ACKNOWLEDGEMENTS

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DEDICATION

To the youth who participate in abseiling and other outdoor education and adventure activities. They provided both the motivation and inspiration for this manual.
ABSEILING IS POTENTIALLY DANGEROUS

Over recent times there has been an increasing demand for less structured activities centred on outdoor experiences where excitement and adventure are to be found in stimulating environments.

Abseiling is one of these activities. It requires elements of skill, physical challenge, judgement, determination, and an appreciation of the environment, coupled with the hint of risk and danger. The skills and judgement of the abseiler are used to minimise the danger and finely control the risk.

This manual aims to provide a basis for acquiring those skills and the underlying knowledge needed to participate in abseiling, safely and enjoyably.

WARNING

• The activities and techniques covered in this text are potentially dangerous. Undertaking them without proper supervision, training, experience, skill, regard to safety, and equipment could result in serious injury or death.

• No endorsement or recommendation for specific uses or safety is implied in reference to particular products or techniques in this text.

• Familiarisation with the techniques in this text does not provide, nor imply, a specific level of competency.
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1. INTRODUCTION

Attention to detail is essential for safe abseiling. It is not a technically difficult sport, but there are many small points that need to be learned.

These are divided into four main sections:

1. INTRODUCTION / HISTORY
2. EQUIPMENT
3. TECHNIQUES
4. SAFETY
1.1.1. WHAT IS ABSEILING

Abseiling (also known as rappelling) means to descend by rope. It involves the use of some form of friction to control the descent down a fixed rope.

USERS

There are numerous activities that utilise the skills gained in abseiling. These include:

RECREATION:
Rock climbing
Mountaineering
Canyoning
Recreational Abseiling
Caving

RESCUE:
Abseiling techniques are utilised by Police, SES, Anti-terrorist groups.

INDUSTRY:
Industry uses abseiling in a wide variety of tasks such as inspection of towers, repair of roofs, pole maintenance, window cleaning etc.

MOTIVATION:
Many motivational courses use the excitement and exhilaration associated with abseiling as a means of instilling positive qualities in their participants.

MILITARY:
The armed forces routinely use these techniques for access to difficult terrain using orthodox methods, high speed descents, and from helicopters.
1.2. HISTORY

TECHNIQUE AND EQUIPMENT DEVELOPMENT

Abseiling started primarily as a means of descending after mountain climbing or for mountaineers to check new climbing routes. Modern equipment and technique developments have seen abseiling grow into a popular and stimulating sport in its own right.

The classic abseil (a) was considered an insecure and painful method that inflicted itself on generations of mountaineers. It was used because it required no special equipment other than the rope itself. The source of friction and control was achieved by having the rope running from between the abseilers legs, across the chest and over the shoulder. Today this technique is mainly used by advanced abseilers in emergency situations where no mechanical device is available.
1.2. HISTORY

Over the shoulder technique (b), a refinement of the classic abseil, bypassed thigh friction (and some of the discomfort) by incorporating a sit sling improvised from a long tape and a locking karabiner (metal ring).

Other techniques evolved using readily available climbing equipment such as pitons and combinations of karabiners to produce the required friction and thus taking the load off the abseilers back and shoulders (c).

Modern technology has lead to the continuing development of ropes, harnesses, devices and techniques making abseiling both safe and enjoyable giving it wide appeal.
2. EQUIPMENT

Most modern abseiling equipment is specifically designed and constructed to perform particular tasks. This necessitates a detailed knowledge of the equipment’s proper use, handling, care and cleaning.
Ropes form the basis of abseiling and are literally the abseiler's life line. How they perform this task is related to three fundamental factors:

1. MATERIALS: Steel  
   Fibre  
   Synthetic

2. CONSTRUCTION: Braided  
   Woven  
   Laid  
   Kernmantel

3. MAINTENANCE: Loading factors  
   Damage / abrasion / wear  
   Exposure  
   Cleaning  
   Storage  
   Retirement

What a rope is made from, how it is made, and how it is used and maintained, all contribute to the properties of the rope. The properties are those factors that determine how it feels, functions, and performs under different conditions.

PROPERTIES: Stretch  
   Tensile strength  
   Abrasion resistance  
   Friction  
   Handling qualities  
   Water absorption  
   Chemical resistance  
   Heat resistance  
   Sunlight resistance  
   Weight
2.1. ROPES / TAPES

The rope is arguably the most important piece of safety equipment the abseiler will use. As such, ropes must always be respected accordingly and treated in the correct way. It is not sufficient to use just any kind of rope. Ropes made for abseiling are highly specialised, and nothing but an approved abseiling rope should be used whenever this sport is practiced.

The earliest abseiling ropes used in the Victorian era were hawser-laid in construction (three strands wound together) and made of natural hemp fibre. These were not very strong. Nylon was invented in 1938 but laid ropes of this material were not introduced to abseiling until after the Second World War. Nylon-laid ropes are still available today, mostly for fixed ropes and handlines, but they are seldom used for abseiling as they kink badly and give a lot of friction and the ridges drag over rock edges. The most popular style of abseiling rope used today is known as kernmantel. This has an inner core or kern that gives the rope its major strength, stretch and load bearing properties, and an outer braided sheath or mantel that protects the core from abrasion and gives the rope its handling characteristics. Kernmantel ropes are classified as being static with low stretch characteristics or dynamic with greater stretch.
Ropes may be made of natural fibres, such as cotton, flax, hemp, coir (coconut fibre), manila hemp (from Abaca plant), henequin and sisal (both from species of Agave) or synthetic filaments, such as nylon, polyester, or glass fibres; or of metallic wire.

Hemp, used in Asia as early as 2800 BC, was adopted in Europe around 200 BC and remained the standard material for ropes until the 19th century, when it was replaced by Manila hemp from the Philippines. The introduction of synthetic fibres in the 1950s in turn replaced Manila hemp as the prime rope material. Modern ropes are made from materials that can be divided into three main categories.

- Metal
- Natural fibre
- Synthetic fibre

**METAL**

Steel ropes, because of their great tensile strength are used for heavy load applications or harsh conditions. Steel ropes are generally constructed from laid strands of galvanised or stainless steel, or other metals, sometimes with a hemp core. They can be used on cranes, tow ropes, ship’s rigging, and rope ladders. Their use in abseiling activities is generally restricted to non-rigid ladders.
2.1.1. MATERIALS

NATURAL FIBRE

Natural fibre ropes can be described as either hard or soft.

Hard ropes are made from manila, sisal and coir.

Manila (the name of a city in the Philippine Islands) is the material obtained from the leaves of Musa Textiles, a tree native to these islands. Sisal is a strong, durable white fibre of a plant that looks something like a spiky cactus, which grows in tropical regions. Coir is the prepared fibre of coconut husks.

Soft ropes include those made from flax, hemp, and cotton.

Flax is obtained from the stems of the plant from which linen is made and linseed oil is produced. Hemp is the common name of an Asian annual herb, Cannabis sativa, and also of its strong, pliable fibres. Hemp stems are hollow and have a fibrous inner bark. The fibres from this bark are used to make a great variety of textile products, including coarse fabrics, ropes, sailcloth, and packing cloth. Cotton is the white, downy, fibrous substance that covers the seeds of the cotton plant.

Note:
Ropes constructed of natural fibres are not considered suitable for recreational abseiling.
2.1.1. MATERIALS

SYNTHETIC FIBRE

Common man-made fibres used in the construction of ropes include:

- Nylon
- Terylene (polyester)
- Polypropylene

**Nylon** is a tough, stretchy, high strength fibre which is readily available as a continuous filament and has many properties which justify its use in abseiling. It is relatively sensitive to heat and should not be subjected to temperatures in excess of **150 degrees Celsius**. Two types of nylon are commonly used in rope manufacture, these are Nylon 6 and Nylon 66. Nylon 6, because of its inherent elastic properties, is the type of fibre used to manufacture most dynamic mountaineering ropes while Nylon 66 is used in static rope varieties such as Bluewater II.

**Terylene** is a high-density fibre that melts at 249 degrees Celsius. It is stable to 175 degrees Celsius in air compared to Nylon’s 150 degrees. While Terylene does not have the tensile strength or dry abrasion resistance of Nylon, it is scarcely affected by water, making it suitable for damp or wet conditions. Terylene is a lower stretch fibre than Nylon and therefore has a lower energy absorption factor. These ropes are not recommended for abseiling.

**Polypropylene and Polyethylene** fibres are extremely light, strong and they float on water, however they have a dangerously low heat resistance (110-165 degrees Celsius) with neither fibre considered safe above **50 degrees Celsius**. This makes the melting of the rope by a hot descending device a distinct possibility. These ropes are not recommended for abseiling.
2.1.2. CONSTRUCTION

The method of construction of a rope is the major factor, apart from the type of fibre used, governing the handling properties of that rope.

Fibres, whether continuous (monofilament) or short (staple), are thread like natural tissues or synthetic molecules, spun into yarns. Several yarns are then twisted to form strands. It is strands that form the basis of the various common types of rope construction.

- Laid
- Braided
- Woven
- Kernmantel

LAID ROPES

Laid ropes are constructed from three or more strands twisted together in a spiral fashion with the direction of twist known as the lay of the rope. Three strands twisted together in a clockwise direction form a hawser-laid rope. Four strands twisted together are called shroud-laid ropes and three hawser-laid ropes twisted together are called cable ropes. Laid ropes are known for their generally good abrasion resistance. This, however is their only strong point when applied to controlled descent techniques. A major drawback is that when ascending or descending on a free hanging pitch there is a tendency for the abseiler to spin, due to the rope untwisting under load. Laid ropes have a high stretch factor (eg. Hemp = 10%), also contributing to spin. Basically, laid ropes are not suited to controlled descents using mechanical descent devices, but they are quite suitable when using body friction techniques.

BRAIDED ROPES

Braided ropes have two clear advantages over laid ropes. They do not contribute to spin, and are available with low static stretch characteristics. A point to consider when selecting a braided rope is the tightness of the sheath since a rope with a tight sheath has higher abrasion resistance, but the tightness may contribute to stiffness.
2.1.2. CONSTRUCTION

WOVEN ROPES AND TAPES

Woven ropes and tapes have similar characteristics to braided ropes. In abseiling, woven tapes and cords are used for their strength and non-stretch properties in harnesses, and tubular and flat tapes are used in setups, etc.

KERNMANTEL ROPES

Kernmantel ropes consist of a core - or “kern” - of many small, hawser-laid cords. Each of these cords is in turn made up of twisted nylon filaments running the full length of the rope, and collectively taking up to 80% of the load. The cords are held together by a tightly plaited sheath called a “mantel”. It is this structure that makes kernmantel rope so strong, while being extremely flexible and easy to handle.

LAID ROPE

BRAIDED ROPE

WOVEN ROPE

SHEATH

CORE

KERNMANTEL ROPE
2.1.3. MAINTENANCE

The way a rope or tape is handled and cared for will directly affect some of its properties. The properties most affected are strength, handling qualities, and behaviour under loading. Ropes and tapes are generally purchased with particular properties in mind with respect to their intended use. The way a rope or tape is maintained is critical in preserving these properties. The following factors contribute to proper rope and tape maintenance.

PRE-USE PREPARATION:

Washing: Both synthetic and natural fibre ropes require treatment prior to their initial use. Synthetic rope must be washed to remove lubricants used in manufacture. The washing shrinks the rope (up to 5%), thereby tightening its strands, which reduces its stretch and improves its abrasion resistance.

Cutting and sealing ends: The cut ends of synthetic rope must be sealed by heat to melt fibre ends together. Natural fibre ropes need to have cut ends whipped in order to prevent them fraying or unravelling.

Marking ends of rope: The application of heat-shrink collar/ sleeves (25mm minimum) to the ends of the rope is optional but is helpful in identifying the pattern of use so that it can be reversed.

USE / LOADING:

Shock loading: Shock loading can occur as the result of an arrested fall, sudden drop or misuse. The result can be permanent distortion of the rope’s fibres. If a dynamic rope, in particular, is subjected to shock loading its function can be irreversibly compromised and it may have to be retired.

Overloading: Ropes are tested and rated by the manufacturer to establish their maximum recommended loading. This usually includes a margin for safety of at least five times its working load. It usually includes allowances for knots, strain and normal wear. Other factors such as water saturation (-0.7%), age (-0.5 to -0.9%), sharp bends (-0.7%), unequal strain (-0.8%), can further reduce its safe working load.
2.1.3. MAINTENANCE

Descending speeds: A moderate speed descent (0.5 metres per second) can generate temperatures of approximately 100 degrees Celsius over 100 metres, while a faster descent (2 metres per second) can generate temperatures of approximately 150 degrees Celsius. It is important to consider the softening temperature of ropes rather than their final melting temperatures since permanent rope damage or even complete failure will always occur when a rope softens. This is typically 50-100 degrees Celsius less than their melting temperature, eg Nylon 66 melts at 250 degrees Celsius and Nylon 6 at 215 degrees Celsius. It is therefore possible to do permanent damage to synthetic rope when descending at rates in excess of 2 metres per second.

