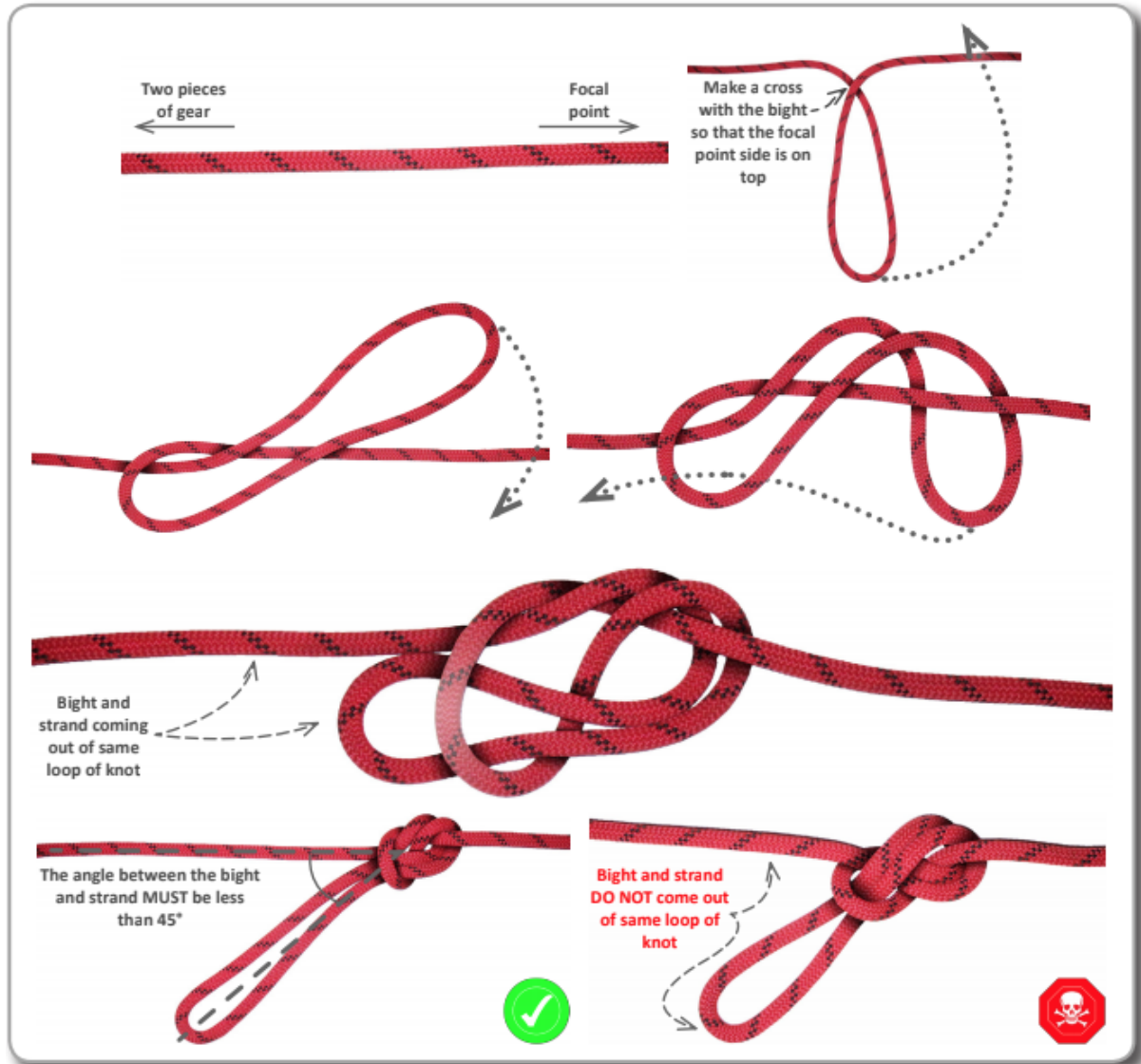
Knot Strength: This knot weakens the rope by 21%, Static Rope strength reduced to 21 kN.

Type of Knot: Directional.

Uses: Tying into harness, Attach a piece of gear at the end of the rope, Focal point of anchor system, Normally first knot tied when connecting each piece of protection on an anchor system.

Unsuitable For: As an inline knot where the both strands of rope coming out of the knot are greater than 90°.

3.2.b Inline Eight



The inline Figure of Eight knot is used to connect two pieces of gear in an anchor, and allows you to easily equalize the loads on both pieces. Take note that this knot is directional, that is, you need to make sure you've tied it to take the load in the correct direction. It is one of the more useful knots in a top rope situation.

Ensure that the bight and the adjacent strand have an angle of LESS than 45° between them, as this will ensure the knot does not flip (which can be very dangerous). Only make small adjustments to the lengths of the bight or strands of the rope (Half a metre at most). This knot can be tricky to tie, however if you do the "cross" the right way (2nd image) then it should be correct. Remember that the knot is tied on the opposite side that you wish the bight to be on.

