# THE ABSEILING

# HANDBOOK

# ABSEILING HANDBOOK

Abseiling is a lot of fun and may offer an experience of exhilaration, personal challenge or adrenalin rush. However, abseiling is not really a "stand alone" activity, but rather a skill that is employed in the sports of rock climbing, canyoning, caving and mountaineering, so go on and try all the rock related activities.

Abseilers need to be aware that it is an activity where serious injury or death can occur as a result of;

- Falling off a cliff.
- Falling rocks.
- Equipment dropped by others.
- Failure of anchors or equipment
- Misuse of equipment.

These risks are minimised by abseiling activities being lead by qualified persons, and by training all persons participating in an abseil activity in cliff top safety, use and care of equipment and standard calls, prior to the activity.
Therefore, to become proficient in abseiling requires more than reading the information contained in this handbook, which is only intended as a learning aid to be used in conjunction with proper instruction.
To become proficient requires undertaking a basic rock-craft course in the first instance, followed by regular practice under varying conditions.

All persons have the responsibility for taking care of their personal safety as well as that of others.

This handbook has been prepared by "Fred" Bernard Kaltenbacher
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and is intended for use by Scouts for Scouts

The 'Absyle' is used for rock work, generally for descending though it can be used of some faces for ascent.

In the 'Absyle' the body is upright but the legs are stretched out, and the feet pressed against the rock face.

The rope passes between the thighs, around one thigh and diagonally up and across the upper half of the body and over the shoulder opposite to the leg under which it passes. The rope may be gripped with one hand.

In descending, the free hand pulls the rope over the shoulder. This leaves a loop below the thigh, and the feet are 'walking' down the rock face until the thigh is again snug in the loop. The 'Absyle' used for descending makes it practically impossible to fall.

In ascending a rock face which has an extreme slope but is not vertical, the feet are 'walked' up the rock face, the body is pulled up the rope, and the slack, hanging below the legs, is pulled up with one hand and fed over the shoulder. By this means the climber can 'sit' on the rope and rest. When using the 'Absyle' it will be found that bare feet, sandshoes or spiked shoes give a better grip on the rock face than plain leather soles

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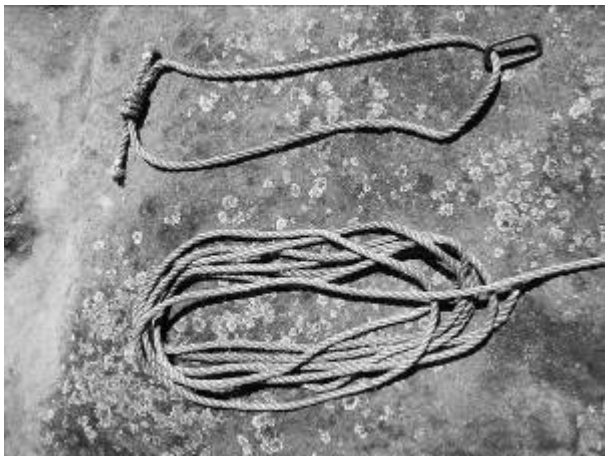
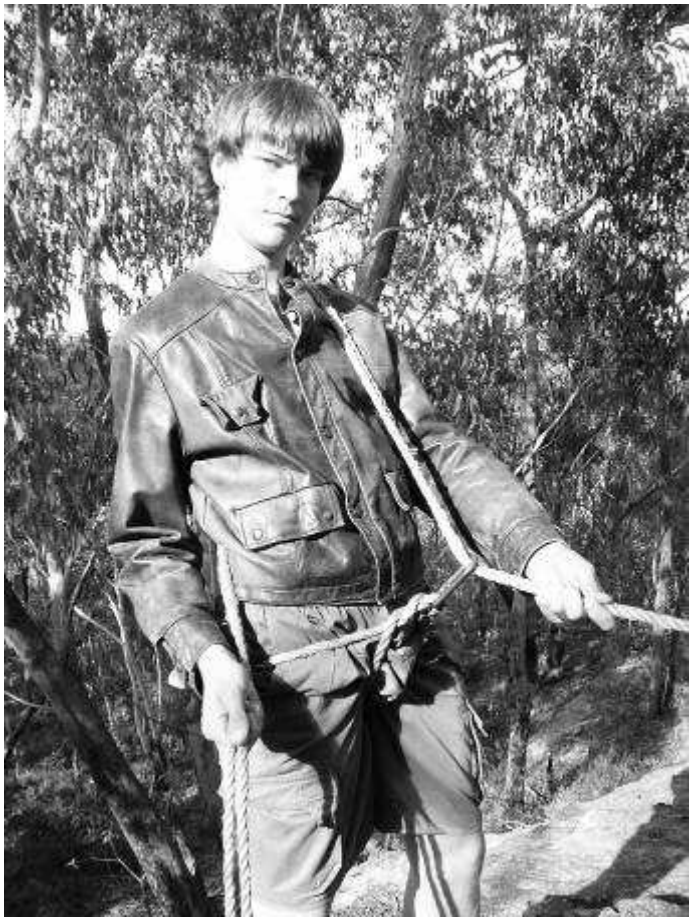
The technique of abseiling evolved from the "classic" method described in Richard Graves' book, with abseilers using a rope sling which was made from the same 1½ inch circumference Manilla rope (approx. 12mm diameter) that was used for abseiling and a carabiner.



The abseiler stepped into the loop of the sling with the carabiner at the back. The abseiler then brought the carabiner forward between the legs. The rope was passed through the carabiner, over the shoulder and across the back. This was much more comfortable than the "classic" technique but still created a lot of friction on the shoulder of the abseiler. It became common for abseilers to wear a leather 'cape' or jacket with some padding on the shoulder. This allowed the height of an abseil to increase to 50metres in reasonable comfort however drops of 100metres were being abseiled.



# THE WAY THINGS ARE TODAY

## ABSEILING EQUIPMENT

N.B. ALL EQUIPMENT MUST BE USED AND CARED FOR ACCORDING TO THE MANUFACTURERS INSTRUCTIONS.

## HELMETS

The helmet is one of the essential pieces of personal protection equipment. A helmet not only protects the abseiler from falling objects, but also protects the head in the event of a fall. The helmet should be one specifically designed for rock work. Other types of helmets such as construction helmets are not suitable as they do not have a "four point of attachment" harness. When choosing a helmet, another consideration is its ability to clear water. This is important when jumping into water during canyoning.

## ROPES

Abseiling can be done on any type of rope as long as it has suitable strength and is of sufficient thickness to offer adequate friction on the device and can be gripped by the abseiler. However, the usually accepted type is of **Kernmantle construction**. The term kernmantle describes ropes that are designed with an inner core (kern) and an outer sheath (mantle)
The approximate tensile strength of a new kernmantle rope can be calculated by squaring the diameter and multiplying by 22.
E.g. 9mm rope would have an approximate tensile strength of (9 x 9) x 22 = 1782 kgs.

Kernmantle rope comes in two main types; dynamic and static.

- Dynamic ropes are designed to stretch under load and therefore absorbs the kinetic energy when a climber falls, reducing the stress on the climber's body.
- Static rope has less stretch than a dynamic rope and this characteristic makes them preferable for use when abseiling, prusiking, or hauling.

### Care of Ropes

Kernmantle rope is perhaps the piece of abseiling equipment that is most prone to damage or wear. Care must be taken to avoid walking on ropes as this can force grit through the mantle where it can then abrade the kern. When setting up an abseil, care should be exercised to avoid sharp edges. The back and forth movement of a rope over a sharp edge can seriously damage a rope very quickly to the extent that it can fail.
**Knives should never be used near a loaded rope. If it is necessary to do so in an emergency, EXTREME CARE must be taken.**
Ropes must be stored so they are not exposed to acids, bleaches or any other chemicals, or excessive strong sunlight.

**Abseiling and climbing ropes must never be used for any other purpose e.g. tying down loads on a vehicle or as tow ropes unless they are no longer being used for abseiling or climbing.**
Ropes may be washed in warm water with gentle soaps only, and well rinsed. Wet ropes should be hung loosely to air dry in a shady ventilated site and then stored in a cool, dark dry place.