DAMAGE / ABRASION / WEAR

Cuts: Ropes and tapes can be cut by the surfaces that they come in contact with such as sharp rocks, equipment etc. Damaged, poorly designed or worn equipment can expose ropes to sharp edges such as screw threads on karabiners, and wear points on devices. This will severely reduce the strength of the rope or tape. Cuts on the side of a tape can lead to rapid deterioration and loss of strength. Falling rocks can cause internal damage to ropes. For this reason ropes should be coiled and placed in a safe area away from falling rocks.

Wear points / abrasion: A constant problem while abseiling is abrasing the rope against sharp edges and protrusions whilst ascending and descending. This is known as external abrasion. Abrasion can be increased by up to 40-50% if the rope is wet. Another more subtle form of abrasion is due to dirt particles rubbing against the fibres inside the rope (internal abrasion). This can come about as a result of standing or treading on the rope particularly when ropes are dirty. Ropes should be kept clear of sand and grit where possible and rope protectors used where applicable, particularly over cliff edges.
2.1.3. MAINTENANCE

Heat abrasion: Heat abrasion usually from friction or poor heat dissipation, is often a subtle form of rope damage that can have a major effect on the strength and handling qualities. Tapes are particularly susceptible to weld abrasion where they come in contact with a rope. This produces partial melting of the tape and appears as a brown discolouration, or in severe cases could be partially or wholly worn through.

Kinking / knotting: All knots and kinks should be removed from the rope after every use to prevent permanent damage and weakening. Preventing damage from kinking can be achieved by flaking the rope before use and employing the proper storage techniques.

Normal wear: There is no hard and fast rule for determining a rope’s life expectancy. A rule of thumb is that ropes used for abseiling on an occasional basis (holidays) could be expected to last 2-4 years. With average use (weekends and holidays) a two-year life span could be expected. Heavy use could reduce the life expectancy of the rope to between 3 months and a year. Extreme use: ie. Falls and high velocity descents could result in immediate retirement of the rope.

EXPOSURE:

Chemicals: Various ropes, especially synthetic ones, are more susceptible to particular chemicals than others. No rope should be exposed to acid or the fumes from acid, as there can be visible or insidious invisible damage to the rope that can severely weaken it. Other chemicals that can adversely affect ropes are numerous and varied. They include all acids, alkalis, household sprays, etc.

Sunlight: Prolonged exposure to UV light can slowly degrade ropes, affecting properties such as strength and abrasion resistance. Leaving ropes in sunlit places such as the back window of a car should be avoided.

Moisture: A wet rope is not only an inconvenience, it affects many of the rope’s properties such as strength, abrasion resistance, and weight. In cold conditions a wet rope may freeze, causing deterioration in its properties.
2.1.3. MAINTENANCE

CLEANING:

Washing: Ropes should be washed regularly or when dirty to remove grit, grime and metal oxides. This reduces the effect on both the rope and abseiling equipment. Ropes are best washed in a washing machine after being chained or flaked into a lightweight bag such as a sleeping bag cover. Mild detergents (preferred), soap, and even fabric softeners can be used to clean and improve handling qualities. Bleach should not be used on nylon rope. Specialised devices (eg, the “Dobi”) are available that are specifically designed to wash kernmantel ropes.

Drying: Ropes should be dried in the open air out of direct sunlight.

STORAGE:

Chaining: Chaining is a method for temporarily storing or transporting a rope. It minimises tangling of the rope and unravels without knotting.

Coiling: Coiling is employed to store abseiling ropes over extended periods of time. The rope is looped in approximately one-metre lengths. Placing a loop in one end and rapping the other end around the coiled rope, passing it through the first loop, and pulling tight secures the coils.

Flaking: Flaking involves playing the rope out on the ground or into a bag and is used to ensure a rope is untangled before use. It also minimises the chance of the rope becoming knotted because of tangling and kinking when in use.
2.1.3. MAINTENANCE

SUMMARY: An abseiling rope should be considered for retirement, restricted use or modification (cutting, knotting) to remove a problem area, if it exhibits any of the following features:

- Excessive wear or cutting of outer cover (50% fibres damaged)
- Areas of reduced (necking) or increased size
- Decayed, soft or burnt areas
- Internal powdering (laid rope)
- Distortion of lay
- Loss of flexibility due to excessive loading

A good time to check a rope is during coiling and uncoiling when visual inspection can be made as well as the feel of the rope as it runs through the hands.
2.1.4. PROPERTIES

Abseiling ropes are constructed of a type of nylon called perlon and are extremely strong, most have almost a 3.06 tonne (3 ton) breaking strain. There are different ropes and varying diameters for different techniques, eg single rope - usually 11 mm in diameter, and double ropes - usually 9mm diameter, as well as a variety of static and dynamic characteristics.

While these properties are interrelated it is useful for advanced abseilers to be familiar with their individual characteristics.

The materials used, construction method and the use and care of a rope, all influence the properties of that rope.

PROPERTIES OF A ROPE:

- stretch
- tensile strength
- abrasion resistance
- friction
- handling qualities
- weight
- water absorption
- chemical resistance
- heat resistance
- sunlight resistance
2.1.4. PROPERTIES

STRETCH
The material and construction methods both contribute to the amount of stretch of a rope.
The basic stretch factor of ropes is as follows:
- Fibre ropes 10%
- Static synthetic ropes 2% - 5%
- Dynamic synthetic ropes 5% - 7%
- Webbing tapes Less than 2%

These figures are for static loading conditions. If shock loads are applied to any of the above, then stretch factors are as follows:
- Fibre ropes no appreciable stretch over 10%
- Static synthetic ropes no appreciable stretch over 5%
- Dynamic synthetic ropes up to 25%
- Webbing tapes no appreciable stretch over 2%

TENSILE STRENGTH
Australian Standard AS 4142.3 - 1993, 'Fibre ropes - Part 3: Man-Made fibre rope for static life rescue lines.'
The tensile strength is defined as the load that must be applied to a rope to cause it to break. The safe working load (SWL 8:1 ratio eg: 3000kg = 375kg) is based on the manufacturer's recommendation and takes into consideration knots, bends and shock-loads, which can reduce strength up to 30%. It should also be noted that Nylon fibres lose much of their capacity to absorb energy by irreversible stretching if they have been subjected to a severe load.

ABRASION RESISTANCE
This is a very important property of ropes used for abseiling. Some rope types are far more durable than others in their resistance to both internal and external abrasion.
2.1.4. PROPERTIES

FRICITION

The friction offered by the surface of a rope is the major determinant of the amount of control given by a descent device and the ease of pushing up an ascending device. Good descent control and low resistance to the movement of an ascent device are important rope qualities. The friction of the rope largely depends on its construction and age (wear, fussing).

HANDLING QUALITIES

The handling qualities of a rope include such factors as flexibility, grip, ease of packing, knotting quality, and susceptibility to kinking or tangling. For the most part, these variables are hard to define and only become apparent under actual use. Some idea of a new rope’s handling characteristics can be gained by forming it into knots, passing it through a descending device, and performing other standard operations. These properties will change with wear and washing. Supplexness is a much-valued handling property, but not at the expense of a loosely braided sheath, which abrades easily and admits damaging grit.

WEIGHT

The weight of a given length of rope is generally proportional to its strength, but can be a disadvantage if the rope has to be carried for any distance.

WATER ABSORPTION

Water absorption will affect the weight of the rope, the likelihood of the rope freezing in cold weather and will reduce all aspects of a rope’s performance. Nylon ropes absorb water readily into the spaces between the fibres and into the fibres themselves. This has dramatic effects on the properties of the rope. Tensile strength will be reduced by approximately 10% and abrasion resistance by 40-50%.
2.1.4. PROPERTIES

CHEMICAL RESISTANCE
Chemical resistance varies with the type of fibre used to make the rope, but all ropes are susceptible to particular chemicals. Synthetic ropes are particularly susceptible to acids, alkalis, petrol etc.

HEAT RESISTANCE
Heat resistance affects all ropes. Synthetic ropes are highly susceptible to both radiant and direct heat with subsequent reduction in safe working loads due to softening. Various descenders generate a great deal of heat through friction but are unable to dissipate this heat rapidly.

SUNLIGHT RESISTANCE
Resistance in Nylon ropes to the effects of ultra-violet radiation has been increased with the addition of more resistant fibres and stabilisers. However, the problem has not been eliminated and exposure to sunlight slowly degrades synthetic rope causing a loss of strength and abrasion resistance.

PROPERTIES OF AN ABSEIL ROPE
The stretch property of a kernmantel rope determines if it is classified as a static or dynamic rope. Static or low stretch ropes are generally used for abseiling where the rope is subjected to relatively constant loading. Dynamic or high stretch ropes are used in climbing and belay applications where the dissipation of forces due to shock loading of the rope is desirable. The dynamic nature of the rope reduces loading on the participant and other equipment such as anchor points in the event of an arrested fall sudden loading.
# 2.1.4. PROPERTIES

## PROPERTIES OF ROPES

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<td><strong>Stored wet</strong></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Stretch</strong></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td><strong>Petrol / oil</strong></td>
<td>**</td>
<td>**</td>
<td>***</td>
<td>****</td>
</tr>
</tbody>
</table>

Note: This table is for comparison of rope materials only and not a recommendation for use.
### 2.1.5. TYPES and USES

#### NOTES

**TAPES**

**SET UPS**

50mm TAPE (flat)

**TAPE HARNESS**

25mm TUBULAR TAPE

**SECUING HARNESS**

25mm TAPE (flat)

**Bottom harness**
Anchor tape (looped three or more times for strength)

**Very strong for anchor tape**
Top harness

**Securing harnesses. Needs three or more loops for strength**

**ROPES**

**ABSEILING ROPE**

11mm KERNMANTEL ROPE

9mm KERNMANTEL ROPE

**PRUSIK LOOPS**

7mm KERNMANTEL ROPE

5mm KERNMANTEL ROPE

**Foot loops**
Prusik loops
Securing equipment

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A thorough knowledge of knots is essential for advanced abseiling. Each of the knots presented has several applications and possible substitutes. The decision as to which knot is best used for a particular application is based on its comparative strength, security, convenience, and its appropriateness for the rope or tape.

It must be remembered that all knots weaken the rope to some extent, some up to one third of its original strength. The ability to select the right knot for a specific use, on a particular rope or tape, and to be able to tie and untie the knot confidently, are fundamental skills for the advanced abseiler.
2.2.1. FEATURES

The five features of a good knot are:

- versatility
- security
- strength
- ease of tying
- ease of checking.

Check the knot visually after tying. Chances are, if it doesn’t look right, then it is not right. Also check other people’s knots before using them; this should be viewed as standard practice and not an insult.

All knots should be dressed after tying. Dressing means orienting the rope within the knot so that it is in its proper relationship to the other parts of the knot. Any knot may be prone to slight slippage under load. To allow for this, all knots should be set. Setting is the process of tightening various parts of the knot by hand to create friction within the knot. The tail-ends of the rope should protrude from the knot at least enough to tie a stopper or keeper knot that prevents the main knot untying or slipping.