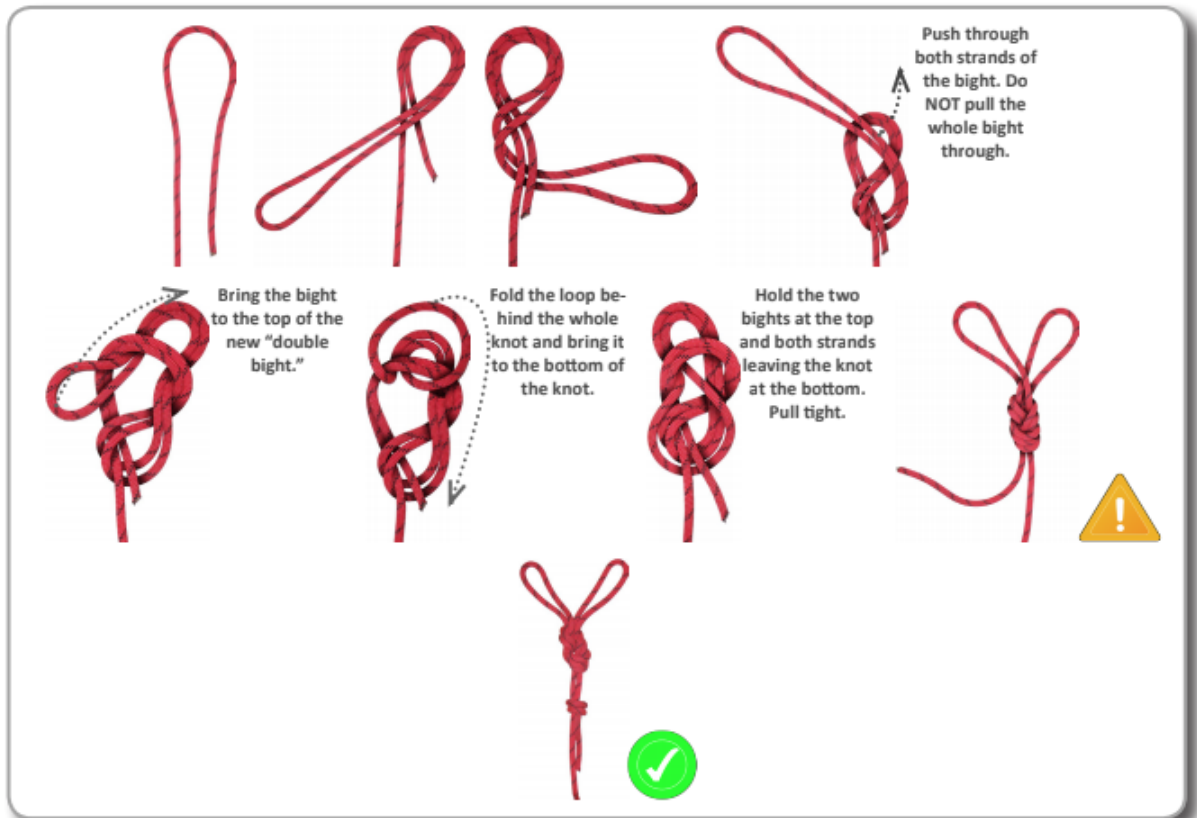
Knot Strength: Weakens Rope by 25%, Static Rope strength reduced to 20.3 kN.

Type of Knot: Inline and Directional.

Uses: Joining two piece of gear while being able to easily equalise the load between the strand and the bight leaving the inline 8.

Unsuitable For: Where the angle between the strand and the bight is greater than 45° (although moving the inline 8 further down towards the focal point can fix this).

3.2.c Bunny Ears



This variation of Figure of 8 is best used to equalise two pieces of gear in close proximity. It is easy to adjust loops by moving rope from one loop to another. While it is easy to adjust the "ears" with respect to each other, it can be quite difficult to adjust the length of the strands going into the knot. It is **NOT** a good idea to finish your anchor with a bunny ears knot because of this adjustment problem.

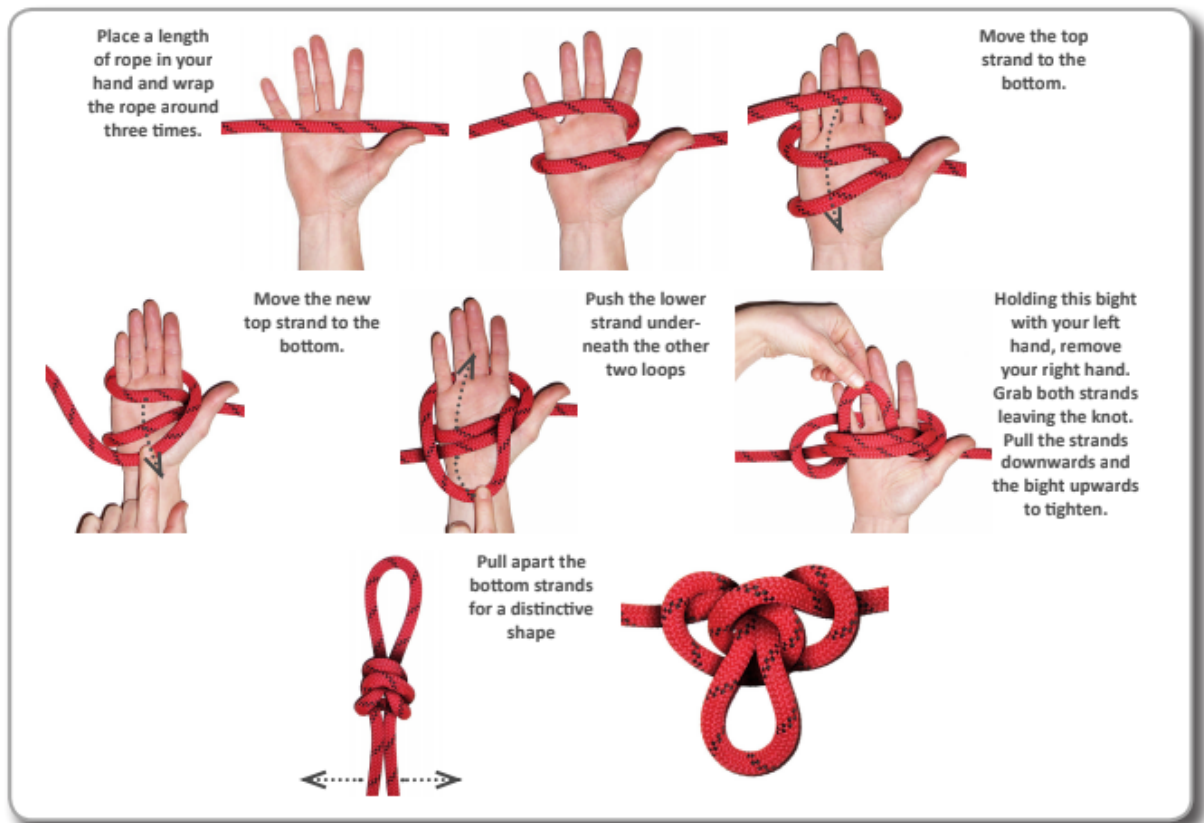
Knot Strength: Weakens the rope by 9%, Static Rope strength reduced to 24.6kN.