Coiling a Rope

Unlike a laid rope, using a circular coiling technique with kernmantle rope causes kinks to form. To avoid this, ropes are best "chained" or coiled using the "butterfly" method.
Ropes must be monitored before use, frequently during use and before storing. The easiest method is to examine the rope is visually while running it through your fingers and feeling for irregularities.

A rope should be replaced if;

- Irregularities can be felt in the rope
- It has been subjected to a heavy fall or overloading.
- It has been exposed to acids or chemicals.
- More than half of the filaments on the mantle are broken.
- The kern can be seen through the mantle

## TAPE SLINGS

Tape slings have many uses from setting up anchors to forming a "tape harness". Purpose made rock-craft tape should always be chosen for rock-craft use. Sewn slings are stronger than knotted tapes and are more secure as they cannot come undone. Buckled tapes are also available.
Tapes may be flat or tubular. Flat tape can be tied more easily than tubular but for the same width tape, the tubular is stronger. The tape knot is the most successful way of tying tapes and is the only knot to be used for rock related activites.

## CARABINERS

Carabiners come in either steel or alloy, in a variety of shapes and may be lockable e.g. screwgate. It is recommended that only the lockable type be used.
Steel carabiners are approximately 30% stronger than alloy and are able to withstand harder knocks. For these reasons steel carabiners are frequently used in rescue work and industrial settings. The lighter weight of the alloy carabiners makes them the more popular choice with rock climbers and canyoners.
Carabiners must always be deployed with the gate locked and with the load on the long axis and NEVER across it.

Carabiners, whether steel or alloy, can sustain fractures that can only be detected by X-Ray. Any carabiner that has been dropped 5 metres or more onto a hard surface, or one with which you have concerns regarding its integrity, should be withdrawn from use immediately.

**DESCENDERS (abseiling devices)**

Descenders can be broadly classified in 4 main types based on their shape, the way they connect to the rope and method of controlling descent.

1. Circular.
2. In-line
3. Tubular
4. Auto-locking

(1) Circular devices create friction by the rope running through and around the device Common examples of this type are the "figure 8" and the "harpoon". These devices are relatively cheap, easy to use and very safe. A drawback with these devices is their tendency to twist the rope. These devices are considered unsuitable for canyoning, as generally speaking, these devices need to be detached from the harness to connect on and off the rope and can be dropped and lost in deep pools. Although there are ways of performing these manoeuvres to avoid losing the device, it is difficult to perform when treading water under a waterfall.

(2) In-line descenders are ideal for long descents with the amount of friction able to be adjusted by varying the number of bars threaded. Examples of in-line descenders are the "Rap Rac" and the "Top Cat". In-line descenders offer better rope wear and less rope twisting. These descenders are suitable for canyoning as they don't require to be removed from the harness to disconnect from the rope. "Top Cats" are fitted with screw gates that make them less easy to disconnect than the "Rap Rac" when treading water.

(3) Tubular devices create friction in response to the device pressing on the rope. The devices are primarily used for belaying but may also be deployed as an abseil device. Examples of these are the "stitch plate" and the "ATC".

(4) Auto-locking devices have a braking system that is applied when the hand is removed from the device. Some examples of these are the "Petzl Grigri" and the "SRT double stop".
These devices are rarely used by abseilers as they are expensive and are more difficult to thread and to use. If these devices are chosen, the abseiler must take extra care to follow the manufacturer's instructions. It is strongly advised to practice using the device on small drops whilst top belayed.

An abseil device will wear out just like anything else. There is no predetermined lifespan and the longevity will be affected by such things as the type of metal the device is made of, length and speed of descents, and the cleanliness of the rope.
An abseil device should be retired when grooves resulting from wear exceed 10% of the original thickness.
Abseil devices can sustain fractures that can only be detected by X-Ray. Any device that has been dropped 5 metres or more onto a hard surface, or one with which you have concerns regarding its integrity, should be withdrawn from use immediately.

## KNOTS

Knots are an integral part of abseiling and it is vital for abseilers to be able to tie whichever knot is required under difficult conditions.
A particular knot may be known by several names, and this can lead to confusion, so a few common terms may be helpful.
A knot is simply a connection in a cord or rope, formed by passing one free end through a loop and drawing it tight, or by intertwining or tying pieces of cord or rope. Knots can be classified according to their purpose. "Bends" are knots used to join two ropes together eg the Hunter's bend, while a "hitch" is a knot that secures a rope to an object such as a post, eg a clove hitch or to the standing part of a rope, eg the rolling hitch. I have called the knots mentioned in this book, in keeping with these classifications. Remember, all knots reduce the breaking strain of a rope.
The knots that are most commonly used in abseiling are:

- Figure of 8
- Figure of 8 on the Bight
- Rethreaded Figure of 8 (which forms a figure 8 on the bight tied around an object)
- Alpine butterfly
- Double Fisherman's Bend
- Hunter's Bend
- Overhand Bend
- Tape Knot
- Prusik hitches
- Munter hitch.

There are at least 4 variations of the Prusik hitch, Standard, Klemheist, French and Bachmann.

Some descending devices and knots are illustrated at the back of this handbook.

## ANCHORS

Anchor points are solid objects to which the ropes are attached for abseiling and top belayed rock-climbing. There are 2 categories of anchor points;

1. Natural.
2. Fixed

(1) Natural anchors are such things as trees, rocks logs etc. i.e. natural features which offer a safe anchor point.

(2) Fixed anchors are fitted to the cliff by bonding them in a hole that has been drilled in the rock. The most common type now is the stainless steel ring bolt that is "cemented" into the hole. The older style "carrot" bolt was a mild steel bolt that had been tapered and driven into an undersized hole that had been drilled 65mm to 75 mm deep. These "carrot" bolts require a "key-hole" bolt bracket fitted to the bolt. A carabiner is then attached to the bracket. Care must be taken to ensure the security of these anchors and the solidness of the surrounding rock.

**RIGGING AN ABSEIL**

When rigging an abseil THINK;

1) What can go wrong?
2) What can I do to minimise the risk?
3) What will I do if something does go wrong?

and design the set up such that the recovery of an abseiler in difficulty can be performed simply and safely.

The abseil should be backed up by selecting a minimum of two secure anchor points, each individually capable of supporting the maximum weight and stress anticipated to be placed upon them.
Anchor points may be positioned "in-line" or as close as possible to it.
If the anchor points are separated, the load may be equalised by connecting a rope between the two anchors and bringing the focal point forward, tying a figure of 8 at a position that ensures the load on each anchor is equal. The abseil rope is then clipped into the focal point with a carabiner. The angle between the "arms" of the anchor system should ideally be less than 90 degrees and must never exceed the critical angle of 120 degrees.
*(As the angle between the "arms" increases, the force on each arm will increase. For example, with a load of 100kg, the force applied to each "arm" when there is an angle of 30 degrees between them, is 51.8kg. When the angle is increased to 90 degrees, the force on each "arm" increase to 70.7kg.With an angle of 120 degrees the force for each "arm" is 100kg and with an angle of 150 degrees the force escalates to a massive 193.2kg)*

The strength for a cord or sling used in an anchor system should not be less than 12Kn. Therefore cord should be of 8mm or greater.

The following table gives examples of the approximate strength of new cords according to their diameter,

| Diameter of cord (mm) | Strength (Kn) |
|---|---|
| 5mm | 4.8Kn |
| 6mm | 6.8Kn |
| 7mm | 9.3Kn |
| 8mm | 14Kn |

*A mass of 100 Kg exerts a force of 1Kn*

In the past it was a common practice, when undertaking multi pitch abseils, to place a rope around a suitable tree and passing both ends down the cliff so that the rope could be retrieved from the bottom. This practice causes damage to the tree, particularly when pulled down, causing the rear of the tree to be "ring barked". There is also greater friction on the rope which may make it more difficult to pull down and it also makes the recovery of .an abseiler who is in trouble more difficult. Therefore this system should never be used. In these circumstances, a sling should be placed around the tree and the abseil rope passed through the sling. (Good sections of old rope make excellent slings.)