Most knots reduce the strength of the rope in which they are tied, generally by 20-40% of the unknotted strength. Knowledge of knot strength is therefore useful but should be kept in perspective: eg bending a rope around a karabiner is likely to cause a greater strength loss than any common knot.
### 2.2.2. TERMINOLOGY

Before learning specific knots and/or hitches, it is useful to be familiar with some accepted terms associated with rope handling and tying.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre</td>
<td>The basic synthetic or natural material that the rope is made from.</td>
</tr>
<tr>
<td>Yarns</td>
<td>The individual fibre is spun into continuous yarn.</td>
</tr>
<tr>
<td>Strands</td>
<td>The individual layers of fibre twisted together to form the rope.</td>
</tr>
<tr>
<td>Lay</td>
<td>The way in which the strands are made up or twisted to form the rope.</td>
</tr>
<tr>
<td>End (tail)</td>
<td>The last few centimetres of the rope.</td>
</tr>
<tr>
<td>Standing part</td>
<td>The main length of rope</td>
</tr>
<tr>
<td>Running end</td>
<td>The end opposite to the standing end.</td>
</tr>
<tr>
<td>Bight</td>
<td>A curve in the rope created by bringing the end to the standing part but not crossing them.</td>
</tr>
<tr>
<td>Loop</td>
<td>Formed by crossing the end over standing part. (overhand or underhand)</td>
</tr>
<tr>
<td>Bend</td>
<td>To join or make fast two ropes with a definite and recognised knot.</td>
</tr>
<tr>
<td>Hitch</td>
<td>Knots used to attach a rope to a spar or similar object.</td>
</tr>
<tr>
<td>Knot</td>
<td>An interweaving of one rope only.</td>
</tr>
<tr>
<td>Stopper</td>
<td>A securing knot to prevent the main knot from slipping or undoing.</td>
</tr>
</tbody>
</table>
LISTED BY USE

End Knots:
- FIGURE of EIGHT KNOTS
- BOWLINE with stopper knot

Middle Knot:
- ALPINE BUTTERFLY
- UNIDIRECTIONAL FIGURE of EIGHT

Joining Knots:
- DOUBLE FISHERMAN’S (rope)
- TAPE KNOT (tape)
- THREADED FIGURE of KNOT

Friction Knots:
- PRUSIK KNOT
- ITALIAN FRICTION HITCH
- KLEMHEIST KNOT
- BACHMANN KNOT

Securing Hitches: (Not SETUPS)
- HALF HITCH
- CLOVE HITCH
- ROUND TURN and TWO HALF HITCHES

Stopper Knots:
- THUMB KNOT
- FIGURE OF EIGHT
### 2.2.4. TYPES

**ALPHABETICAL LISTING**

<table>
<thead>
<tr>
<th>TYPE:</th>
<th>USES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpine Butterfly</td>
<td>Mid rope perpendicular attachment points</td>
</tr>
<tr>
<td>Bachmann</td>
<td>Uni-directional friction, Ascending knot</td>
</tr>
<tr>
<td>Bowline</td>
<td>Non slip knot used in emergency with stopper knot</td>
</tr>
<tr>
<td>Clove hitch</td>
<td>Starting knot</td>
</tr>
<tr>
<td>Double figure of eight</td>
<td>End knot or attachment</td>
</tr>
<tr>
<td>Double fisherman’s</td>
<td>Joining rope or cord</td>
</tr>
<tr>
<td>Double headed figure of eight</td>
<td>End knot for multiple attachment</td>
</tr>
<tr>
<td>Dulhunty Loop</td>
<td>Adjustable loop</td>
</tr>
<tr>
<td>Figure of eight</td>
<td>Stopper knot</td>
</tr>
<tr>
<td>Italian friction hitch</td>
<td>Bi-directional friction knot</td>
</tr>
<tr>
<td>Klemheist knot</td>
<td>Uni-directional friction knot</td>
</tr>
<tr>
<td>Prusik knot</td>
<td>Uni-directional friction knot</td>
</tr>
<tr>
<td>Round turn &amp; two half hitches</td>
<td>Attaching rope to a support</td>
</tr>
<tr>
<td>Tape knot</td>
<td>Joining all tapes</td>
</tr>
<tr>
<td>Threaded figure of eight</td>
<td>Tying a loop around an object</td>
</tr>
<tr>
<td>Thumb knot (overhand knot)</td>
<td>Stopper or keeper knot</td>
</tr>
<tr>
<td>Two half hitches</td>
<td>Finishing off knot</td>
</tr>
<tr>
<td>Unidirectional figure of eight</td>
<td>Mid rope attachment points along direction of pull</td>
</tr>
</tbody>
</table>
ALPINE BUTTERFLY KNOT

MAIN APPLICATIONS:
Forms loops along rope giving secure attachment points.

ADVANTAGES:
Loop won't slip or tighten, allows for precise placement of loops, easily untied.

DISADVANTAGES:
Complicated to tie.

SPECIAL POINTS:
The knot is particularly effective when the load is to be applied at right angles to the rope.

TO TIE THE KNOT:
1. Form a loop in the rope and hold it in one hand at the point where the rope crosses itself.
2. Make another twist in the same direction and produce another eye.
3. Fold the first loop over the standing part and through the second eye.
4. Pull the loop through and tighten it by pulling on the standing parts.
MAIN APPLICATIONS:
A sliding friction knot useful for prusiking and pulley systems.

ADVANTAGES:
Less likely to jam after loading than prusik knot. It also holds well on wet or icy ropes.

DISADVANTAGES:
Needs both hands to tie.

SPECIAL POINTS:
Altering the number of turns can vary the amount of friction.

TO TIE THE KNOT:
1. Place a karabiner through a loop of rope.
2. Position the back of the karabiner (the long side opposite the gate) against the rope and parallel to it.
3. Wrap the loop around the main rope and back through the karabiner so that it encircles both.
4. Continue wrapping the loop around both the main rope and karabiner making a minimum of three turns.
5. Tension is placed on the free end of the loop to lock the knot.
BOWLINE KNOT

MAIN APPLICATIONS:
Non slip knot used for rescues and attaching rope.

ADVANTAGES:
Can be tied one handed.

DISADVANTAGES:
Can distort to form a slip knot if tightened incorrectly.

SPECIAL POINTS:
Should be used with a stopper knot.

TO TIE THE KNOT:
1. Place an overhand loop at a distance from the end of the rope to allow the running end to pass around or through the supporting object.
2. Pass the tail through the loop from the under side and around the back of the standing end.
3. Bring the tail back down through the loop from the top.
CLOVE HITCH

MAIN APPLICATIONS:
General purpose hitch for attaching a rope to a beam, spar, or pole.

ADVANTAGES:
Quick to tie. Can be formed anywhere along the rope if the end of the object is accessible.

DISADVANTAGES:
Hard to keep tension on rope while tying.

SPECIAL POINTS:
For security needs two half hitches on the standing part as it can work loose if load is erratic. Is particularly good when speed is important.

TO TIE THE KNOT:
1. Pass the running end around object.
2. Bring the end across the standing part and around the bar again.
3. Pass the end through the loop formed by the second turn around the object so that the tail exits in the opposite direction to the standing end.
4. An alternative method if one end of a beam is accessible is to form opposite (overhand, underhand) loops in the rope, aligning the loops so that they pass over the end of the beam.
DOUBLE FIGURE of EIGHT KNOT

MAIN APPLICATIONS:
End knot. Setups. Attaching rope to equipment. Foot loops.

ADVANTAGES:
Strong, uncomplicated, and unlikely to work loose. Easy to tie and undo. Easily checked.

DISADVANTAGES:
Difficult to adjust.

SPECIAL POINTS:
Secure with stopper knot.

TO TIE THE KNOT:
1. Form a bight in the end of the rope and let it fall over the back of the hand holding the rope.
2. Bring the bight to the front of the standing part and continue it to encircle the standing part one full turn.
3. Pass the end through the loop formed and pull to tighten.
DOUBLE FISHERMAN’S KNOT

MAIN APPLICATIONS:
Forming loops in accessory cords eg. prusik loops. Joining main ropes.

ADVANTAGES:
Strongest knot for joining ropes.

DISADVANTAGES:
Bulky knots on larger ropes. Difficult to tie. Consumes more rope than simpler knots.

SPECIAL POINTS:
Check frequently for tightness and creep of tails. Leave long tails.

TO TIE THE KNOT:
1. Hold both ends to be joined with sufficient overlap of their running ends.
2. Wrap one running end twice around the standing part of the second rope so that it overlaps itself.
3. Pass the tail through the loops formed.
4. Mirror the procedure for the second rope.
DOUBED HEADED

FIGURE of EIGHT KNOT

MAIN APPLICATIONS:
Joining rope to multiple anchor points. Two attachment points on end of rope

ADVANTAGES:
Strong secure knot.

DISADVANTAGES:
Bulky knots on larger ropes. Difficult to tie. Consumes more rope than simpler knots.

SPECIAL POINTS:
Check frequently for tightness and creep.

TO TIE THE KNOT:
1. Form a large bight in the end of the rope and let it fall over the back of the hand holding the rope.
2. Bring the bight to the front of the standing part and continue it to encircle the standing part one full turn.
3. Form a second bight in the end of the rope and pass most through the loop formed.
4. The loop in the end of the rope is passed over the knot and the two loops forming the second bight are pulled tight.
DULHUNTY LOOP

MAIN APPLICATIONS:
Rescues, belaying, footloops.

ADVANTAGES:
Variable length.

DISADVANTAGES:
May slip under heavy loading.

SPECIAL POINTS:
The length of the loop can be adjusted by sliding the prusik knot along the loop.

TO TIE THE KNOT:
1. Form a prusik knot around an index finger so that the joining knot of the loop is on the side opposite of the prusik knot.
2. Pass the prusik loop containing the joining knot through the prusik knot.
3. Place two locking karabiners in the main loop.
4. Place the small loop containing the joining knot in one of the karabiners.
FIGURE of EIGHT KNOT

MAIN APPLICATIONS:
End knot.

ADVANTAGES:
Strong, uncomplicated, and unlikely to work loose. Easy to tie and undo. Easily checked.

DISADVANTAGES: Uses more rope and more complicated to tie than a thumb knot.

SPECIAL POINTS:

TO TIE THE KNOT:
4. Let the end of the rope fall over the back of the hand holding the rope.
5. Bring the end to the front of the standing part and continue it to encircle the standing part one full turn.
6. Pass the end through the loop formed and pull to tighten.
ITALIAN FRICTION HITCH

MAIN APPLICATIONS:
Friction hitch useful for belaying, and can be used with a locking karabiner in place of a descending device for abseiling.

ADVANTAGES:
Simple and easy to tie with no additional equipment needed other than karabiner.

DISADVANTAGES:
Can be easily tied incorrectly by being confused with clove hitch.

SPECIAL POINTS:
Should only be used with locking karabiner.

TO TIE THE KNOT:
1. Form two loops on either side of the rope (one overhand and one underhand loop).
2. Bend both loops forward
3. Place a karabiner through the loops and pull the tail of the rope down to tighten knot.
KLEMHEIST KNOT

MAIN APPLICATIONS:
Ascending main rope, temporarily securing main rope.

ADVANTAGES:
Facilitates variable friction, easier to release after loading than prusik knot.

DISADVANTAGES:
Difficult to tie one-handed, possible failure under shock loads.

SPECIAL POINTS:
Cord should be at least 3mm smaller in diameter than main rope. The number of turns dictates friction.

TO TIE THE KNOT:
1. Wrap loop around main rope three or more times leaving several centimetres of the loop free on the top end.
2. Bring the lower end back up through loop at the top.
3. Pull on the lower end of loop to tension knot.
PRUSIK KNOT

MAIN APPLICATIONS:
Climbing a rope (prusiking), temporarily securing person or equipment to a rope. Self belay.

ADVANTAGES:
Simple to tie, slides along rope when loose but locks when force is applied parallel to rope.

DISADVANTAGES:
May slip if rope is wet or icy. Needs the load to be completely removed in order to unlock the knot.

SPECIAL POINTS:
The rope used for the prusik loop must be at least three millimetres smaller in diameter than the main rope.

TO TIE THE KNOT:
1. Pass the prusik loop over the main rope forming a bight in one end.
2. Pass the bight through the loop two or more times.
3. Pull the bight to tighten the knot.
ROUND TURN & TWO HALF HITCHES

MAIN APPLICATIONS:
Securing a rope to post, pole, or beam eg. Abseiling setups.

ADVANTAGES:
Simple to tie, can be loaded from most directions, does not significantly weaken rope.

DISADVANTAGES:
Could work loose with on and off loading.

SPECIAL POINTS:
An excellent hitch for securing the end of a rope to any object. Should be secured with stopper knot.

TO TIE THE KNOT:
1. Pass the end of the rope around the object twice (or more times) without crossing over itself.
2. Take the end of the rope over the standing part and form a half hitch.
3. Continue the end over the standing part in the same direction to form a second half hitch.
MAIN APPLICATIONS:
The only knot suitable for joining flat tapes or straps.

ADVANTAGES:
Simple to tie, secure.

DISADVANTAGES:
May slip or the ends may work through if insufficient tail is left.

SPECIAL POINTS:
Sufficient tail should be left to tie a thumb knot (overhand knot) on each side of the knot. This should be approximately five times the tape width.

TO TIE THE KNOT:
1. Form a thumb (overhand) knot in one end of the tape leaving sufficient tail.
2. Pass the other end of the tape (to form a loop) or the end of the second tape through the first knot following it’s path in reverse direction.
3. Secure the knot by applying weight to either side of the knot and tie thumb knots around the tape using the tails.
MAIN APPLICATIONS:
Attaching rope around a support or through loops in equipment.

ADVANTAGES:
The same advantages as a double figure of eight plus it can be threaded around or through objects that aren’t accessible to preformed loops.

DISADVANTAGES:
Takes more concentration to tie than standard figure of eight.

SPECIAL POINTS:
Should be secured with stopper knot. More secure than bowline.

This same method can be used to join two ropes of equal thickness if a second rope is threaded through the first figure of eight knot.