Type of Knot: Directional.

Uses: Joining two pieces of gear together that are in close proximity.

Unsuitable For: When two pieces of gear are far apart a bunny ears will use lots of rope and may be impractical to use, finishing your anchor system on a bunny ears.

3.2.d Alpine Butterfly



The Alpine Butterfly is another inline knot, and can be used in much the same way. It has the advantage of being non-directional (it can be loaded in all directions), and is easier to tie correctly when compared to the inline eight. However it is a little trickier to adjust than an Inline-8, but is a perfectly valid knot to use to join two pieces of protection together.

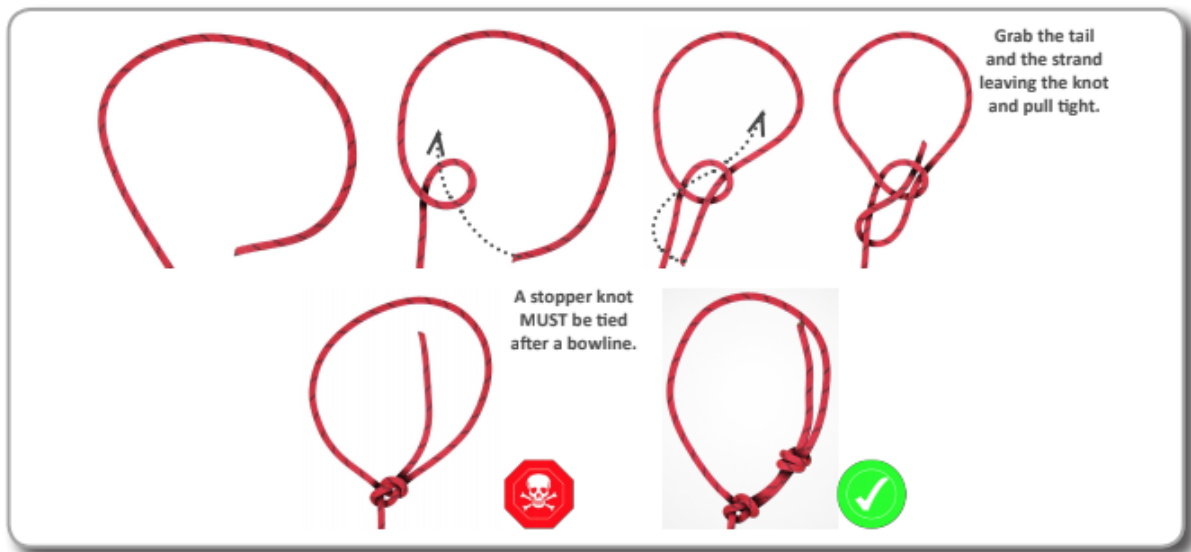
Knot Strength: Weakens the rope by 25%, Static Rope strength reduced to 20.3 kN.

Type of Knot: Inline and Multi- Directional.

Uses: Joining 2 pieces of gear, Used to isolate damaged pieces of rope, Can be used as part of a safety line. Used in lead anchors.

Unsuitable For: Where lots of adjustments in equalisation may be necessary.

3.2.e Bowline



The bowline is useful for tying the end of the set-up rope around larger boulders or trees. A bowline can readily work its way untied and therefore must be **ALWAYS TIED OFF WITH A STOPPER KNOT** (6th image). Also note that the tail of the rope is on the inside of the loop (images 4- 6).

Knot Strength: Weakens the rope by 33%, Static Rope strength reduced to 17.8 kN.

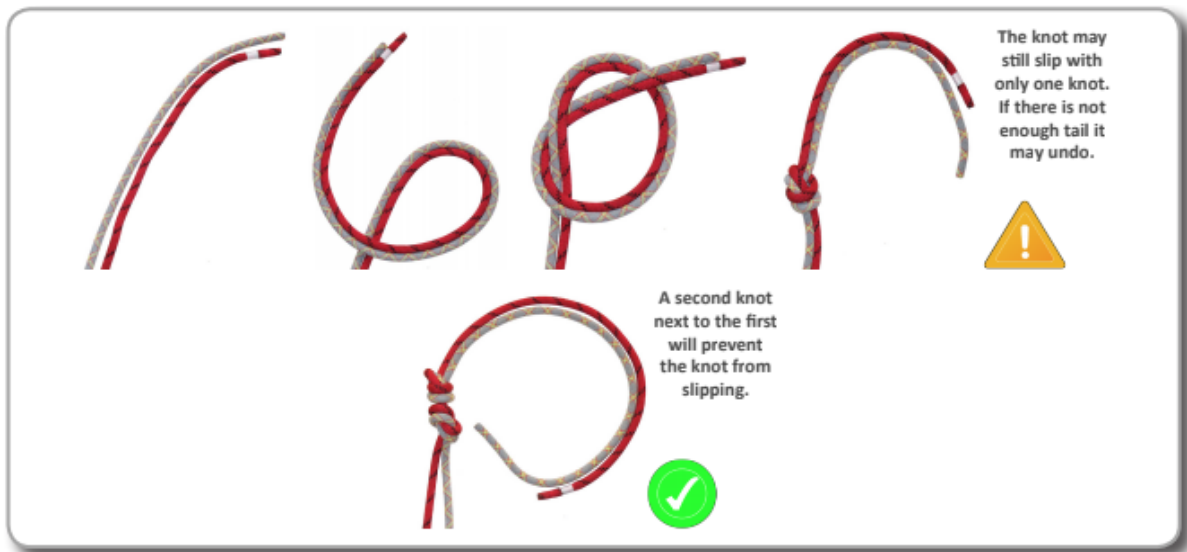
Type of Knot: Directional.