*Do not trust existing slings that may be weakened from heat damage from the friction of the retrieval of an abseil rope or U V exposure. Remove old slings and carry them out*

## DEPLOYING THE ROPE

A safety line must be secured before approaching closer than 2 metres of the edge. Before deploying the abseil rope, tie a "figure of 8 on the bight" in the end of the rope, call "ROPE BELOW" wait for five to ten seconds in case someone is climbing below you. If no call is heard, call loudly "ROPE BELOW" again, pause, take note of any trees that may snag the rope and then launch it out from the cliff.
*(The use of a rope bag is highly recommended as it makes the rope easier to carry, protects the rope from dirt and abrasion when carried, makes deploying easier and packing away quicker.)*

## BELAYING.

Belaying is a term used to describe the technique of safeguarding an abseiler. There are 3 different systems;
Self Belay
Top Belay
Bottom Belay

Self Belay relies on the use of a prusik cord attached to the abseil line with a prusik hitch, above the descender and connected to the abseiler's harness. The abseiler slides the knot down as he/she descends. Should the abseiler lose control on the descent, he/she will release the prusik knot which will tighten and stop the fall. The abseiler then self recovers and continues to descend. The Klemheist Prusik hitch is recommended for use in this application, as the Standard Prusik hitch can jam when suddenly weighted, making it difficult to loosen to allow further descent.
WARNING!!! Be aware that when abseiling using a self belay, it is necessary to descend at a SLOW SPEED. Otherwise the heat caused by friction between the rope and the prussic loop will damage the prussic cord.

Top Belaying is arguably the safest method. A second rope is attached from the abseiler to a belaying mechanism (e.g. a stitch plate) operated by a person at the top of the cliff. A Top Rope belay can cause problems if the abseiler is negotiating an overhang and the belayer does not feed out sufficient slack. Therefore, to be completely effective, the Top Belayer needs to be in a position where they can see and communicate with the abseiler at all times.

Bottom Belaying is the most common technique employed. The belayer stands at the bottom of the cliff and can stop the abseiler by pulling on the rope firmly. To be fully effective, the belayer needs to standing directly below the abseiler and able to see and communicate with them. It is essential that the belayer remains alert and has both hands on the rope at all times. The belayer is in a position where he/she is exposed to falling objects. If an object is dislodged, the belayer must move close in to the base of the cliff and avoid looking up.

## COMMUNICATIONS

Clear and simple communication calls are essential for to ensure the safety of all persons on or around an abseil. The key to efficient communication is to use simple, concise and loud calls. Standard calls have been simplified to those used previously. **It is strongly recommended that the calls that are in current standard practice be learnt and used to avoid confusion.**

| **CURRENT STANDARD CALLS** | PREVIOUS STANDARD CALLS |
|---|---|
| **"ABSEILING"** indicates the person is ready to descend but waiting for the belayer to call | "ON ROPE" when connected to the abseil rope |
| **"ON BELAY"** indicates the belayer is in position with both hands on the rope and the abseiler may proceed | "ON BELAY, ABSEIL WHEN READY" when the belayer is in position with both hands on the rope |
| **"HOLD"** indicates the abseiler wants to be stopped | "ABSEILING" when beginning movement down the rope |
| **"ABSEILING"** when recommencing the descent | "HOLD" when the abseiler wants to be stopped |
| **"OFF ROPE"** when disconnected from the abseil rope | "ABSEILING" when recommencing the descent |
| **"ROCK"** or **"BELOW"** when an object has been dislodged | "SAFE" when the abseiler has reached the bottom |
| | "OFF ROPE" when disconnected from the abseil rope |
| | "OFF BELAY" when the belayer is no longer remaining in position to belay |
| | "ROCK" or "BELOW" when an object has been dislodged. |

## ASCENDING

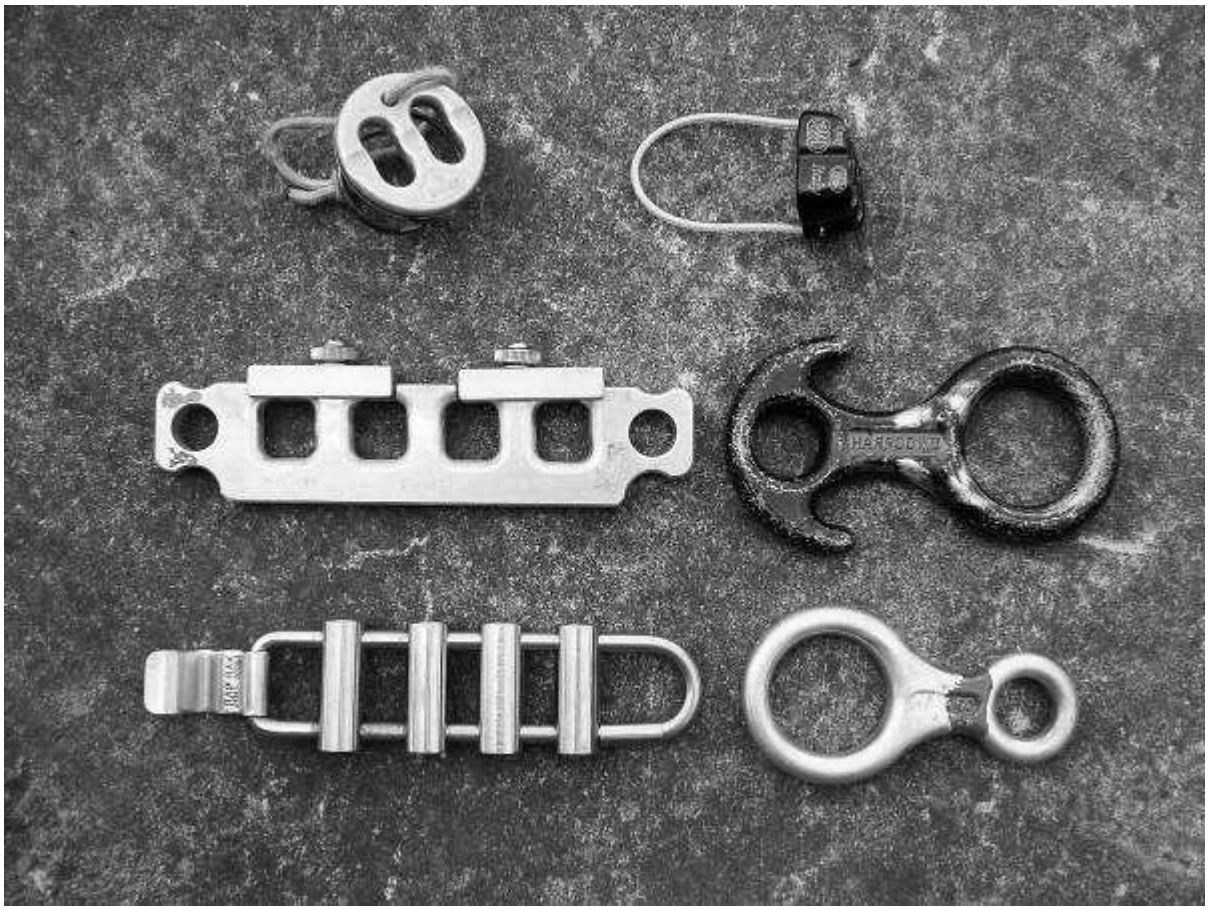
It is sometimes necessary to ascend a rope and is also an essential skill for performing a self-recovery. Most difficulties that an abseiler may experience can be overcome by using a self-recovery. Therefore it is a skill that should be practiced regularly.
Ascending can be done by using;

- Mechanical ascending devices.
- Prusik loops.

For either, the principle is the same. You ascend the rope by raising one ascender by hand while supported by the other ascender. Weight is then taken on the one that has been raised while the second one is raised.