TO TIE THE KNOT:
1. Place a standard figure of eight knot at a distance from the end of the rope to allow the tail to pass around or through the supporting object.
2. To form the knot place a loop in the rope, pass the end around the standing part and through the loop.
3. After passing the running end around or through the support, the tail is threaded back through the figure of eight knot following the standing part in a reverse direction.
Platform Knot

**MAIN APPLICATIONS:**
Stopper knot, end knot, and used to prevent the end of a rope unravelling.

**ADVANTAGES:**
Simple and quick to tie.

**DISADVANTAGES:**
May be difficult to untie after loading.

**SPECIAL POINTS:**
Can be used in conjunction with a tape knot as a stopper knot.

**TO TIE THE KNOT:**
Take the running end over the standing part and then through the loop formed.
TWO HALF HITCHES

MAIN APPLICATIONS:
Attaching a rope to a beam. Finishing knot.

ADVANTAGES:
Can be tied with rope under tension. Simple to tie and untie.

DISADVANTAGES:
Limited security.

SPECIAL POINTS:
A very good all purpose hitch.

TO TIE THE KNOT:
1. Pass the end of the rope through or around the object to which it is
to be secured.
2. Pass the end of the rope over and around the standing part
creating a loop and continue passing the end through the loop.
3. Take the end of the rope around the standing part again below the
first half hitch.
4. Bring the end of the rope up through the loop formed and pull
tight.
UNIDIRECTIONAL
FIGURE of EIGHT KNOT

MAIN APPLICATIONS:
Forms loops along rope giving secure attachment points that can be loaded in the direction of pull.

ADVANTAGES:
Loop won’t slip or tighten, allows for precise placement of loops, easily untied.

DISADVANTAGES:
Complicated to tie so that the loop faces in the right direction.

SPECIAL POINTS:
The knot is particularly effective when the load is to be applied in the direction of pull.

TO TIE THE KNOT:
5. Form a loop in the rope and hold it in one hand at the point where the rope crosses itself.
6. Make another twist in the same direction and produce another loop in the standing part.
7. Fold the first loop over the standing part and through the second.
8. Pull the loop through and tighten.
2.3. HARNESSSES

Harnesses are used to secure a descending device and other equipment to the abseiler. They vary from relatively simple and easy to construct tape harnesses to sophisticated, commercial harnesses. All harnesses have properties that vary according to the intended task and budget.

1. PROPERTIES:
   • distributes load to strongest part of body
   • spreads out shock
   • simplifies attachment to rope
   • comfort
   • strength
   • attachment points for equipment

2. TYPES:
   Commercial
   • nappy
   • sit
   • chest
   • full-body

   Tape harnesses
   • chest
   • seat
A good harness should distribute the load to the strongest part of the body. This is usually the pelvis as it is a strong bony ring, with strong joints and powerful muscles to protect it.

The harness should also disperse any shock so that the pressure is not applied to one point or in a narrow band, which could potentially cause injury in the event of a sudden load.

The design of the harness should simplify attachment to the rope using karabiners, maillon etc.

Above all, a good harness should be comfortable to wear, particularly if it is to be used for extended periods of time. With ever improving materials, manufactured and tape harnesses can be of lightweight construction without sacrificing strength, durability, or comfort.

A secondary, but not necessarily unimportant consideration, is the provision of attachment points for equipment such as prusik loops, karabiners, and rescue equipment.
2.3.2. TYPES

COMMERCIAL HARNESSSES

There is a wide range of commercially manufactured harnesses that provide security, comfort and convenience to abseiling enthusiasts. Following is a description of four types of commercially made harnesses.

Nappy: A rugged non-adjustable general-purpose harness made of one-piece construction.

Sit: A sit harness is generally made up of a waistband, leg loops, and at times an extra supporting loop. These can be fixed or adjustable and are generally designed to afford comfort, ease of use, and attachment points for equipment.

Chest: A chest harness can be a fixed or adjustable harness generally made of tape or tube that crosses at the back and is attached directly to the rope using a mechanical ascending device, or to the seat harness as a safety measure. They are not used as the primary means of support or connection to the rope.

Full-body: The full body harness is a combination of sit and chest harnesses in one unit and is particularly good for young children or where a high attachment point is needed.
2.3.2. TYPES

NAPPY TYPE HARNESS

Based on ‘ROC JOC’ packaged instructions
Used by permission

THE TAPE PROTECTORS SHOULD ALMOST BUT NOT QUITE MEET

WRAP 12mm TUBULAR WEBBING AROUND THE TAPE PROTECTORS AS MANY TIMES AS POSSIBLE. SECURE WITH A TAPE KNOT. THE HARNESS SHOULD BE FIRMLY TIGHT

CLIP A KARABINER AROUND THE 12mm WEBBING. CONNECT FIGURE OF EIGHT, ETC. TO THE KARABINER

Fig. 1

Fig. 2

Fig. 3
2.3.2. TYPES

FULL-BODY HARNESS

CHEST HARNESS

SIT HARNESS
ADJUSTING TAPES:

1. To adjust a commercial harness, pass the end of the tape through both parts of the belt buckle and pull it so that it fits snugly around the waist, lying just above the hips.
2. Once the belt is comfortably tight, pass the loose end over the near bar of the buckle, then under the far bar, and pull tight. There should always be at least 10cm spare tape at the end.
3. When correctly tied, there should only be one bar of the buckle visible.
4. Repeat for leg straps and all other buckles.
SELF CONSTRUCTED HARNESSSES

Self constructed tape harnesses can be easily constructed from 25 mm or 50mm tape, either joined by a tape knot (most commonly) or sewn. These tapes can be used for either upper or lower harnesses.

Seat (bottom): There are two common types mostly constructed from 50mm tape.
   1. Continuous tape:
   2. Swami Seat (sit sling):

Chest (top): There are also two common chest harnesses used, mostly constructed from 25mm tape.
   1. Double shouldered chest harness
   2. Single shouldered chest harness
2.3.2. TYPES

SELF CONSTRUCTED SEAT HARNESS

Continuous Tape Seat: The continuous tape seat harness can be constructed using approximately 6 metres of 50mm tape. The middle of the tape is passed from the back to the front between the legs (fig 1). The free ends are brought around the thighs and passed from below through the loop in front (fig 2). The free ends are then taken around the waist on their respective sides and wrapped around until there is just enough tape left to tie a tape knot to secure the harness (fig 3).
2.3.2. TYPES

SELF CONSTRUCTED SEAT HARNESSSES

Swami Seat (sit sling): The ends of approximately 2 metres of 50mm tape are secured with a tape knot to form a loop. The size of the loop is determined by the size of the person (fig 1). The loop is placed around the waist with the ends of the loop held in the front. Part of the loop is pulled from the back between the legs and up the front to meet the other ends (fig 2). These three parts are secured with a locking karabiner (fig 3).

Fig. 1

Fig. 2

Fig. 3
2.3.2. TYPES

SELF CONSTRUCTED CHEST HARNESSSES

Double shouldered chest harness is constructed by joining approximately 2 metres of 50mm tape to form a loop. It may be necessary to adjust the length depending on the size of the individual. This is twisted to form a figure of eight with each of the two loops placed over the shoulders from the back and secured in the front with a locking karabiner.
SELF CONSTRUCTED CHEST HARNESSSES

Single shouldered chest harness

TAPE KNOT

FRONT VIEW

FRONT VIEW
2.3.3. MAINTENANCE

CLEANING
Harnesses need the same care as that given to abseiling ropes. They should be stored and transported in a protective bag where possible and washed when dirty.

RETIRING HARNESSSES
The relatively large surface areas of the tapes from which harnesses are made make them susceptible to abrasion and deterioration from sunlight. For this reason they will need to be retired frequently.

SPECIAL CONSIDERATIONS
Harnesses are particularly vulnerable to damage, such as cuts or wear, to the edge of tapes. Any such damage should result in the immediate retirement of the harness as the tape can weaken dramatically. Weld abrasion is the name given to the partial melting of the tape caused by friction heat produced most often by the rubbing of a taut rope on part of the harness. The exposed stitching on a harness should be inspected frequently for wear because of its susceptibility to abrasion.

NOTE
The pressure applied by a harness to an unconscious or immobilised person can cause serious injury or death within six to seven minutes if not released.
2.4. KARABINERS

Karabiners are linking or securing devices made from aluminium alloy or stainless steel, forged into oval or approximate D-shapes. There are two main types of karabiner: non-locking and positive locking. Both are fitted with sprung gates, with the gates of locking karabiners further secured by a metal sleeve which screws over the latch preventing it from opening.

NON-LOCKING (Snaplink)

- Mountaineering
- Rock climbing
- Indoor Climbing
- Securing accessory equipment

POSITIVE LOCKING (Screw Gate)

- Abseiling
- Setups
- Rescues

This document was last updated on 02/20/07 © P Hutchinson 1997
2.4.2. TYPES

NON-LOCKING (Snaplink)

Non-locking karabiners have very limited application for abseiling use. This design of karabiner is specifically useful for rock climbing and mountaineering where speed and ease of attachment are vital. Security cannot be assured because the possibility exists for the gate to open allowing the rope to pull out under certain loading conditions. They can be used to secure equipment eg rescue equipment and prusik loops, to the loops of a harness. There are two basic types, straight and bent gate.

STRAIGHT GATE
NON-LOCKING KARABINER

BENT GATE
NON-LOCKING KARABINER
2.4.2. TYPES

POSITIVE LOCKING (Screw Gate)

Positive locking karabiners are generally stronger and more secure than non-locking karabiners. They are used extensively in abseiling for setups and to attach descending devices to harnesses. Other abseiling uses include connecting chest and bottom harnesses, improvised descending devices (piton brake bar, crossed karabiners), and attaching to safety lines.

OVAL LOCKING KARABINER

'D' SHAPE LOCKING KARABINER
2.4.3. SAFETY CONSIDERATIONS

LOADING

Karibiners are designed to have maximum strength through their long axis, and no load should be applied directly to the gate. Three way (triaxial) loading can cause a karabiner to fail under much lower loads than if it is loaded along it’s long axis. ‘D’ shaped karabiners generally offer greater strength as the load is directed away from the weaker gate side of the karabiner. Bending a karabiner over a rock ledge or twisting it unnaturally should be avoided. If this should happen and the gate of the karabiner does not close under it’s own spring action it should be discarded. A karabiner should not be subjected to loads with the gate open as the strength of the karabiner is markedly reduced and can easily result in damage or failure.

CARE AND CLEANING

If a karabiner is clogged with dirt and grit, sticks open, or is exposed to salt water, it should be washed in warm water and dried thoroughly. The gate hinge can be lubricated with a silicone spray ensuring all excess is wiped off.
2.5. DESCENDING DEVICES

Descending devices are used to secure the abseiler to the rope and produce friction on the rope by various methods to facilitate a controlled descent.

PROPERTIES:

- method of producing friction
- heat dissipation
- on / off time
- variability of friction
- maximum friction
- safety
- durability
- effect on rope
2.5.1. PROPERTIES

Descending devices produce friction on the rope in one of two ways. The first is by a directional change (twist) in the rope. The second is by a three-force system (pinching effect) while maintaining a straight-line pull.

Heat dissipation is a critical factor in determining the suitability of a descending device for specific applications. As most abseiling ropes are sensitive to heat, a device with design features or constructed from materials that reduce its ability to dissipate heat makes it unsuitable for fast drops, long drops or heavy loads.

On / off time is an important consideration when selecting a descending device for activities such as rescues, canyoning and emergencies. Some devices such as the figure of eight have to be removed from the harness in order to be attached and unattached to the rope. Others like the robot and rappel rack can be attached and unattached with the device still secured to the harness.

Many devices have variability of friction while others are fixed. The friction is increased or decreased by adding elements that change the drag on the rope.

Whether or not the friction of a particular device can be varied there is a maximum friction that can be generated by applying normal pressure to the rope. This should be considered when selecting a descending device for a long drop, large person, or rescue situation.

Because of their design, some descending devices are inherently safe to use eg. Figure of eight, whereas others such as the robot (which can flip open) should be used with caution and care.

Their design and the material from which they are made influence the durability of descending devices. They are commonly made from either steel or aluminium alloy.

A descending device can have various effects on a rope such as excessive heat, twisting effect or kinking. All are detrimental and severely reduce the working life of a rope.
In order to assess abseiling devices and evaluate their various characteristics the following categories are used:

- Comments (general)
- Uses
- Properties
- Special Notes
- Attachments
- Tie-off methods

A combination of these factors (along with personal preference) determines the suitability of a particular design of descending device for a specific application.

The devices are listed in the following order:

**Directional Change Descending Device:**
1. Figure of Eight
2. Harpoon

**Straight Line Pull Descending Device:**
3. Rappel Rack
4. Whaletail
5. Crossed Karabiners
6. Piton Brake
7. Robot

**Mechanical Descending Device:**
8. Stop Devices

**Belay Device:**
9. Belay Plate or Sticht Plate

**Mechanical Ascending Device:**
10. Mechanical Ascender
FIGURE of EIGHT
DESCENDING DEVICE

COMMENTS: Commonly used lightweight and secure descending device. Inexpensive and widely available easily used.
USES: General recreational abseiling, Rock climbing.