Uses: Tying around large bollards, Tying around large trees. Easy to adjust.

Unsuitable For: Cannot be used in the middle of the rope.

3.3 Joining Ropes

3.3.a European Death Knot (EDK)



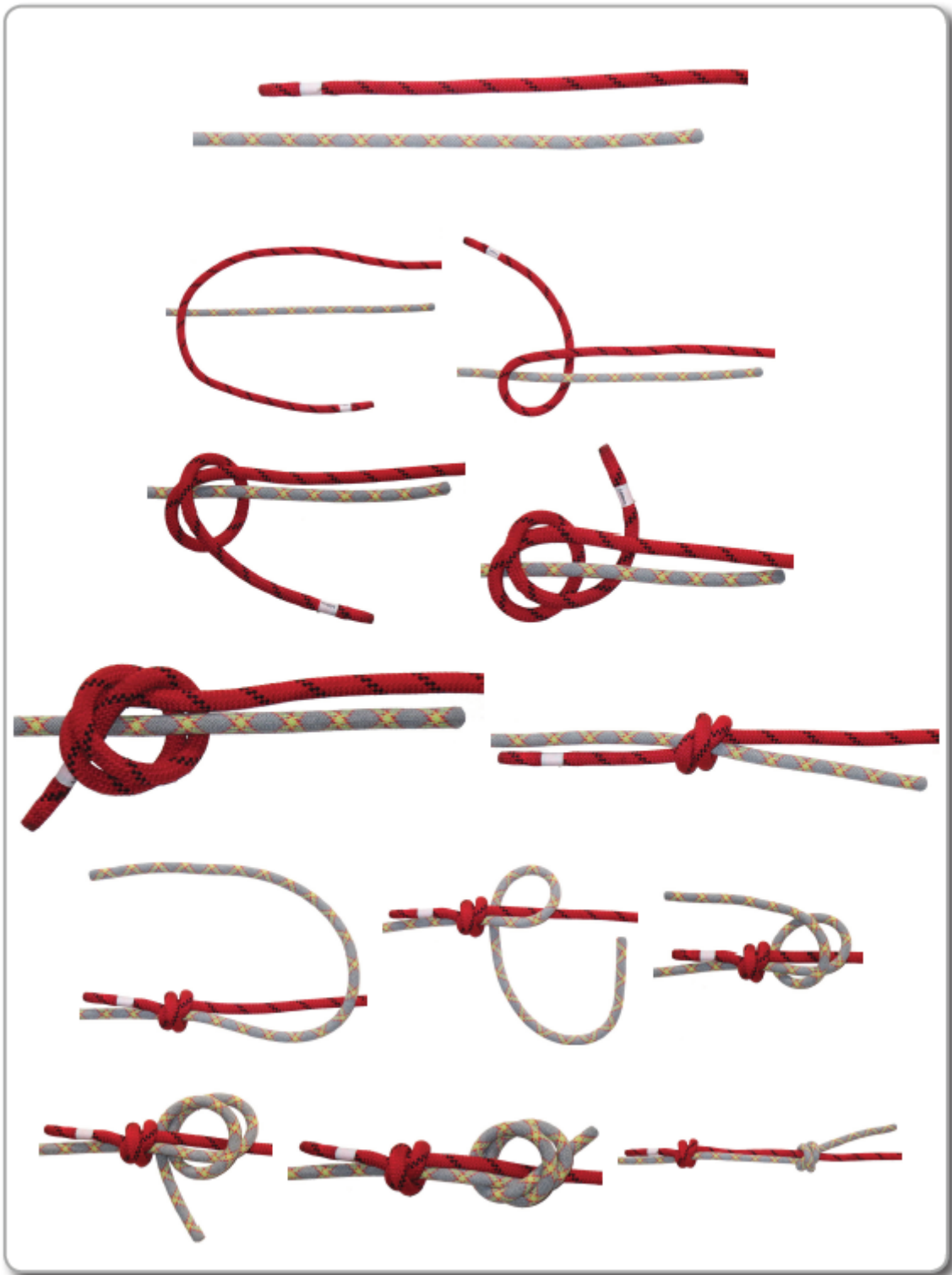
The European Death Knot is commonly used to join two ropes of roughly equal size together. It is seen quite often when abseiling greater than 25- 30 metres, where a 60m rope would not reach the bottom of a climb. Its main benefit is the way the knot sits 'above' the ropes which can help prevent snagging when pulling down the rope after an abseil. 1- 2 metres of tail should be left when tying the knot and for greater safety another EDK should be tied right next to the first one (5th image). The knot should be TIGHT before abseiling. Though technically not an inline knot, modern rope strength allows it to be used as such, provided the knot is tight to prevent it from capsizing (which is how the knot got its name).

Knot Strength: Weakens Rope by 35%, Static Rope strength reduced to 17.6 kN.

Uses: Joining two ropes of approximately similar size together when abseiling.

Unsuitable For: NEVER use with less than 1 metre of tail (leftover rope), Not recommended for joining two ropes together in an anchor system for top roping.