There are quite a few types of ascenders on the market and are reasonably expensive. The alternative is to use prusik loops. These are made of kernmantle cord that has been formed into a continuous loop and tied with a "double fisherman's bend" or a "Hunter's bend". The length of one loop is from foot to belly-button and the other from belly-button to the top of the forehead. It is advisable to carry a third prusik loop for helping to pass over an overhang.
The prusik loops are attached to the rope using one of the prusik hitches. The two most commonly used in this situation are the Standard Prusik hitch or the Klemheist hitch.
Ideally, the diameter of the prusik cord will not be greater than half the diameter of the rope, as this will ensure a good friction grip. In any event, there must be at least a 3mm difference in diameter. The potential exists for a short falls to occur, therefore 6mm cord is the most commonly chosen. In the conventional method of prusiking, the waist loop is attached from the harness to the rope. The leg loop is attached to the rope and is simply stood in. This gives one point of attachment which means if the waist loop failed, the person would fall. A safety measure that is advisable to use is to secure a caribiner to the loop by means of a marlin hitch A cord can then be attached from the carabiner to the harness, thereby giving two points of attachment to the rope.

# DEVICES AND KNOTS



| | |
|---|---|
| Top Left | Stitch Plate |
| Top Right | A T C |
| Centre Left | Top Cat |
| Centre Right | Harpoon |
| Bottom Left | Rap Rac |
| Bottom Right | Figure 8 |

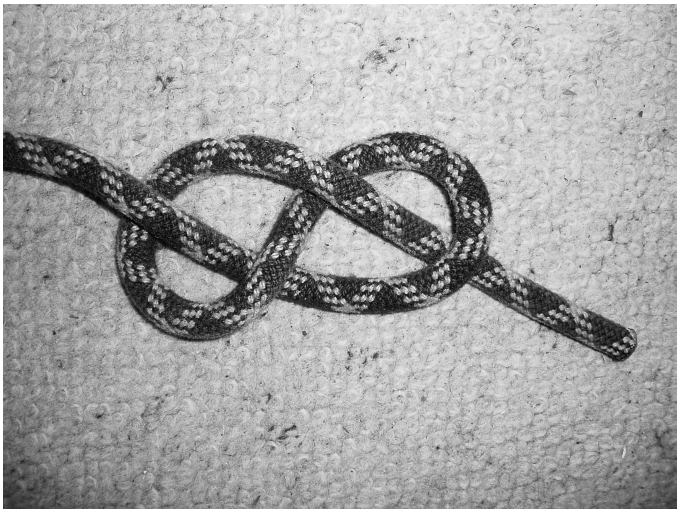
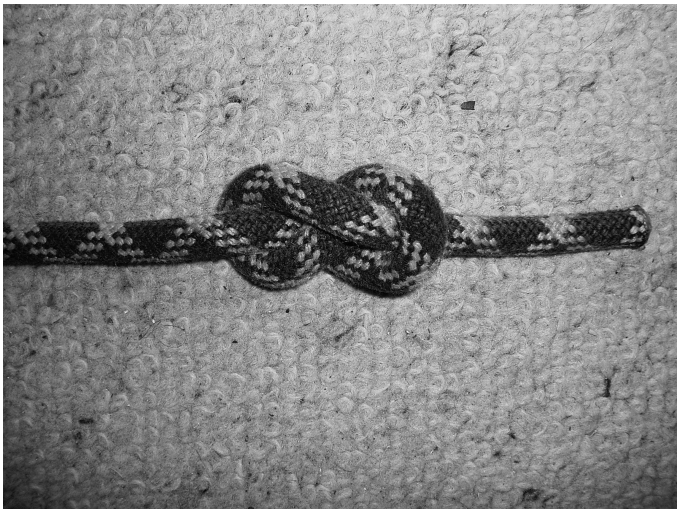


FIGURE of
EIGHT



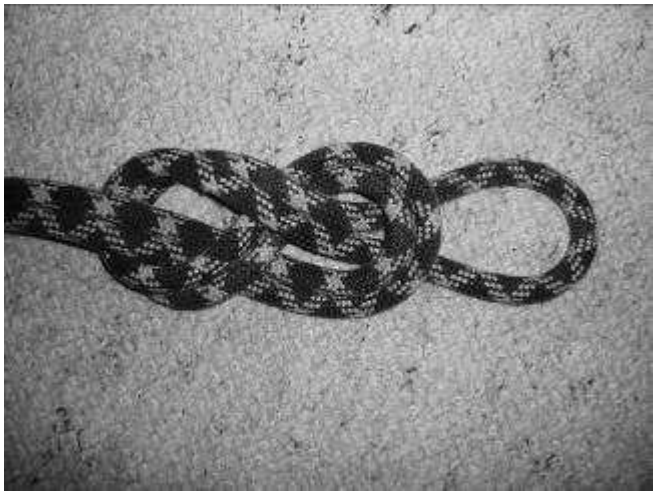
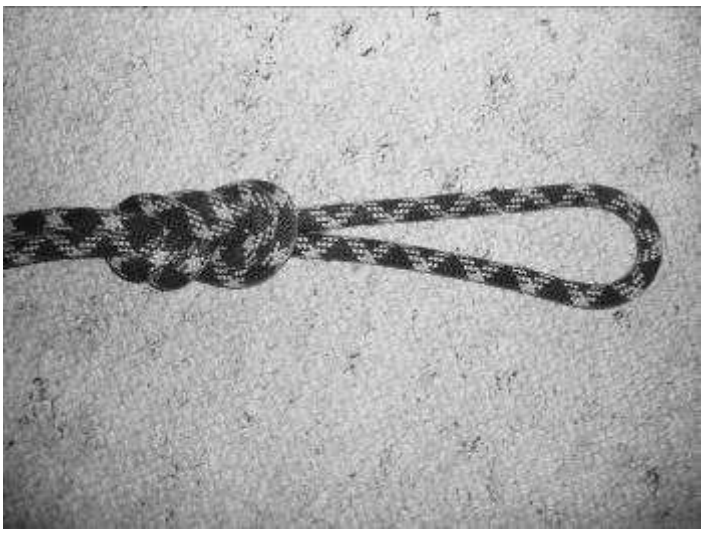
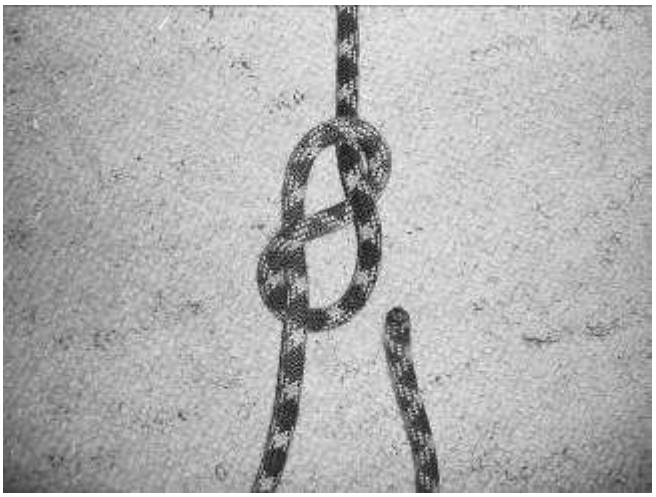
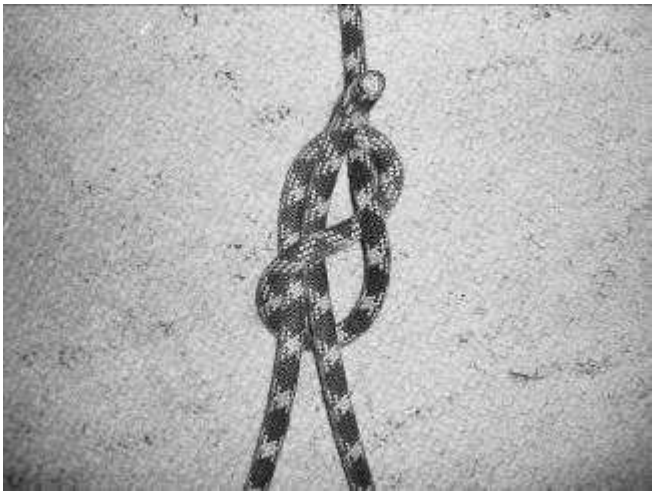
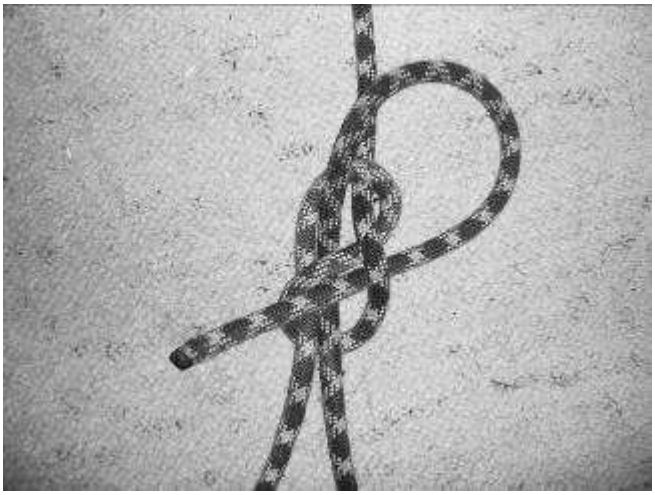