PROPERTIES:
Friction production: Directional change
Heat dissipation: Moderate
On / off time: Moderate
Variability of friction: None
Maximum friction: Good
Safety: Excellent
Durability: Good
Effect on rope: Twists rope

SPECIAL NOTES: The rope(s) should pass over the ring, then under, to transverse across the upper surface of the figure eight. This minimises the chance of the rope sliding up to form a larks foot knot.

TIE OFF METHODS: Unsecured or temporary: As illustrated
Secured: Take tail of abseiling rope around body or through the karabiner attached to the harness and place two half hitches around the abseiling rope above the descending device.
FIGURE of EIGHT

ATTACHMENT TO ABSEIL ROPE (STEPS 1 2 & 3)
FIGURE of EIGHT

SIMPLE TIE-OFF METHOD
FIGURE of EIGHT

UNSECURED (or short term) TIE-OFF METHOD (Steps 1 & 2)
FIGURE of EIGHT
SECURED TIE-OFF METHOD (STEP 1)
SECURED TIE-OFF METHOD (STEP 2)
HARPOON
DESCENDING DEVICE

COMMENTS: Can be used as conventional figure of eight, or as a quick on/off device, easily used.
USES: Canyoning, general recreational abseiling, rescue.

PROPERTIES:
Friction production: Directional change
Heat dissipation: Good
On / off time: Fast / Moderate
Variability of friction: None
Maximum friction: Good
Safety: Moderate / Good
Durability: Excellent
Effect on rope: Can badly twist rope

SPECIAL NOTES: Should be used as a quick on-off device by experienced abseilers.

TIE OFF METHOD: Same as for a figure of eight if used conventionally.
If the device is used in the quick on / off configuration the tail of the abseil rope can be secured by wrapping it around the attachment points provided.
CONVENTIONAL ATTACHMENT METHOD
HARPOON

QUICK ON / OFF ATTACHMENT METHOD
RAPPEL RACK
DESCENDING DEVICE

COMMENTS: Commonly used, easily used
Can be used with single or double ropes
USES: Recreational abseiling, Canyoning, Caving, Rescue

PROPERTIES:
Friction production: Straight line pull over bars
Heat dissipation: Good
On / off time: Moderate
Variability of friction: Multiple
Maximum friction: Good (6 gate)
                      Poor (4 gate)
Safety: Moderate
Durability: Excellent
Effect on rope: Minimal

SPECIAL NOTES: Six gate recommended for SRT, beginners and those over 90kg.

TIE OFF METHOD: If the design is appropriate the tail of the abseil rope can be secured under the far end of the device
RAPPEL RACK

ATTACHMENT TO ABSEIL ROPE (four bar)
RAPPEL RACK

TIE-OFF METHOD 1
TIE-OFF METHOD 2
WHALE TAIL
DESCENDING DEVICE

COMMENTS: Excellent general purpose descending device.
USES: General recreational abseiling, Rescue

PROPERTIES:
Friction production: Straight-line pull through channels
Heat dissipation: Very Good
On / off time: Moderate
Variability of friction: Multiple
Maximum friction: Very Good
Safety: Good
Durability: Excellent
Effect on rope: Minimal

SPECIAL NOTES: Care should be taken to ensure that the rope passes through the gates in the correct way i.e. over the flat side of the friction surface.

TIE OFF METHOD: See illustration.
ATTACHMENT TO ABSEIL ROPE (STEP 1)
ATTACHMENT TO ABSEIL ROPE (STEP 2)
WHALE TAIL

TIE-OFF METHOD

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STOP DESCENDING DEVICE

COMMENTS: This device has a mechanism that locks automatically should the abseiler let go of the handle. There are single and double rope versions available. There are devices with double acting brakes.

USES: General recreational abseiling, Rescue

PROPERTIES:
Friction production: Straight-line pull
Heat dissipation: Good
On / off time: Moderate
Variability of friction: Limited
Maximum friction: Poor with heavy load
Safety: Good
Durability: Excellent
Effect on rope: Minimal

SPECIAL NOTES: Initially designed for caving but is now widely used for industrial purposes.

TIE OFF METHOD: (temporary) Release brake handle.
(secure method) Pull free end of rope through attaching karabiner and over device
STOP DESCENDER

RELEASE HANDLE TO ACTIVATE BRAKE

USE BRAKE HAND TO CONTROL DESCENT
STOP DESCENDER

TIE-OFF METHOD
CROSSED KARABINERS

COMMENTS: Can be constructed from readily available abseiling equipment (large “D” shaped locking karabiners) but can be extremely difficult to assemble.

USES: Improvised or emergency abseiling

PROPERTIES:
- Friction production: Straight-line pull
- Heat dissipation: Poor / Fair
- On / off time: Slow
- Variability of friction: Limited
- Maximum friction: Poor
- Safety: Good
- Durability: Excellent
- Effect on rope: Minimal

SPECIAL NOTES:
- The karabiners should be arranged in pairs with the gates on the same side but facing in opposite directions.
- The transverse karabiners should have their gates on the side away from the rope.
- Double rope recommended particularly for heavier abseilers and long drops.

TIE OFF METHOD: Same as secure tie-off method for Figure of Eight device.
CROSSED KARABINERS

ATTACHMENT TO ABSEIL ROPE (STEPS 1 & 2)
CROSSED KARABINERS

ATTACHMENT TO ABSEIL ROPE
**FRENCH CROSSED KARABINERS**

**COMMENTS:** Can be constructed from readily available abseiling equipment (large “D” shaped locking karabiners) but can be difficult to assemble. May be used on single or double ropes.

**USES:** Improvised or emergency abseiling

**PROPERTIES:**
- Friction production: Straight-line pull
- Heat dissipation: Fair
- On / off time: Slow
- Variability of friction: Limited (Multiple karabiners)
- Maximum friction: Good
- Safety: Moderate
- Durability: Excellent
- Effect on rope: Minimal

**SPECIAL NOTES:** Needs care in construction and use.

**TIE OFF METHOD:** Same as secure tie-off method for Figure of Eight device.
COMMENTS: The piton brake bar is an inexpensive descending device that utilises common mountaineering equipment (piton, locking karabiner), but has limited application for recreational abseiling because of it's lack of versatility and safety.

USES: Emergency abseiling device.
Limited application in recreational abseiling and canyoning.

PROPERTIES:
- Friction production: Straight line pull
- Heat dissipation: Very poor
- On / off time: Fast
- Variability of friction: None
- Maximum friction: Poor
- Safety: Poor
- Durability: Poor
- Effect on rope: Excessive heat production

SPECIAL NOTES:
Particular care should be taken to ensure that:
- the piton is longer than the long axis of the karabiner
- as the rope passes through the karabiner it should tend to tighten the screw gate
- the eye of the piton is opposite the gate of the karabiner.

TIE OFF METHOD: Same as for figure of eight.
ATTACHMENT TO ABSEIL ROPE (STEP 2)
ROBOT
DESCENDING DEVICE

COMMENTS: Not recommended for inexperienced abseilers because of its fast descending rates, lack of security, and excessive heat build-up.

USES: Primarily for rock climbing, Canyoning

PROPERTIES:
Friction production: Straight-line pull
Heat dissipation: Very poor
On / off time: Excellent
Variability of friction: Limited (by threading rope through the lower horns)

Maximum friction: Poor
Safety: Poor
Durability: Good
Effect on rope: Excessive heat build up

SPECIAL NOTES: This device is mainly used in situations where fast descent and quick on/off times are needed, ie canyoning.

TIE OFF METHOD: None specifically recommended
ATTACHMENT TO ABSEIL ROPE
BELAY PLATE

COMMENTS:
USES: Belaying, emergency descents

PROPERTIES:
Friction production: Three-point friction
Heat dissipation: Good
On / off time: Slow
Variability of friction: None
Maximum friction: Very Good
Safety: Good
Durability: Excellent
Effect on rope: Minimal

SPECIAL NOTES:
TIE OFF METHOD: Same method as secured tie-off for Figure of Eight descending device, that is, pass free end through karabiner and tie two half hitches around main rope.
BELAY PLATE

ATTACHMENT TO ABSEIL ROPE
TIE-OFF METHOD (STEP 2)
**COMMENTS:** Ascending devices are designed to allow the rope to move through the device in one direction only. This is accomplished with the use of a cam that locks onto the rope in one direction and unlocks in the other.

**USES:** Ascending, rescues, securing equipment or individuals to a rope.

**PROPERTIES:**
- Friction production: Straight line
- Heat dissipation: N/A
- On / off time: Good
- Variability of friction: None
- Maximum friction: Very Good
- Safety: Very good
- Durability: Very good
- Effect on rope: Slight

**SPECIAL NOTES:**
- Care should be taken to ensure that the safety lock is in the locked position before ascending and that it remains in this position while in use
- Shock loading an ascender (especially toothed cams) can tear the rope sheath.
ASCENDING DEVICE

- Attachment point to harness
- Arch to accommodate rope
- Lock to hold mechanism open when attaching to rope
- Friction mechanism releases as device is moved up rope
- Locks onto rope with downward pressure on the device

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ASCENDING DEVICE

ATTACHMENT TO ABSEIL ROPE
If a device is clogged with dirt or grit, sticks or jams, or is exposed to salt water, it should be washed in warm water and dried thoroughly. Devices should be checked regularly for wear and damage. Any time a device has been dropped on to a hard surface it should be considered unfit for use (even without visible damaged) unless proven otherwise.
3. TECHNIQUES
The safety of any abseiling activity is limited to the integrity of the anchor point. The setup area must be accessible to the abseiler and afford a secure anchor point(s).

ANCHOR POINTS:

- **Trees:** A natural and readily available source of anchor points.
- **Rocky outcrops:** Large rocks, if they are the right size and shape, and are stable, can be used as anchors.
- **Improvised:** Various temporary and “portable” structures can be used as anchor points.
- **Man-made:** Various man made structures can be used as anchor points.

![Diagram of anchor setup]

ANCHOR

TAPE SLING

LOCKING KARABINER

THIMBLE

TAPE KNOT

FIGURE OF EIGHT KNOT

STOPPER KNOT
3.1.1. ANCHOR POINTS

TREES
To test the suitability of a tree to act as an anchor point it should:
- Have a well established deep root system
- Be large enough to support a person’s weight applied at shoulder height without the root system moving
- Generally be alive with green foliage and bark
- Be upright or sloping away from the cliff edge.
- Preferably not be a palm, fern or grass tree as they are inherently weaker or have a shallow root system and should be treated with caution.

ROCKY OUTCROPS
Rocky outcrops can take many forms, such as ribs, flakes, jughandles, bollards, boulders, knobs and chockstones. These terms refer to the various shapes and types of outcrop.

Ribs are outcrops that run perpendicular to the rock surface. They should be loaded in the direction of the rib.

Flakes are thin slabs that lie parallel to the rock face. Before anchoring to a flake, it is important to gain some idea of it’s bonding to the wall. Large flakes have been known to pull off under load. Tapping with a hammer will usually expose an insecure flake. They should not be loaded in an outward direction as they only suitable for direct vertical loading.

Jughandles are small holes or arches in the rock. Large jughandles make ideal anchor points, as there is no way the rope can slip off.
3.1.1. ANCHOR POINTS

Knobs are protrusions from the bedrock and can often make a good natural bollard. They should not be smoothly rounded, but should have suitable indentations to prevent the sling or rope slipping off. Knobs are the strongest of the rock outcrop anchor point.

Boulders form a large part of the natural environment. Their suitability as abseiling anchor points is totally dependent on their size and stability. Large flat-based boulders on a level surface are ideal. Slings or ropes should be placed as close as possible to the base of the boulder or as natural indents permit. Slings or ropes should not be attached to projections that may lever the boulder loose.

Chockstones are rocks wedged in cracks in the bedrock. To be of use as an anchor it must be strong and compact rock that is firmly wedged so that it won’t crumble or pull free, and the applied load acts to wedge the chockstone more securely.

NOTE:
If the security of any anchor point is in doubt, it should not be used or it should be backed up to secondary anchor points.
3.1.1. ANCHOR POINTS

**IMPROVISED**

Many man made structures or objects can qualify as safe and effective anchor points. As with all anchor points the connection should be as close as possible to the base of the anchor point to minimise the levering effect.

**Man made structures**: These include telegraph poles, roof trusses, large support beams, fences, and building frames etc.

**Extended Anchors**: If no appropriate anchors are available in the immediate vicinity it may be possible to establish one by running lengths of rope to where there are suitable anchor points. This should only be done with static, not dynamic rope.