3.3.b Double Fisherman's





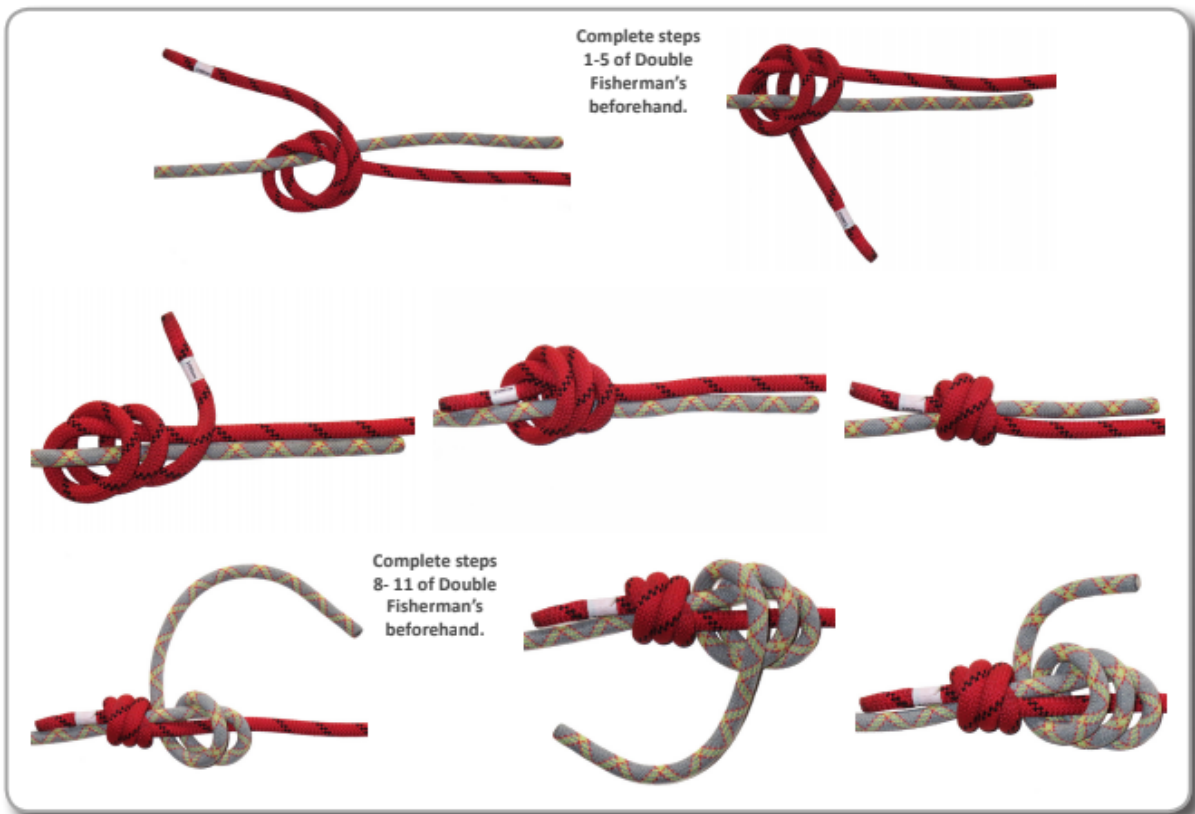
A Double Fisherman's is very useful for joining together two pieces of cord or rope, i.e. for creating a Prusik loop, or joining ropes for a long abseil. A stopper knot is tied in each piece of cord (or rope) around the other piece. A Triple Fisherman's is tied exactly the same way, but with one extra coil on each side.

Knot Strength: Weakens the rope by 20%, Static Rope strength reduced to 21.6 kN.

Uses: For making a Prusik loop, Joining two lengths of nylon rope together.

Unsuitable For: Can be difficult to untie and can jam easily in cracks, which should be considered when joining ropes for abseiling. Should **not be used with spectra cord** as it can undo by itself, use a **triple fisherman's** instead.

3.3.c Triple Fisherman's



A Triple Fisherman's is very useful for joining together two pieces or cord of rope, i.e. for creating Prusik loop, or joining ropes for a long abseil. It is less likely to become loose than a double fisherman's especially with cord made from spectra. If you have to join two ropes or cords

together and you do not know the material it is made from, use a Triple Fisherman's instead of a Double Fisherman's. Always have enough tail after the knot until it has been loaded fully.

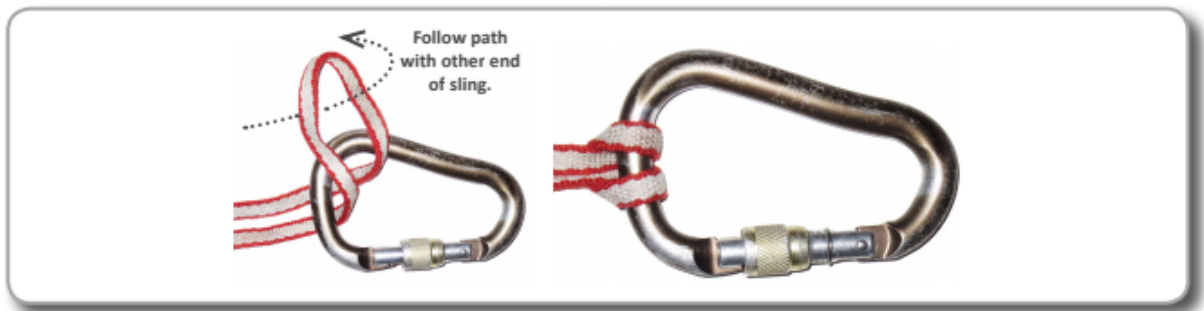
Knot Strength: Weakens the rope by 20%, Static Rope strength reduced to 21.6 kN.

Uses: For making a Prusik loop, Joining two lengths of any type of rope together.

Unsuitable For: Can be difficult to untie and can jam easily in cracks, which should be considered when joining ropes for abseiling.

3.4 Slings

3.4.a Girth Hitch



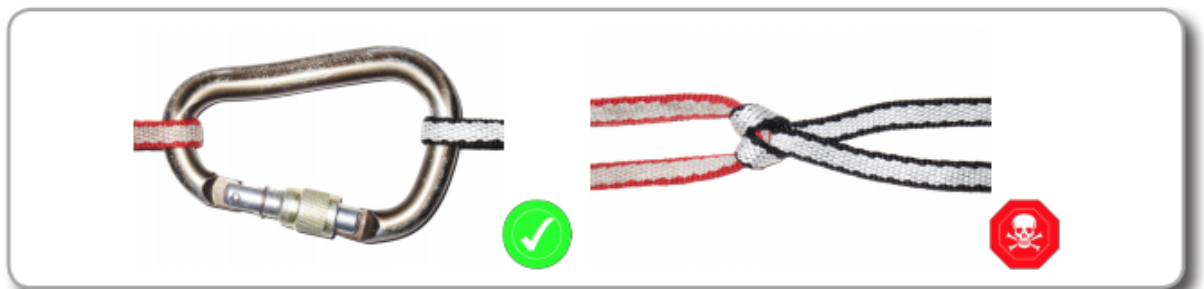
The Girth Hitch, also known as the Lark's Foot is useful to tie a sling around a bollard or a tree. It can also be used to tie in a sling to your harness.