FIGURE of EIGHT
ON THE BIGHT



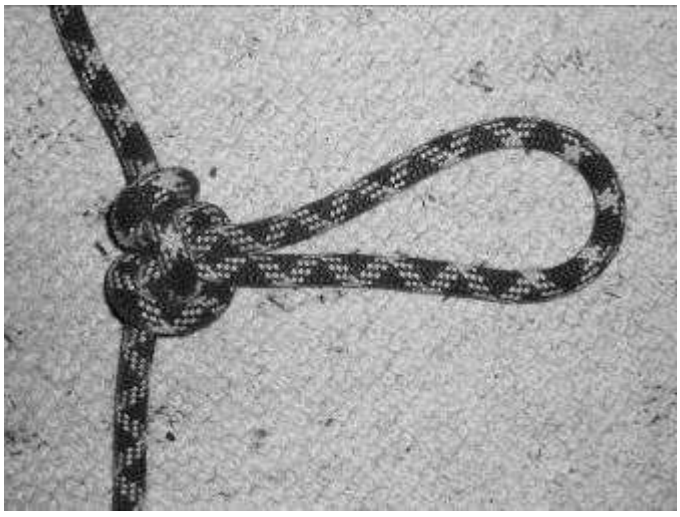


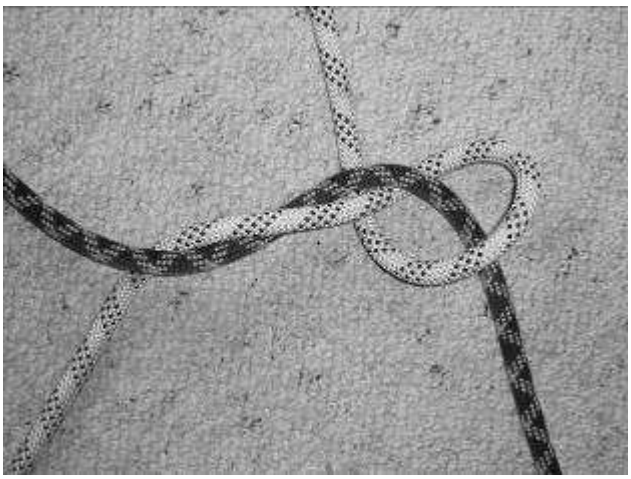
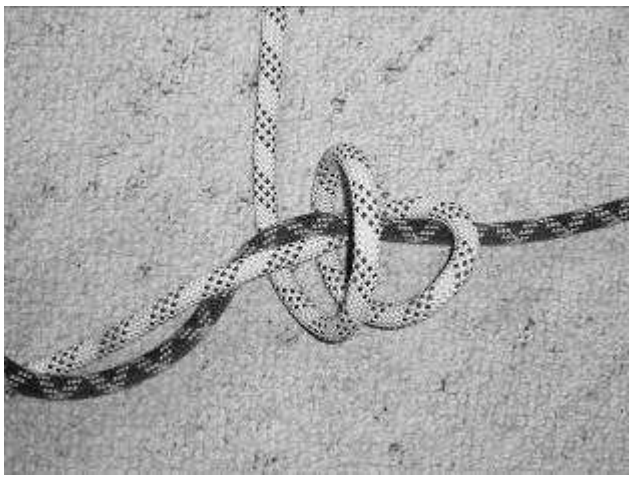
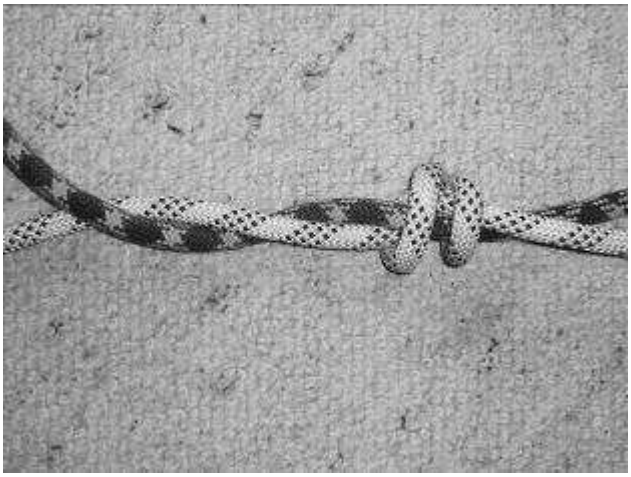
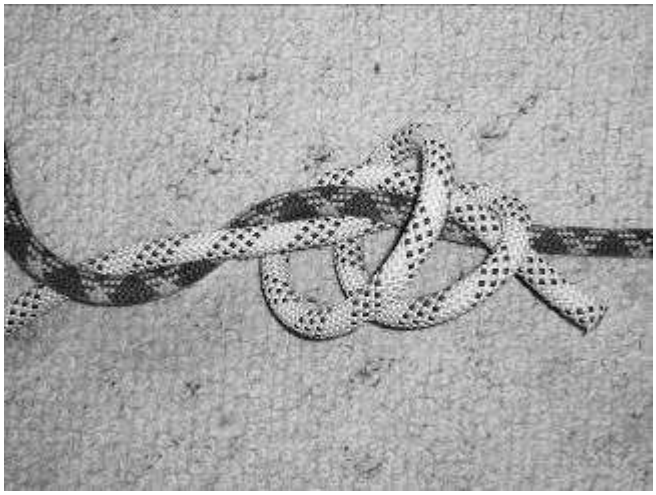
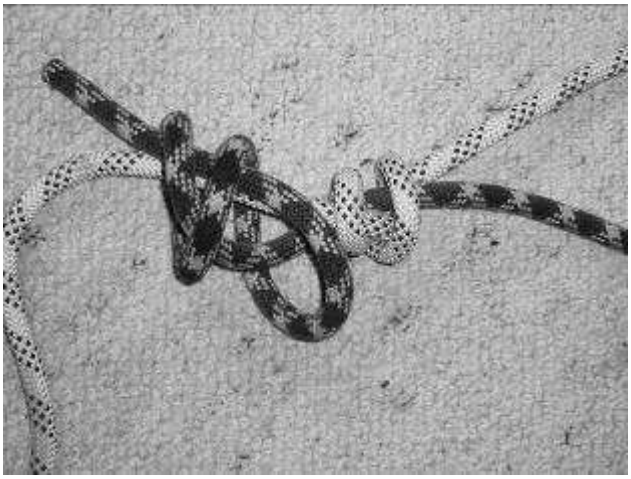
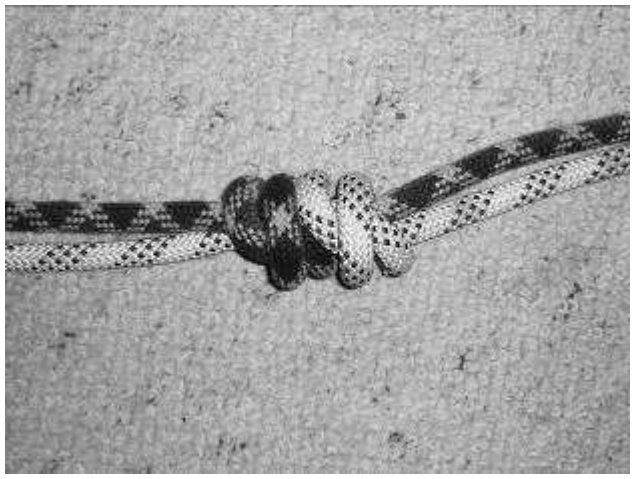