**Motor Vehicles**: A form of ‘portable anchor’ is often available with motor vehicles. Safety guidelines that should be followed when using motor vehicles include:
- Set parking brake
- Chock wheels
- Remove ignition key
- Use structural parts such as axles and cross members as attachment points
- Protect ropes from oil, petrol, grease etc.
3.1.1. ANCHOR POINTS

MAN-MADE

Pitons, Chocks, and Bolts:
Pitons are devices that come in many shapes and designed to be hammered into horizontal and vertical cracks in the rock surface. The effectiveness of a piton depends on the way it has been inserted into a crack and the position in which it absorbs the strain from the rope. As a general rule, horizontal pitons are used on horizontal cracks, vertical pitons on vertical cracks. The use of pitons as anchor points is generally not an abseiling technique but they can be used in canyoning, rock climbing and mountaineering. It should be noted that pitons have the potential to damage and scar the rock.

Chocks and stoppers are basically metal blocks, either hollow tube or solid, which come in many shapes and sizes. They take the place of natural chockstones in forming wedges when placed in tapering cracks and a load is placed on them. Similar devices are the cams or expanders that operate on the principle of expanding the width of the device to wedge into the crack.
Bolts may be normal straight construction, eye bolts, dyna-bolts or loxins made from high tensile steel. Bolts, like pitons, damage the environment and leave permanent scarring. Their use for abseiling can only be justified in the absence of alternative suitable anchor points.
3.1.2. SPECIAL CONSIDERATIONS

ROPE PROTECTORS

Every attempt should be made to protect the main abseiling rope from damage and abrasion by placing suitable padding over any sharp edges or abrasion points. Rope protectors are commonly made from canvas, carpet or similar material. Commercially made edge rollers are available and are particularly useful in preventing edge friction when raising or lowering.

SPECIAL PRECAUTIONS

All karabiners used in setups should be locking type with the appropriate rating for the intended loading factors. Special consideration should be given to ensure that the appropriate knots are used and that they are tied, dressed, and set correctly with stopper knots in place. All components of the setup should be backed up where applicable.

When selecting an abseil site consideration should be given to the potential dangers that the participants may encounter. These dangers may include falling rocks, slippery surfaces, climatic conditions and environmental dangers such as venomous plants and animals.

ENVIRONMENTAL PROTECTION

The outer covering of trees should be protected with the use of a protective covering placed under setup tapes and ropes. Minimal impact strategies should be developed and followed to protect the physical environment during descent, ascent and access to the setup point. Special consideration should be given to minimize impact on flora and fauna encountered at the abseiling site and while gaining access to and from the site.
3.1.3. SETUP TYPES

There are various methods suitable and safe for connecting the main abseiling rope to the anchor point.

**TAPE SLING SETUP**

An appropriate length of 50mm flat tape, or 25mm tubular tape, is wrapped around an anchor point (usually a tree) at least two or more times, secured with a tape knot and finished with two thumb knots to act as stopper knots. The sling should be placed as low as possible on the anchor to avoid any bending effect. A double figure of eight knot is placed in the end of the abseiling rope and secured with a stopper knot. A thimble is fitted firmly in the loop formed by the figure of eight knot and placed in a locking karabiner that in turn is placed around the loops of tape and locked.
3.1.3. SETUP TYPES

CANYONING SETUP

Canyoning Setup: Because it is usually necessary to retrieve the rope at the bottom of a descent when canyoning, the setup must be temporary and easily dismantled, yet remain safe while in use. A typical canyoning setup involves finding the midpoint of the abseiling rope and placing it around the anchor point so that both sides of the rope reach the bottom of the drop. To secure the rope an alpine butterfly knot is tied in both sides of the rope, close to the anchor and a locking karabiner placed between the loops. The last person down removes the karabiner and knots, and then descends on the double rope ensuring that both ends are secured below.
ROUND TURN and TWO HALF HITCHES SETUP

A single abseiling rope is wrapped around the anchor three or more times, secured with two half hitches and finished with a double fisherman’s knot used as a stopper knot. The anchor is commonly a large tree with some form of protection placed around the trunk to prevent damage or wear to the bark. Features of this system are that the knots do not significantly reduce the strength of the rope and can be untied while under tension but it does use more rope.
3.1.3. SETUP TYPES

- Anchor
- Tree protector
- Round turns
- Figure of eight knot (on the bight)
- Karabiner (locking)
- Rope protector
- Abseil rope
3.1.3. SETUP TYPES

MULTIPLE ANCHOR SETUPS

An abseiling setup using multiple anchors can be used to distribute the load over two or more anchor points. This may be necessary if there is any doubt regarding the loading capacity of a single anchor or to change the angle of pull on the abseil rope.

There are three common types of setups using multiple anchors. These are:

- Tensionless (or secondary) Anchor Setup
- Load Sharing Setup
- Self-Equalising Setup
3.1.3.1 SETUP TYPES

TENSIONLESS (or Secondary) ANCHOR SETUP

This setup utilises a primary anchor point that minimises the load on the secondary (tensionless) anchor. The secondary anchor is used as a backup (or safety) of the primary anchor.
3.1.3.2 SETUP TYPES

LOAD SHARING SETUP

The load sharing setup involves tying a double headed figure of eight knot in the end of the abseil rope and attaching the two ends to different tape sling setups on two separate anchor points.
SELF-EQUALISING SETUP

A self-equalising setup involves two or more tape slings with karabiners attached. An additional loop of tape, tubular tape or rope is placed through the karabiners. A karabiner attaches the abseil rope to this loop ensuring that the angle formed between the anchors is less than 120 degrees (preferably less than 90 degrees). The loop should have a twist on one side to prevent the karabiner slipping off should one anchor fail. It should be noted that if one side should fail a shock loading will be applied to the other anchor.
3.1.4. SAFETY CONSIDERATIONS

SAFETY LINE

If it is appropriate and practical a rope should be placed at the setup site so as to restrict access to the cliff edge, unless the person is attached to the main abseiling rope or a safety rope or tape securely fastened to an anchor point. The safety line is primarily used as a barrier and should not be used as a secure attachment point or relied upon to arrest a fall.
When setting up any sling or supporting ropes it is important to consider the angle of pull on the rope, sling and even the anchor points themselves. From 0 to 60 degrees approximately half the load is applied to each side. From 60 to 120 degree angle, a force approximately equal to the load is applied to each side, and above this angle the force increases to many times the initial load.
3.2. BELAYING

Belaying is the name given to a variety of techniques that are designed to provide additional security and control for the abseiler. Belaying offers a back-up method of arresting or controlling the descent of an abseiler particularly in the event of equipment failure, incompetence or incapacity.

METHODS OF BELAY

Top belay involves the use of an additional rope secured to the abseiler and passing through a second device fixed at the cliff top.

Bottom belay is a method of applying direct pull on the main abseiling rope from below to control the descent of the abseiler.

Self-belay is an advanced technique employing a prusik loop (or mechanical device) attached from the main rope above the descending device to the abseiler and acting as a ‘dead mans brake’ in the event that the abseiler releases control of the descent. Its disadvantage is that it can not be reversed easily once activated.

BELAYING GUIDELINES FOR SINGLE PITCH ABSEILING

- Some form of belay should be used as a safety measure on all descents. (Top, bottom, self)
- The belayer should be completely independent of the belay system. (The belayer should not have to ‘escape the system’)
- A second anchor point should be used for top belay systems.
- The angle from the point of belay to the abseiler should be as close as possible to the line of descent.
- The belayer should minimise slack in the belay rope between the point of belay and the abseiler.
- Ideally the abseiler should be visible to the belayer as well as having an effective means of communication.
- The person belaying should be prepared and able to respond at all times while the abseiler is ‘on rope’.
3.2.1. TOP BELAY

A top belay employs a second rope attached to the abseilers harness on one end, and an additional friction device (such as a stitch plate) on the other end, appropriately secured at the top of the cliff.

The person at the cliff top can control the descent of the abseiler by varying the friction on the belay rope.

This is the most secure form of belay as it offers double security on equipment including the rope and descending device. If the appropriate belay device is used it acts as a fail safe system, in that if the belayer loses concentration or is distracted at the time of an unexpected load the abseiler’s descent will be halted.
A bottom belay is employed to offer backup security to an abseiler in the event of loss of control during the descent because of incapacity or inexperience. The bottom belay utilises a person at the bottom of the cliff face who is able to apply a downward force on the main rope if the abseiler needs assistance in slowing or stopping the descent. The downward pressure utilises the inherent friction of the descending device, and under normal conditions, with a suitable descending device, very little pressure is needed by the belayer to control the descent. However, if the descending device is not able to adequately control the descent because the rope is wet or icy, or the device is inappropriate, or damaged, the belayer should be prepared to exert considerable force on the rope.

The belayer needs to pay special attention to the possibility of falling rocks and other objects. This may necessitate a pulley type setup at the base of the cliff, possibly employing a tape sling and karabiner, so that the belayer can stand away from the cliff and still maintain control of the rope.
3.2.3. SELF BELAY

Self belay methods give added security to the abseiler in situations where it is impossible to bottom belay or impractical for a top belay. There are two main forms of self belay.

1. Mechanical
   - Jumar
   - Petzl shunt
   - Gibbs spring loaded ascender

2. Friction knot
   - Prusik knot
   - Klemheist knot
   - Bachmann knot

The main principle of a self-belay system is to utilise a locking device or knot attached to the bottom or chest harness and positioned on the rope above the descending device. It is activated in the case of incapacity, incompetence or equipment failure (such as the descending device failing or becoming detached from the rope), by the abseilers weight. It is prevented from locking during a normal descent by mechanical tension within the device (spring loaded) or by being held in a non-locked position by one hand (prusik knot, mechanical ascender). Shock loading mechanical devices (especially tooth cams) should be avoided as tearing of the rope sheath may result.
3.3. CALLS & COMMUNICATIONS

Calls refer to the standardised communications used in abseiling to allow precise information to be exchanged between the abseiler and the belayer (see section on Belays). This ensures that both parties are ready and can respond to any emergency quickly. All calls should be loud, clear and concise.

<table>
<thead>
<tr>
<th>Abseiler</th>
<th>Belayer</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘ON ROPE (number)’</td>
<td>‘ON BELAY (number)’</td>
</tr>
<tr>
<td>‘DESCEND WHEN READY’</td>
<td></td>
</tr>
<tr>
<td>‘DESCENDING’</td>
<td></td>
</tr>
<tr>
<td>‘SLACK’</td>
<td>‘OFF BELAY’</td>
</tr>
<tr>
<td>‘UP-ROPE’</td>
<td></td>
</tr>
<tr>
<td>‘THAT’S ME’</td>
<td></td>
</tr>
<tr>
<td>‘FALLING’</td>
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<tr>
<td>‘ROCKS’</td>
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<tr>
<td>‘SAFE’</td>
<td></td>
</tr>
<tr>
<td>‘OFF ROPE’</td>
<td></td>
</tr>
</tbody>
</table>
3.3. CALLS & COMMUNICATIONS

‘ON ROPE (number)’ Called to alert both the top and bottom parties to the presence of an abseiler on the main rope (or a designated rope).

‘ON BELAY (number) Descend when ready’ Called by the belay point operator when the belay point is ready.

‘DESCENDING’ Called by the abseiler to signify the commencement of the abseil.

‘SLACK’ This can be called by the abseiler at any time to have the belayer(s) pay-out the belay line.

‘UP-ROPE’ Called by the abseiler to remove slack or ‘take-in’ the belay line

‘THAT’S ME’ Called by the abseiler to indicate to the belayer(s), that there is sufficient tension on the belay line.

‘FALLING’ Called by the abseiler to the belayer(s) any time an immediate halt to downward movement is required for any reason whatsoever.

‘ROCKS’ This can be called by any member of the group. It alerts everyone to the fact that something is falling. This is called immediately by anyone who drops, throws or dislodges anything over any edge at any time.

‘SAFE’ Called by the abseiler to signify the completion of the descent.

‘OFF ROPE’ Called by the abseiler to indicate that both the main rope and belay rope are free and ready for recovery or re-use.

‘OFF BELAY’ Called by the belayer to indicate to the abseiler that a belay is no longer applied.
3.3. CALLS & COMMUNICATIONS

‘ON ROPE’

‘DESCENDING’

‘ON BELAY, DESCEND WHEN READY’
3.4. CLIFF TOP CHECKLIST

The golden rule of abseiling is:
“check, double check and, if in doubt triple check”

To implement this rule, the abseiler and instructor carry out a set of six checks immediately prior to any abseiling activity. These checks ensure that all equipment is secure, safety equipment is being worn, and that the abseiler knows the appropriate procedures to safely complete the activity.

**ADHERE** to the following check list.

**ANCHOR:** Check that the anchor point is secure, the tape sling or ropes are correctly tied (including end knot), the rope extends to cliff base, and karabiners are closed and locked.

**DEVICE:** Check that the device is hooked up correctly, and that karabiners are closed and locked.

**ARNESS:** Check that the harness is correctly fitted and that all knots and buckles are secure.

**EQUIPMENT:** Ensure helmet, gloves, and shoes are worn and correctly fitted and that loose clothing and long hair are secured.