Knot Strength: Weakens the sling by 40- 60%, sling strength reduced down to 8.8 kN.

Uses: Sling a bollard or tree, Extending a cam loop, Simple and effective way to attach a sling to your harness.

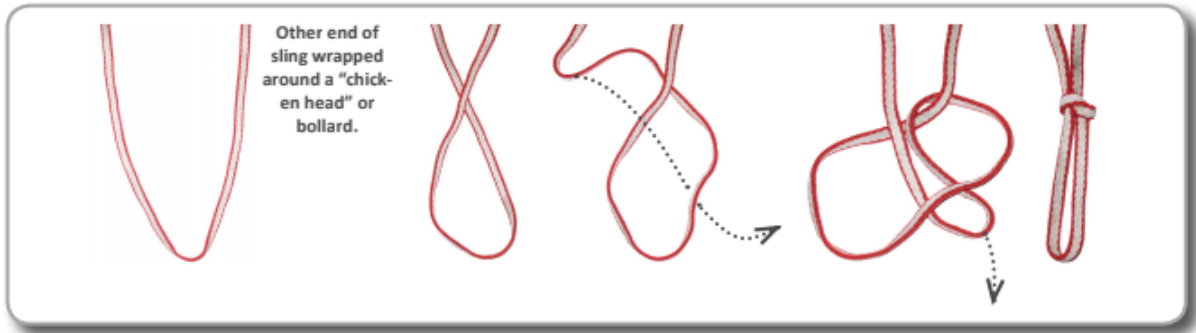
Unsuitable For: Joining two slings together.

3.4.b Joining Slings



NEVER use a girth hitch to join two slings. The friction generated will slice through each sling. Use a Carabiner instead.

3.4.c Slip Knot

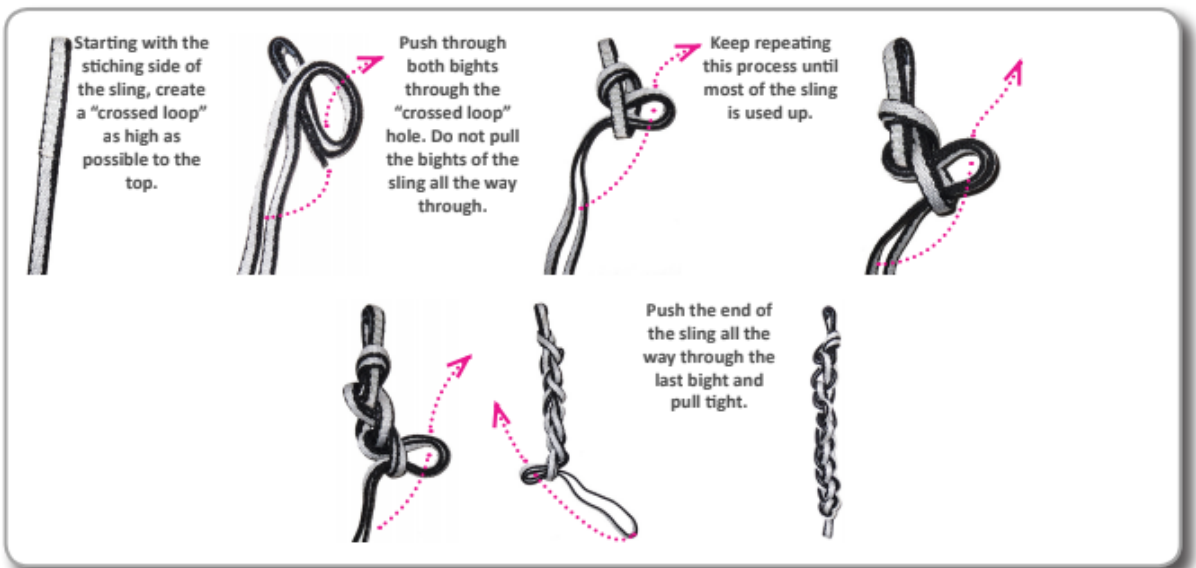


The slip knot is handy because, as its name suggests, you can slide it up to adjust the size of the loop. You might use it to sling a horn ("chicken head") of rock.

Knot Strength: Weakens the sling by 35%, sling strength reduced to 14.3 kN.

Uses: Where there is not enough length in the sling to use a girth hitch around a small bollard or "chicken head."

3.4.d Daisy Chain



Uses: A way to keep slings neat and tidy after use and to store on rack.

3.5 Prusiks

Prusik knots are usually tied with accessory cord or a sling around a rope, and then clipped to your harness. The intention is to create friction (and heat) with a knot where it will still slide along the rope at low speeds/loads, but if you slip and load the knot, it will lock onto the rope.