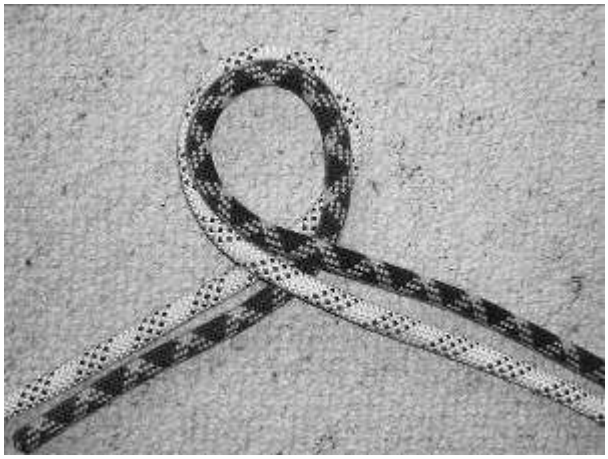
RETHREADED FIGURE of EIGHT

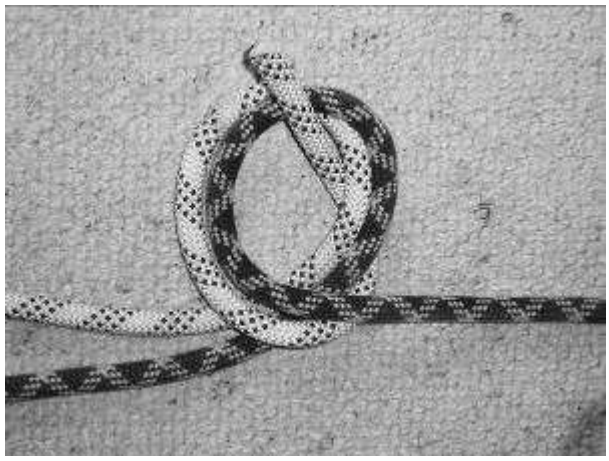
ALPINE BUTTERFLY

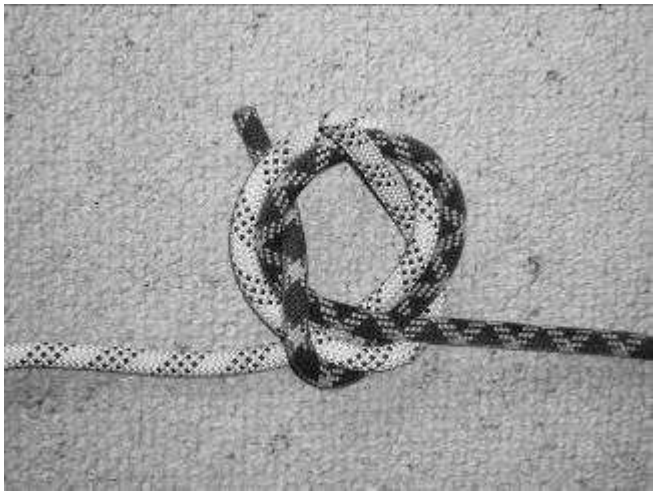


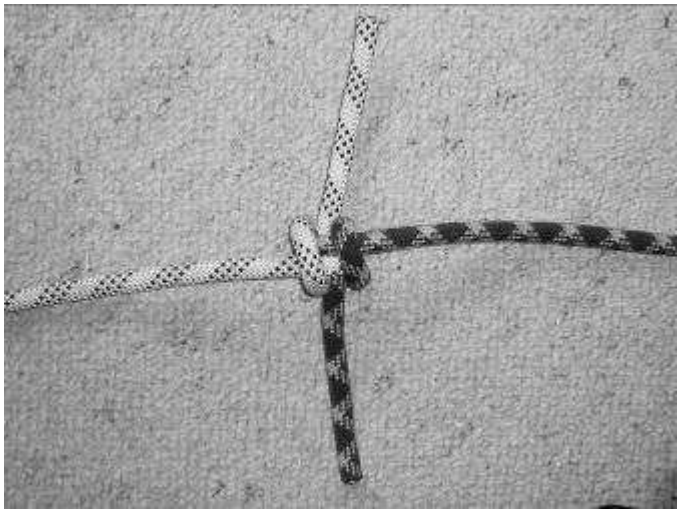
DOUBLE FISHERMAN'S
BEND

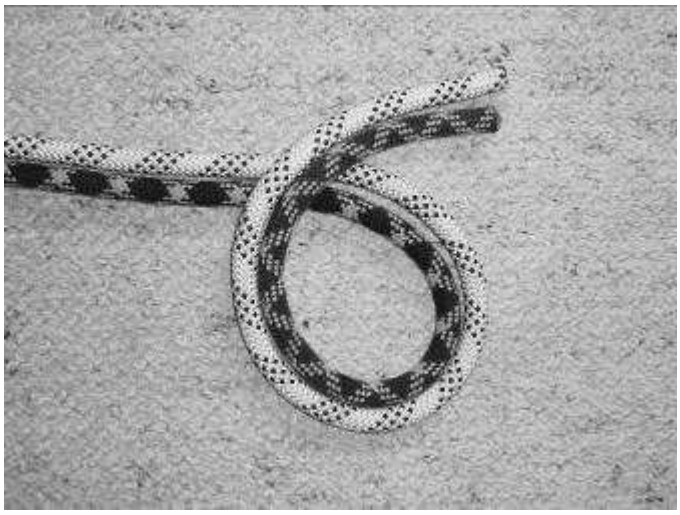




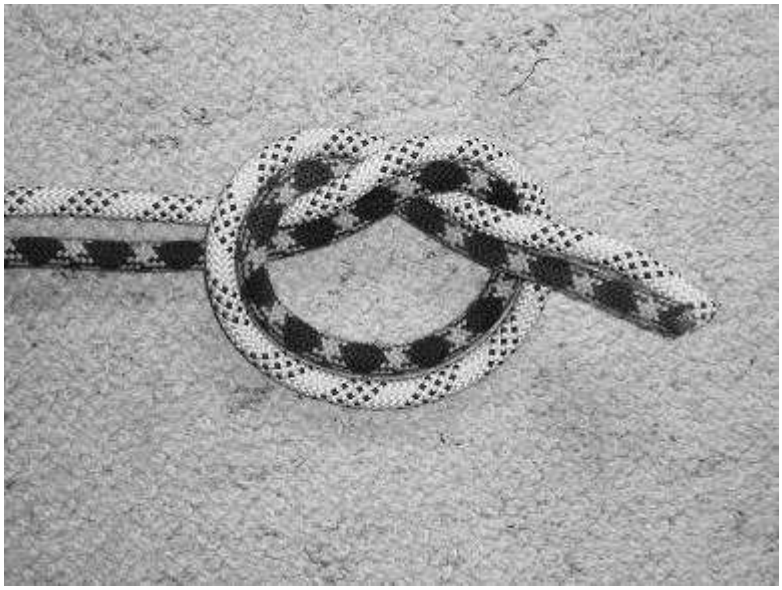


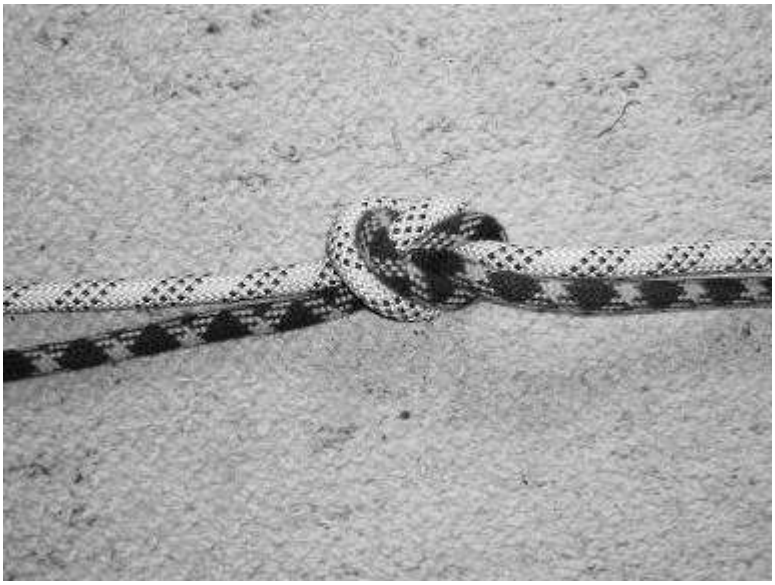
HUNTER’S BEND