**RESTRAINT:** All abseilers must be checked to ensure they are appropriately belayed before commencing activity.

**EFFECTIVE COMMUNICATIONS:** Check that basic calls and communication techniques are known by all those participating.

**NOTE:**
All checks are to be carried out by the abseiler and then double-checked by an instructor or companion.
3.4. CLIFF TOP CHECKLIST

A  Anchor (setup)
D  Descending device
H  Harness (top and bottom)
E  Equipment (safety and personal)
R  Restraint (top, bottom, self belay)
E  Effective (emergency) calls
3.5. DESCENDING TECHNIQUES

ABSEILING TECHNIQUE

Lean back
Feet apart
Walking steps
Brake hand behind bottom
Let rope feed through hand
Don’t grip with top hand
Abseil slowly
Relax and enjoy
3.5.1. SINGLE ROPE TECHNIQUE

LEAN BACK 60 - 90 DEGREES

HELMET

GLOVES

GUIDING HAND

BRAKING HAND

FEET APART
3.5.1. SINGLE ROPE TECHNIQUE

Lean back:
The abseiler should flex slightly at the waist and generally lean back at an angle of 60 to 90 degrees to the cliff face. This position gives the correct pressure for the feet and allows the weight of the abseiler to be correctly distributed through their harness and descending device. Leaning too far forward causes the feet to lose adhesion, particularly on slippery or loose surfaces. Leaning too far back increases the chance of the abseiler inverting (tipping upside down).

Feet apart:
Keeping the feet about shoulder width apart prevents the abseiler from becoming unstable and tipping to the side.

Walking steps:
The descent should be controlled by the descending device, not the feet. They are used to maintain balance and prevent impact with the cliff face. Two main techniques that accomplish this are a walking backward technique and a hopping action.

Brake hand behind bottom:
The brake hand should be the abseiler’s dominant hand and is used to grip the rope slightly behind the back. To increase friction (braking effect) on the rope the brake hand is brought behind the bottom in a sitting action. To reduce friction (increase descent speed) the brake hand is pulled out from the body allowing the rope to slide through the hand.

Let rope feed through hand:
The friction on the rope is not applied by squeezing the rope tighter but is controlled by the position of the brake hand.

Don’t grip with top hand:
The top hand is mainly for stability, not to control the descent.

Abseil slowly:
A fast descent increases the risk of a loss of control, as well as causing over heating of the descending device resulting in damage and increased wear to the rope.

Relax and enjoy:
Bending the legs slightly and keeping them relaxed helps prevent jars and jolts. Gripping too tightly with either hand can lead to fatigue and jerking motion while descending. The aim is to create a smooth and continuous descent. This reduces wear and tear on equipment and strain on anchor points.
3.5.2. ADVANCED TECHNIQUES

DESCENDING OVER A KNOT:

It may become necessary to abseil over a knot because of either a long drop requiring the joining of two ropes or the rope becoming entangled.

**Equipment:** Additional equipment to that normally used in abseiling is needed when attempting to abseil over a knot or obstruction. This would include

- Two prusik loops
- Karabiner attached to the harness
- Foot loops

**Technique:**

When slightly above the knot or obstruction, tie off the descending device to prevent further downward movement (unless jammed on knot). Attach a short prusik loop to the main rope above the descending device and the other end to the harness. This is preferably done with a separate locking karabiner so that the karabiner attaching the descending device does not have to be undone while weight bearing. If necessary attach a set of foot loops below the first prusik loop. Stand up, taking full weight on foot loops.
Push the top prusik loop up the main rope so that it supports your full body weight and is high enough to produce slack through the descending device. Attach a second prusik loop to the rope, below the knot or obstruction and connect the other end to the spare karabiner.
3.5.2.1. DESCENDING OVER A KNOT

Disconnect the descending device from the rope and relocate it to a position below the knot or obstruction and the second prusik loop, yet remaining as close as possible to the knot. Tie off the device. Alternately lower the top prusik loop and the foot loops until your weight is transferred back to the descending device.
3.5.2.1. DESCENDING OVER A KNOT

Remove the prusik and foot loops and unlock the descending device to continue the abseil.

NOTE:
There should be two points of attachment to the rope at any one time (not including foot loops). The second attachment is not illustrated for simplicity.
3.5.2. ADVANCED TECHNIQUES

LONG DESCENT

On long descents it may be necessary to consider various factors as well as employing specific techniques and procedures in order to overcome conditions not usually encountered on short descents.

**Weight of rope.** The weight of the main abseiling rope needs to be considered when attempting a descent over fifty meters as it can create significant drag on the descending device. The drag produces a braking effect, most noticeable at the top of the cliff, and decreasing toward the bottom. This can lead to misjudging the resistance required on a variable friction descending device. A typical 11mm static abseiling rope would weigh up to 80g per metre resulting in a load of 8kgs at the top of a 100 metre descent.

**Heat generation.** On long descents, heat from the friction produced by the descending device can build up to high levels damaging ropes and creating a potential hazard for the abseiler. The heat generated by some devices is sufficient to produce third degree burns on unprotected skin or melt nylon rope.

**Fatigue.** Inexperienced, frail or young abseilers could find that on extended descents they could become fatigued, placing themselves in danger. Under these circumstances appropriate belaying is essential.

**Communications:** Effective communications between the cliff top, cliff base, and the abseiler can be compromised by distance. Particular techniques should be employed that will ensure the appropriate information reaches the intended recipient effectively and efficiently. These could include coded whistle blasts, walkie-talkie or other prearranged communication systems.
3.5.2. ADVANCED TECHNIQUES

OVERHANGS

Abseiling an overhang can be accomplished by descending until both feet are on the lip of the overhang and then lowering the hips so that they are below the edge of the overhang. On small overhangs it may be possible to lower one foot from the lip and brace against the wall underneath, then lower the other foot. Once both feet are on the cliff face below the overhang continue descending in the conventional manner. With large overhangs where it is too wide to brace below the lip, it is necessary to employ a technique that prevents or minimises the tendency to swing back toward the cliff face due to lack of support under the overhang.
3.5.2.3. OVERHANGS

One technique involves leaning against the cliff face above the overhang with most of the inward pressure being taken on one hip. It is then possible to descend slowly being careful not to put pressure on the descending device or trap the fingers of the guide hand between the face and the rope.

**NOTE:**
If negotiating an overhang using a figure of eight device it is important to have the rope routed in such a way so that it passes across the upper surface of the device and not below it. This minimises the chance of the rope being dragged to the top of the device forming a lark’s foot knot.
Another technique involves pushing off above the edge of the overhang and descending rapidly in order to clear the edge before swinging back in. This technique stresses the rope, anchor point and could damage the rope on the edge of the overhang. The technique needs to be well executed, as slowing the descent prematurely will result in the abseiler swinging in to the cliff face without having cleared the overhang.

- LEAN WELL BACK
- PUSH OFF CLIFF FACE
- LET THE ROPE RUN FREE UNTIL CLEAR OF OVERHANG
**3.6. ASCENDING TECHNIQUES**

**PRUSIKING**

Prusiking is a method of ascending or climbing a fixed rope and derives its name from the type of knot commonly used for this purpose. The technique involves two friction knots or specifically designed devices that can be slid up the rope when unloaded yet locks when a load (body weight) is applied. Alternately raising one while the other supports the weight produces movement in an upward (or downward) direction. The technique is suggested as a safety measure for returning to the top of the cliff if further descent is impossible. The technique involves knowledge of:

- Tying prusik loops
- Adjusting prusik loops
- Attaching loops / ascenders to rope
- Climbing techniques
3.6.1. ASCENDING

USING PRUSIK LOOPS

Tying prusik loops: Two prusik loops are needed, one attached to the harness, and a set of foot loops. These should be made from 5-7mm kernmantel rope. The upper loop is tied using a double fisherman’s knot.

Adjusting prusik loops: The length of the upper loop should reach from the harness to a point up the rope that is always within reach. The rope for the foot loops should run from each foot to a position roughly at waist level with the legs slightly bent, and allowing for loops for both feet and another at the mid point of the rope. A figure of eight knot is placed at the mid-point of the rope forming a several centimetre loop. The loops for the feet are constructed using figure of eight knots.

Attaching to rope: The upper loop is attached to the main rope using a Prusik, Klemheist or Bachmann knot and attached to the harness with a locking karabiner. The foot loops are attached to the main rope below the upper loop by tying a prusik knot in the centre loop.

Climbing technique: Holding the rope with a hand over, or close to, each knot stand up in the foot loops. Stay close to the rope. Push the upper knot up as far as it will go. When the upper knot has been pushed up, gently transfer weight to the harness and sit down. The lower knot can now be moved up while keeping the rope taut below the knot. If a prusik knot jams, remove all weight from it and twist the knot before pushing it up.
3.6.1. ASCENDING

(USING PRUSIK LOOPS)

NOTE:
There should be **two** points of attachment to the rope at any one time (not including foot loops). The second attachment is not illustrated for simplicity.
3.6.1. ASCENDING

(USING PRUSIK LOOPS)

TAKE WEIGHT ON PRUSIK LOOPS

SLIDE FOOT LOOPS UP ROPE
3.6.1. ASCENDING

(USING PRUSIK LOOPS)

SLIDE PRUSIK LOOP UP ROPE

TAKE WEIGHT ON FOOT LOOPS
Prusiking over a knot is basically the reverse situation to abseiling over a knot and the need can arise under similar circumstances.

Equipment:
- Two prusik loops attached to the harness using
- Separate locking karabiners
- Set of correctly adjusted foot loops.

Technique:
As the knot is approached take the weight on the foot loops, detach the upper prusik loop and re-attach it to the main rope as far above the knot as is comfortable. Take the weight on the upper prusik loop and repeat the same procedure for the next prusik loop. With the weight still on the upper prusik loop move the foot loops over the knot and continue prusiking.

REMEMBER:
There should always be two points of attachment with the rope in addition to foot loops.
3.6. ADVANCED

ASCENDING TECHNIQUES

PRUSIKING OVER A KNOT

ATTACH PUSIK LOOP ABOVE KNOT

MOVE PRUSIK LOOPS AND FOOT LOOPS ABOVE KNOT
4. SAFETY
SAFETY STARTS WITH YOU
4.1. SAFETY RULES

CLIFF TOP:

- Stay two body lengths from edge
- Do not cross safety line without security
- Handle equipment carefully
- Do not tread on ropes
- Don’t drop or throw things over edge
- Go through cliff top check list

DESCENDING:

- Know calls
- Wear safety equipment
- Descend at a safe speed

BASE OF CLIFF:

- Face cliff
- Watch for falling objects
- Report all accidents and injuries
4.1. SAFETY RULES

CLIFF TOP:

- **Stay two body lengths from edge:** To prevent momentum or an accidental slip resulting in a fall.

- **Do not cross safety line:** The safety line is set up to restrict access to the cliff edge to only those connected to the safety rope.

- **Handle equipment carefully:** Do not drop, throw or handle equipment in a rough manner.

- **Do not tread on ropes:** Care must be taken of all ropes, particularly avoiding standing on them.

- **Don’t drop or throw things over edge:** Extreme care must be taken not to throw or drop any object over the edge of a cliff.

- **Go through cliff top check list:** Always go through ADHERE cliff top check list prior to abseiling.

DESCENDING:

- **Know calls:** It is imperative that all those involved in abseiling are familiar with the application and meaning of all calls.

- **Wear safety equipment:** Always wear appropriate safety equipment eg. helmet, gloves, etc.

BASE OF CLIFF:

- **Face cliff:** It is necessary to face the cliff while at the base of the cliff to watch for falling objects.

- **Watch for falling objects:** Always be aware of the possibility of dislodged rocks or dropped equipment

- **Report all accidents and injuries:** Report any damage to equipment or personal injury immediately
4.2. SAFETY EQUIPMENT

Personal safety equipment must be worn during all abseiling activities. Safety equipment should be inspected for signs of damage or wear before each use.

**Clothing:** Well fitting clothes should be worn to minimise the chance of an item of clothing being pulled into the descending device. Straps and items of jewellery such as necklaces should be removed or secured before abseiling.

**Gloves:** Gloves must be worn on all descents to protect the hands from the heat generated by the descending device or through direct contact with the rope. The glove should be well fitted and have leather on the palm surface.

**Helmet:** There are two types of approved helmets used in abseiling
1. General industrial safety helmet complying with Australian Safety Standards.
2. Specific climbing/abseiling helmet complying with UIAA standards.

**Footwear:** Footwear must be worn at all times and should be sturdy, well fitting and appropriate for the terrain.
4.3. FIRST AID & RESCUE EQUIPMENT

Rescue Equipment:

Specific rescue equipment in working order should accompany all abseiling activities. This equipment includes pulleys, special ropes and devices needed to raise or lower an abseiler from the cliff face in the event of an emergency.