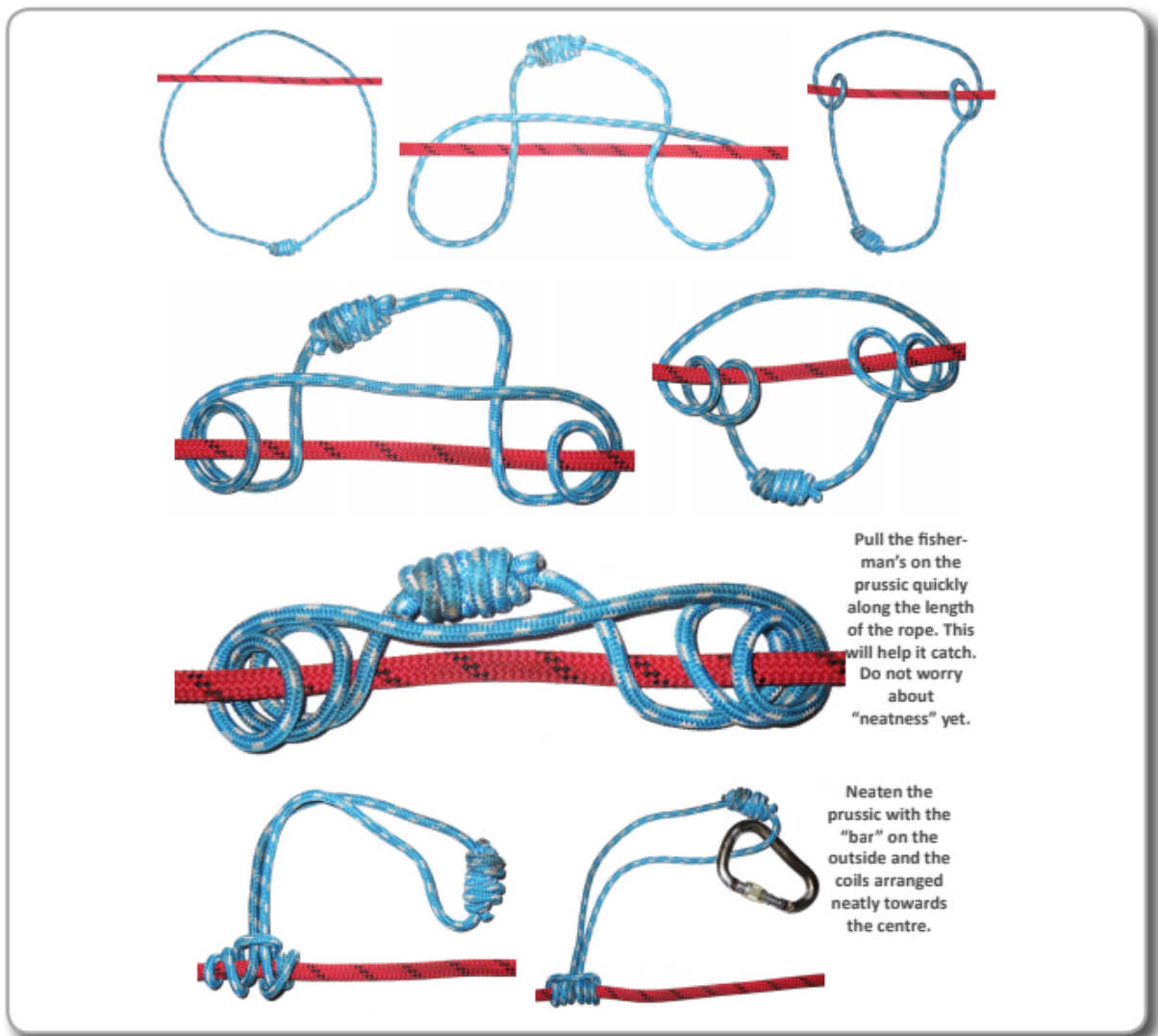
Remember that a Prusik works by generating friction, which produces lots of heat. When abseiling with a Prusik, the faster you go the hotter the Prusik gets. Go too fast and the thin cord will melt, especially if it is made of Dynema or spectra.

A Prusik works best when it is between one third and one half of the thickness compared to the rope it is being tied around. We normally use 5mm nylon cord, though 6mm- 7mm Dynema is a lot stronger. Once a Prusik is loaded it will not slip. To unload it, grab the Prusik where it wraps around the main rope and attempt to slide it.

To make your own Prusik use the double fisherman's if the cord is made of nylon, or the triple fisherman's if made of spectra. If you are unsure in any way on which material the Prusik cord is made from, use a triple fisherman's to form the Prusik loop. Ensure you have at least 1 to 2 centimetres of tail after tying the fisherman's knots as it may move slightly until it has been loaded fully a few times.

NEVER TRUST YOUR LIFE TO ONE PRUSIK.

3.5.a Classic Prusik



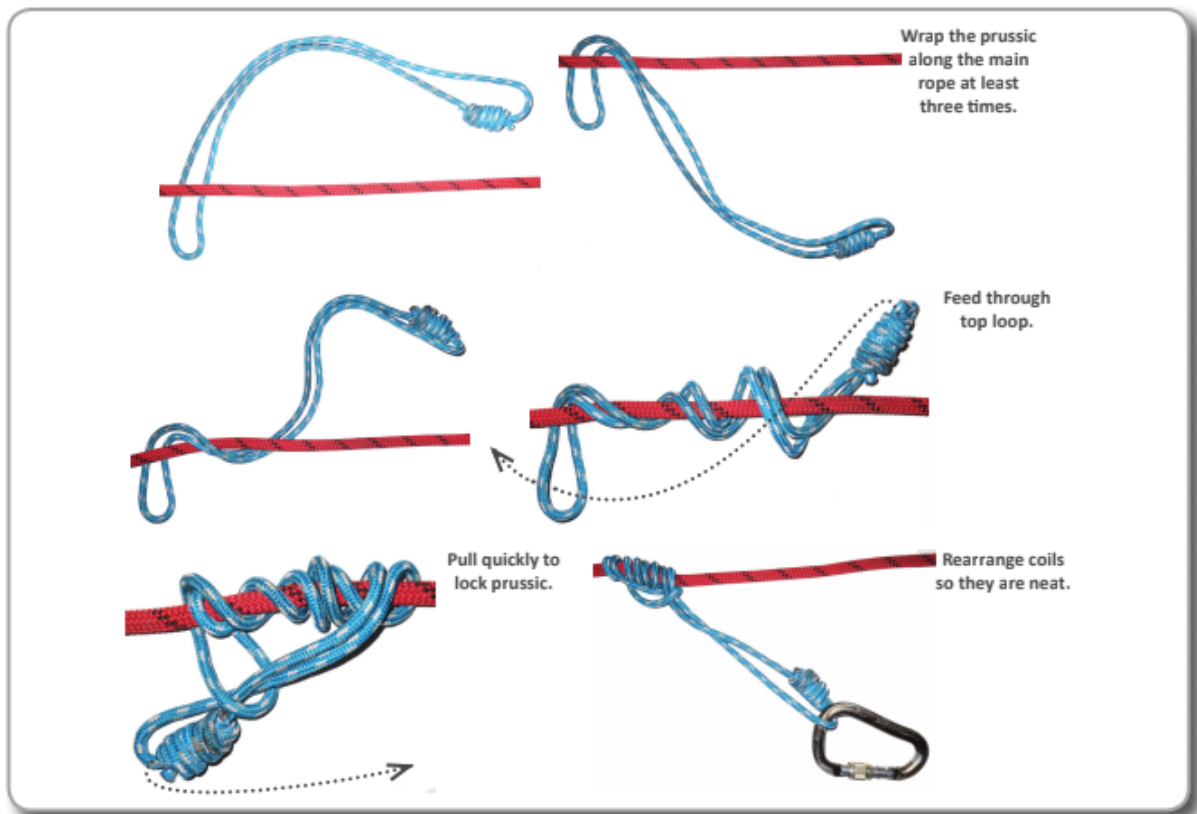
The classic works in both directions along a rope, and doesn't need much cord to make an effective Prusik. However it will be hard to "unlock" after it has been loaded. Never use a classic Prusik when abseiling as you may not be able to release it if it locks, especially if you are dangling in space on an overhang.