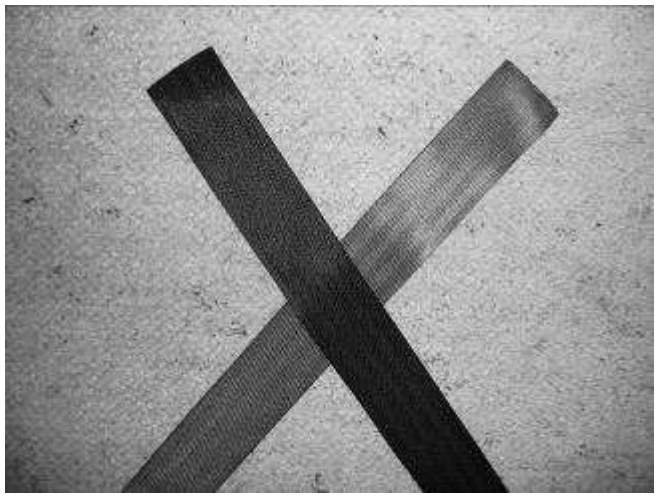


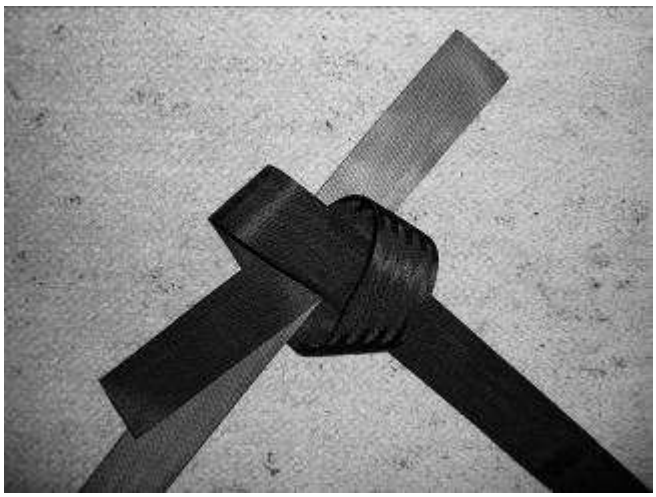


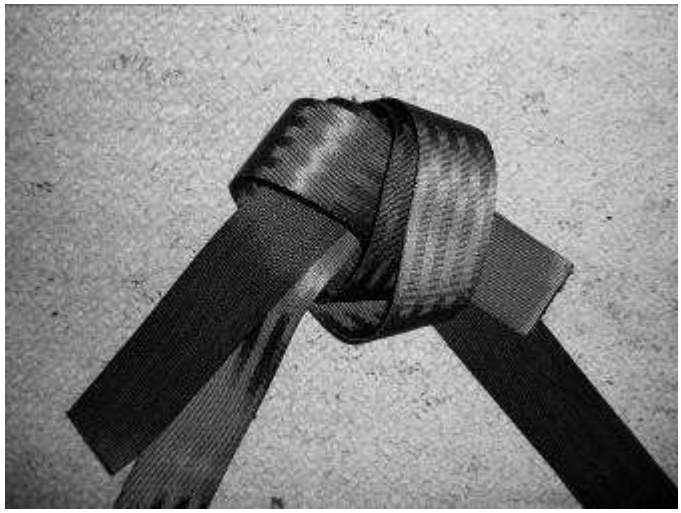
OVERHAND BEND











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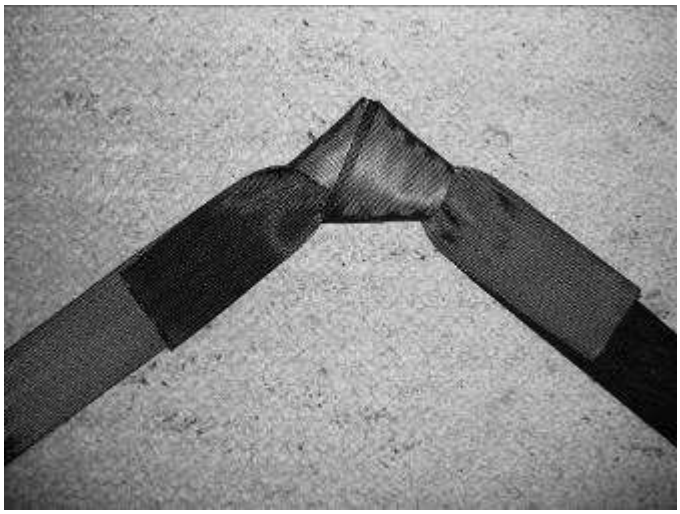
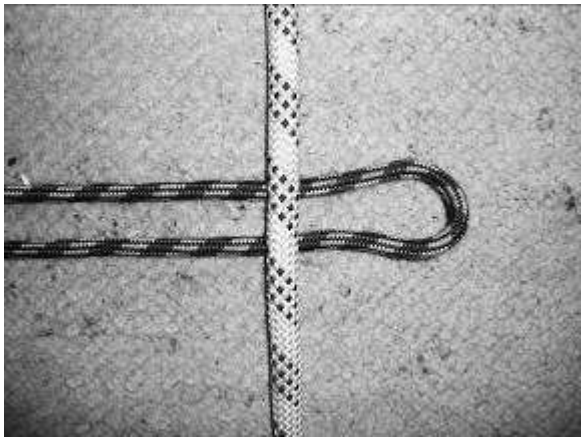
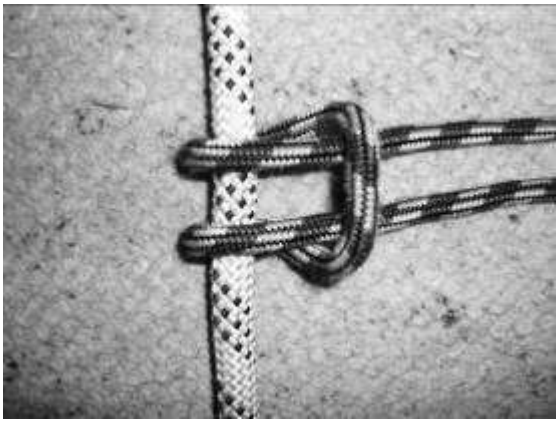
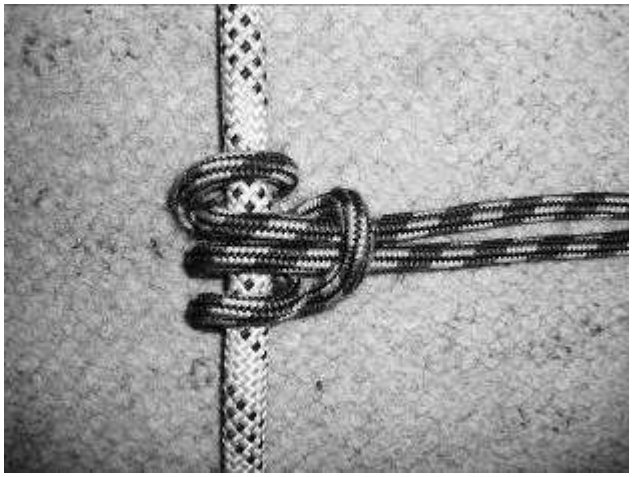
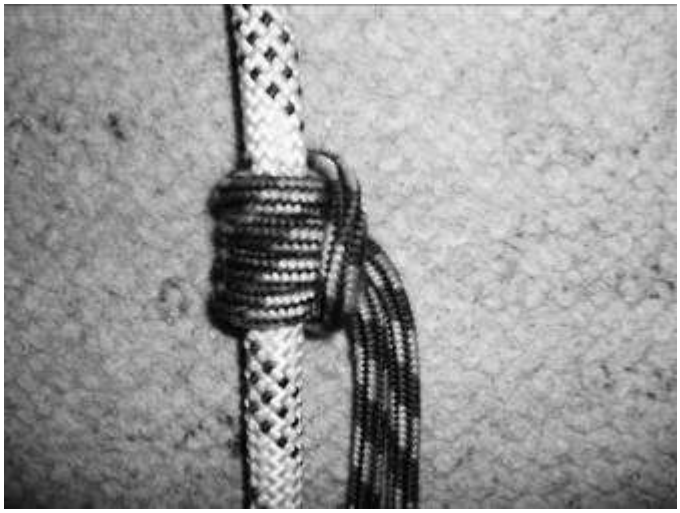