First Aid Equipment:

Standard first aid equipment should be kept up to date, maintained and available at all abseiling activities. First Aid equipment should be appropriate to the location in which the activity is being conducted. Medical supplies for specific health needs such as diabetes and asthma should be readily available.
4.4. RESCUE TECHNIQUES

There are three essential components that underlie an efficient rescue procedure. They are:

- Speed
- Simplicity
- Security

**Speed** becomes paramount if the victim has suffered an accident or incapacity that places them in an emergency or potentially life-threatening situation. These could include illnesses such as diabetes, asthma, heart disease or stroke etc. Accidents can result in concussion, haemorrhage, fractures etc. Other situations creating time constraints would be potential drowning from canyoning mishaps, and venomous bites and stings. The pressure applied by a harness to an unconscious or immobilised abseiler can cause serious injury or death within six to seven minutes if not released and even a conscious person should be rescued within 20 minutes.

**Simplicity** is necessary when employing rescue techniques to reduce the risk of mistakes and speed up rescue procedures. This is generally achieved by using the minimum of equipment coupled with the most straightforward techniques that achieve the rescue.

**Security** is usually achieved by employing fail-safe procedures that minimise the risks to the victim and rescuer. These include:
- Using separate karabiners to attach prusik loops to harness.
- Not undoing any karabiner or knot unless there are two other points of attachment to the abseiling rope.
- Using self-belay procedures following the undoing and reattachment of any equipment.
RAISING THE VICTIM

The incapacity of an abseiler, failure of equipment, or other contingency, may necessitate raising the abseiler to the cliff top in order to effect a rescue.

Raising a victim from a cliff usually involves either brute strength or preferably the use of a pulley system. The technique can be employed when access to the cliff base is difficult for rescuers eg, canyoning, or when the victim is near the top of a long decent.

Equipment:
- 11mm abseiling rope (rescue rope)
- Belay device: Figure eight etc
- Pulley block system
- Two prusik loops, mechanical ascenders etc
- Karabiners

Raising Techniques

Direct lift method: This technique can be employed when the victim is light weight, near the top, and there are a number of able bodied people capable of assisting in the rescue. The procedure is:

Attach a prusik loop, mechanical ascender, or belay device from the anchor point to the main rope.
Directly pull the main rope using as many assistants as needed in order to raise the victim. Ensure all those assisting are well away from the cliff edge or secured to a safety line.
At the same time, slack is taken out of the rope using the belay device.
The process is continued until the victim is brought over the edge of the cliff.
4.4.1.1. RAISING THE VICTIM

Pulley block system: The use of a self contained pulley system offers large mechanical advantage with simple setup and operation. The procedure is:

Attach the pulley block system to the anchor and to the main rope using a prusik loop or mechanical ascender. Attach a second shorter prusik loop or mechanical ascender from the anchor to the main rope. As the main rope is raised using the pulley system, slack is removed from the main rope by sliding the short prusik loop down the main rope. The prusik knot or mechanical ascender securing the pulley system to the main rope is then extended down the main rope and the process repeated.

PULLEY BLOCK SYSTEM
4.4.1.1. RAISING THE VICTIM

Z-pulley method: A leverage system similar to the floating pulley can be improvised to haul an abseiler up the cliff face or to take the load off a jammed device without the need for pulleys. The system offers a three-to-one mechanical advantage with a locking action in the direction of the load. It can be constructed with the use of two karabiners and either two prusik loops or two mechanical ascenders. A karabiner is connected to the anchor point with either a rescue rope from the victim or top belay rope passing through it. A prusik loop to the rope and secured to an anchor point. The rope is then passed through a second karabiner attached further down the main rope with a prusik loop or ascender. As the rope is hauled in the prusik loops (or ascenders) are alternately moved down the rope until the victim reaches the top.

Z-PULLEY SYSTEM

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4.4.1.2. LOWERING THE VICTIM

Lowering a victim usually involves detaching the main abseiling rope from the anchor point and employing the use of a second rope to lower the victim to the ground. To accomplish this an upward force must first be exerted on the main rope to release the anchor point and the second rope used to control the descent.

Equipment

- 11mm abseiling rope (rescue rope)
- Belay device: Figure eight, Sticht plate etc
- Pulley block system
- Two prusik loops, mechanical ascenders etc
- Karabiners

Lowering Techniques

Top belay: If the victim is top belayed they should be raised enough to take the weight off the attachment point of the main rope to the anchor so that it can be detached. This can be done with the assistance of a pulley system. The victim is then lowered to the cliff base using the belay rope and the attached belay device.
4.4.1.2. LOWERING THE VICTIM

No Knot Setup

If the main abseil rope is over twice the cliff height a no knot setup can be put in place with a descending device attached close to the anchor point on the main abseiling rope and secured to an anchor point in the normal way. If the rope is not long enough but a second rope is available either a unidirectional figure of eight knot is placed in the main abseiling rope or a descending device is attached to the main rope using prusik knots or preferably a mechanical ascender. A descending device is attached to the unidirectional figure of eight knot and secured in the normal manner to an anchor point. The rescue rope is threaded through the descending device and tied off. All attachments should be made with locking steel karabiners.

In the event that a victim needs to be lowered from the cliff face the no knot setup can be untied transferring the load to the backup device. Using the descending device to control the descent the victim can be lowered to the cliff base. If prusik knots or a mechanical ascender is used to attach the descending device to the main rope a figure of eight knot should be placed in the tail of the main rope and locked to the rescue rope before the victim is lowered.
4.4.1.2. LOWERING THE VICTIM

- Tape Sling Setup
- No Knot Setup
- Half Abseil Rope Used for Rescue
- Belay Device
- Rope Protector
- Abseil Rope
4.4.1.2. LOWERING THE VICTIM

- PRIMARY ANCHOR
- NO KNOT SETUP
- KARABINER
- UNIDIRECTIONAL FIGURE OF EIGHT KNOT
- ROPE PROTECTOR
- ABSEIL ROPE
- RESCUE ROPE
- BELAY DEVICE
- SECONDARY ANCHOR
4.4.1.2. LOWERING THE VICTIM

Pulley block system: The self contained pulley block system is used in conjunction with a rescue rope to lower the victim and combines substantial mechanical advantage with simple setup and operation. The procedure is:

A descending (belay) device is attached to an anchor point with the rescue rope threaded through it. The short end of this rope is connected to the main rope with a locking karabiner through a figure of eight knot (on the bight). (Step 1)

Attach the pulley block system to the anchor and to the main rope using a prusik loop or mechanical ascenders. The main rope is raised, using the pulley block, enough to remove the weight from the karabiner securing the main rope to the anchor so that it can be undone. Slack is taken out of the rescue rope so that the pulley system can be removed. The rescue rope, attached to the main rope, is lowered and controlled by the belay device. (Step 2)

STEP 1
4.4.1.2. LOWERING THE VICTIM

STEP 2

LIFTING EFFORT

PULLEY SYSTEM

MECHANICAL ASCENDER

TO VICTIM

RESCUE ROPE
4.4.1.2. LOWERING THE VICTIM

**Floating pulley**: This method gives a mechanical advantage in managing the victim's weight as they are being lowered.

The procedure is:
An 11mm abseiling rope (rescue rope) is wrapped around the anchor three or more times leaving sufficient tail to tie a figure eight knot (on the bight) in the end. The other end of the rescue rope is threaded through a pulley attached to the main rope using a prusik loop or ascending device. A belay device is attached to the short end of the rescue rope by securing it to the previously tied figure of eight knot with a locking karabiner. The long end of the rescue rope is attached to the belay device after it passes through the pulley. The main rope is raised, using the rescue rope enough to remove the weight from the karabiner securing the main rope to the anchor so that it can be undone. A figure of eight knot is tied in the free end of the main rope and linked to the pulley with a locking karabiner as a safety measure. As the main rope is lowered using the pulley, the belay device controls the descent.

**FLOATING PULLEY SYSTEM**

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4.4.1.2. LOWERING THE VICTIM

- STOPPER KNOT
- FIGURE EIGHT KNOT
- KARABINER
- ANCHOR
- DESCENDING DEVICE
- ROUND TURNS
- RESCUE ROPE
- PULLEY
- KARABINER
- PRUSIK LOOP
- PRUSIK KNOT
- ABSEIL ROPE
- VICTIM
4.4.2.1. SELF RESCUE

SELF-RESCUE TECHNIQUES

Under some circumstances an abseiler may extricate themselves from the predicament they are in by reversing the factors that have impeded their descent. These circumstances commonly involve the descending device becoming jammed by clothing, hair etc, or the accidental locking of a prusik knot while self belayed. The need for self-rescue also arises when the abseiler inverts while descending. This situation commonly occurs as the abseiler negotiates the cliff edge or on slippery surfaces and results in a feet up, head down position. This position is reversed by ensuring the belay is activated, extending the legs and letting them swing to one side to regain the upright position.

There are four main techniques used for self-rescue.

Loop the main rope: A method of freeing a locked prusik loop or ascending device involves looping the main rope under one foot. With the knee bent, bring the loop up to chest height, securing it to the main rope with a half hitch and hold the tail securely to the main rope. By straightening the bent leg the weight is taken on the foot loop, taking the load off the prusik loop and allowing it to be unlocked.

Foot loops can be attached to the main rope above the descending device using a prusik knot or mechanical ascender. By taking the weight on the foot loops the load is removed from the descending, or self-belay device allowing it to be freed. This technique is dependent on the abseiler having access to correctly adjusted foot loops.

Changing to a second abseiling rope can be employed in situations such as an obstructed or short rope. The technique involves placing a prusik loop on the second rope and connecting it to the harness. Next a set of foot loops are attached to the second rope. When the weight is taken on the foot loops the descending device can be transferred to the second rope and locked off. The weight is taken off the prusik loop so that it can be removed or freed and used as a self-belay device. The foot loops are then removed and the device unlocked with the descent continued on the second rope.
4.4.2.1. SELF RESCUE

CHANGING DIRECTION
(abseil to prusik or prusik to abseil)

Abseil to prusik: It may be necessary to change from abseiling to ascending because the rope is obstructed, knotted, or does not reach the cliff base etc. In these situations the descending device is locked off and a prusik loop, or mechanical ascender is placed on the main rope above the descending device and locked into the harness preferably with a separate locking karabiner. A set of foot loops is then attached to the rope below the first loop. For safety reasons there should be a second point of attachment to the main rope using a second prusik loop or mechanical ascender. When all connections to the main rope are in place and the karabiners are checked the descending device can be detached from the rope by standing in the foot loops and sliding the prusik loops (ascenders) up the rope to take the body weight.

Prusik to abseil: The need to change from prusik to abseil could come about because of fatigue or not being able to negotiate a difficult overhang. The procedure involves taking the weight on the upper loops and attaching the descending device to the slack rope directly below the ascenders of prusik knots. Once the device is secure and locked off the safety loop can be removed from the main rope. The second loop should remain attached to the rope to act as a self-belay. The self belay should be unlocked by standing in the foot loops attached below the descending device and sliding the self belay down the rope until the weight is fully supported by the device. The foot loops are removed and the abseil commenced.

NOTE:
The appropriate procedure to lock the descending device should be used before attempting any self-rescue technique.
4.4.2.2. CLIFF FACE RESCUE

CHANGE-OVER RESCUE

At times it may be necessary for a rescuer to descend to the victim and perform rescue procedures on the cliff face.

It is possible for the rescuer to descend to the victim and effect a rescue or clear the problem by taking the weight off the victim’s device or transferring the victim to the abseilers device. The victim can be transferred back to his or her own rope or both the rescuer and victim can continue the descent to the bottom on one rope. With both these options the initial procedures are the same.

A second abseil rope is set up preferably on a separate anchor. The rescuer then descends on the second rope until positioned just above the victim and locks off their own descending device. A safety line is connected from the rescuer to the victim’s harness with cord or sling with locking karabiners on either end.

A single pulley or a pulley block system is attached to the rescuer’s rope (see note) using a prusik loop or ascending device and the other end attached to the victim’s harness using a locking karabiner. If the rescuer is using a counter weight system (single pulley) then sufficient rope is needed to form a foot loop at one end. The rescuer then places a downward force on one side with one foot while pulling up the rope on the victim’s side of the pulley. An alternative method is to use a pulley system connected in a similar manner to the single pulley.

The victim is released from their descending device and transferred to the rescuer’s device. Alternatively their descending device can be cleared of any obstruction and they can be reconnected to their abseiling rope. If the victim is to descend on the rescuer’s device the pulley is disconnected and they both descend to the base. If the victim is returned to their device, the safety line connecting the victim to the rescuer is released before the pulley is disconnected. Both rescuer and victim continue the descent on their own ropes.

NOTE: It may be advantageous to place the rescue pulleys on the victim’s rope to eliminate rope stretch, particularly if the victim is on a dynamic rope.
4.4.2.2. CHANGE - OVER RESCUE