Number of Coils: A minimum of 2 wraps is required, but 3 is recommended for most applications. To use with a safety line 4 coils would help the Prusik "bite" into the rope in the event of you slipping.

Pros: Can be loaded in both directions, Length of Prusik does not matter.

Cons: Can be extremely difficult to unlock once it has "bitten", should not to be used for abseiling.

3.5.b Kleinheist Prusik



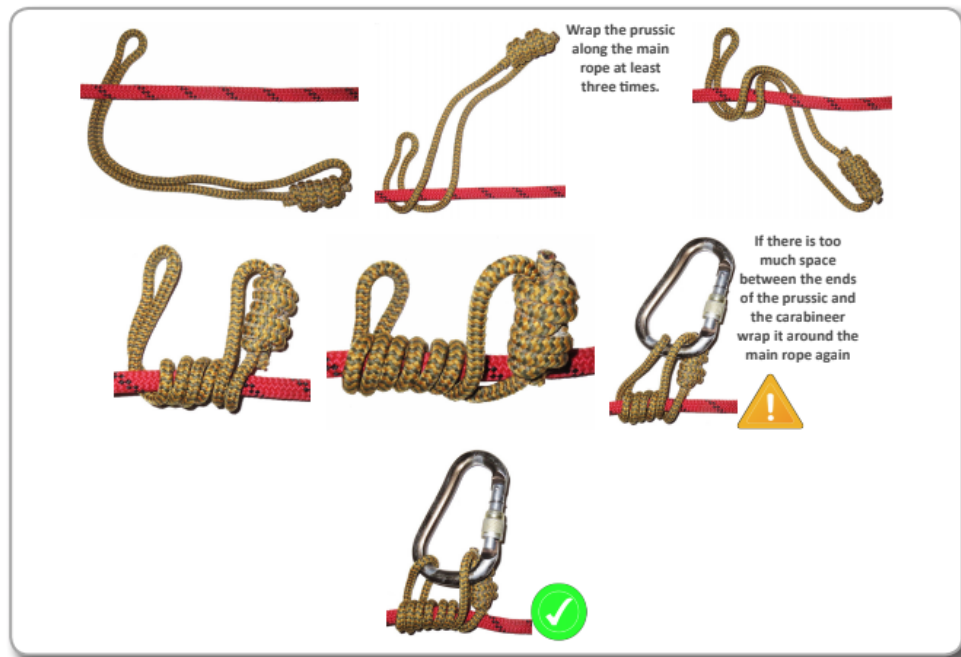
The Kleinheist Prusik only works effectively in one direction along the rope, but is a bit easier to tie and to unlock, and is the best to use with slings. Its ability to move under load is somewhere between a classic Prusik and a French Prusik. A minimum of two wraps around the rope is required, though three is recommended. Four wraps or more may be needed if using a sling.

Number of Coils: A minimum of 2 wraps is required, but 3 is recommended. 4 or more when using a sling.

Pros: Length of Prusik does not matter, can be moved under load (though can be quite difficult), can be tied with slings.

Cons: Only locks properly in one direction, does not slide as well as a French Prusik under load.

3.5.c French Prusik



The French Prusik is able to be unlocked while under load - which means you have to be very careful using this knot, but also makes it invaluable as an abseil backup. Make sure you don't leave a large gap between the ends of the Prusik loop and the carabiner, else it will tend to loosen off. A French Prusik requires at least three wraps around the main rope to be effective.

Number of Coils: A minimum of 3 wraps around the rope is required for the French Prusik. However it is more important that there is very little left of the Prusik once the carabiner has been clipped in.

Pros: Can be moved under load making it very useful for abseiling.

Cons: Length of Prusik is critical (An overhand knot can be used to shorten a Prusik).

4. Further Reading

There are plenty of websites which have animations demonstrating how to tie these knots, though they may be tied in a different fashion, or without stoppers at the end. Here are some of the animated knot and other sites for climbing reference:

<https://www.animatedknots.com/indexclimbing.php>: By far the best site for animated knots of every shape and size.

https://www.netknots.com/rope_knots: Another animated knot website.

<https://www.thebmc.co.uk/knots-booklet>: A short booklet produced by the BMC in 1997.

<https://www.rei.com/learn/expert-advice/climbing-knots.html>: Lots of videos of useful climbing knots.