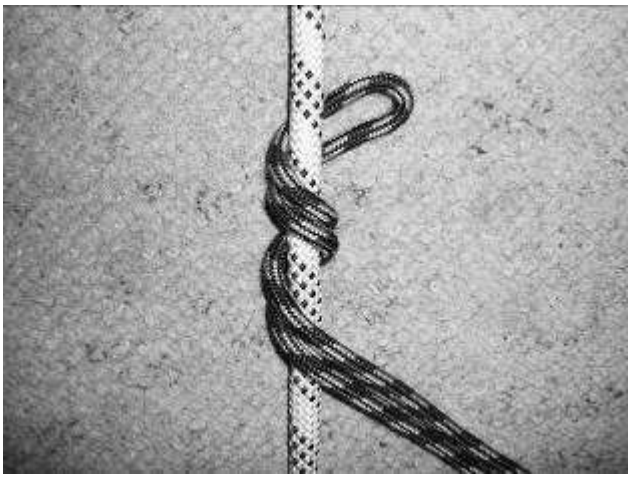


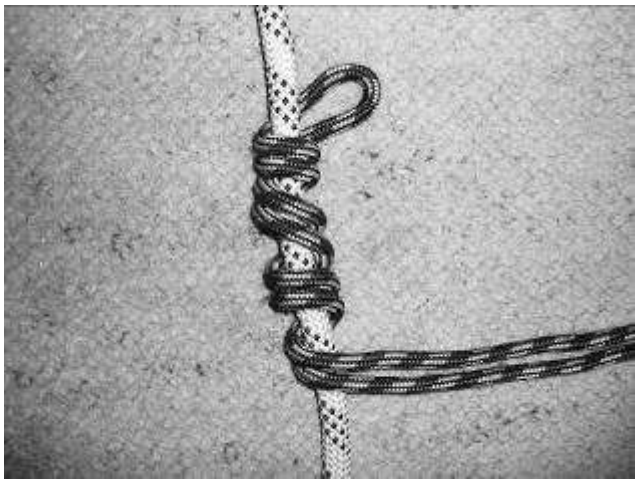


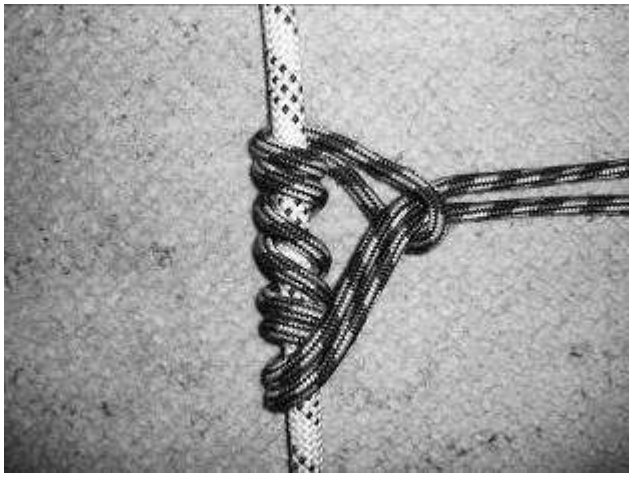


STANDARD PRUSIK

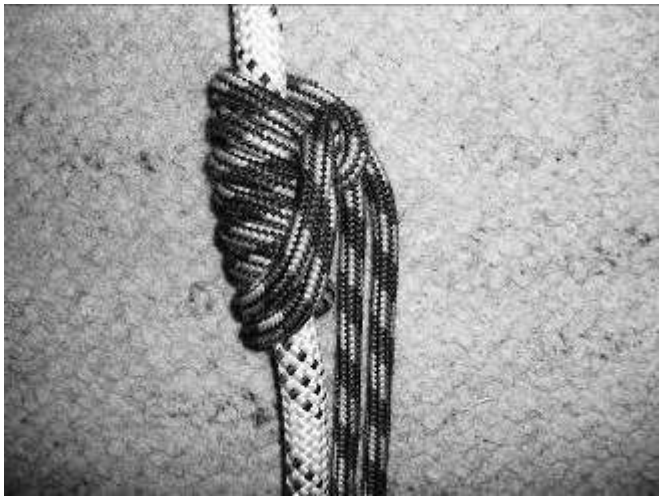


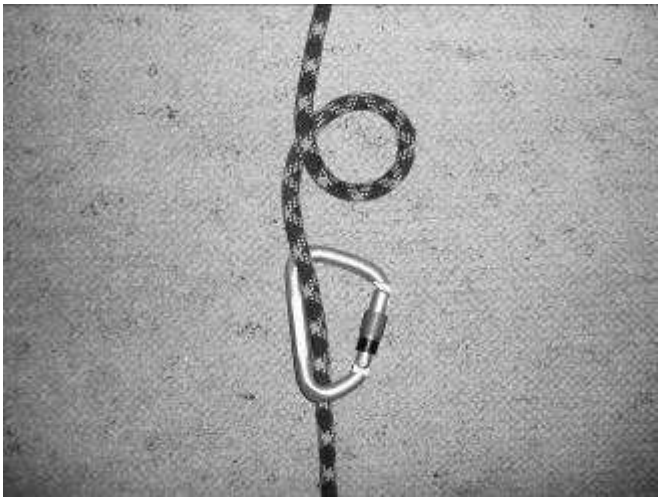


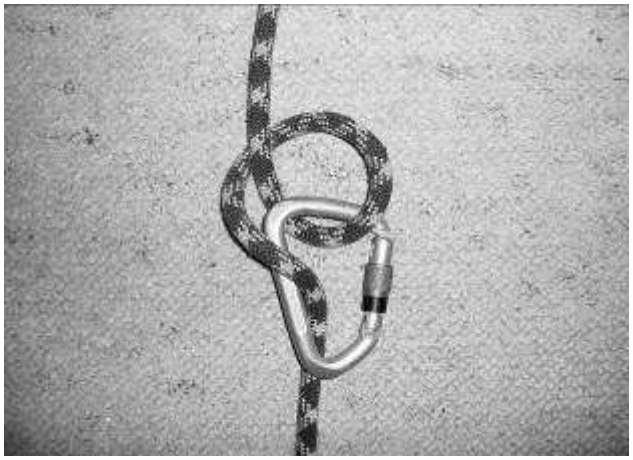




KLEMHEIST PRUSIK







MUNTER HITCH

REMEMBER YOUR A B C

Always

Be

Careful