

HANDBOOKS

MOUNTAIN ESSENTIALS®

# WALKING on a GLACIER

Sébastien CONSTANT



## This handbook cannot be considered a substitute for practical training.

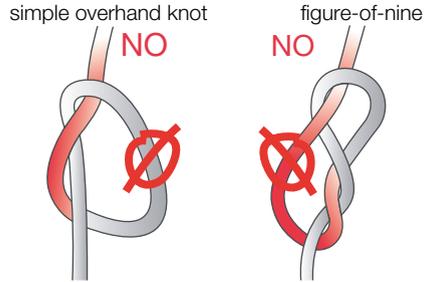
WARNING	p. 1	1-5 ANCHORS AND ROPE WORK	p. 28
INTRODUCTION	p. 2	- Placing an ice screw	p. 28
TABLE OF CONTENTS	p. 3	- Abalakov belays	p. 28
		- Setting up a belay	p. 29
		- Belaying a second or a leader	p. 30
		- Abseiling	p. 31
<b>I - TECHNICAL INFORMATION</b>			
<b>1-1- EQUIPMENT</b>			
- Rent or buy	p. 4		
- Protective clothing	p. 4		
- Boots	p. 5	<b>II - A DAY IN THE MOUNTAINS</b>	
- Gaiters	p. 5	<b>2-1 FROM DANGER TO RISK TAKING</b>	p. 32
- Crampons	p. 6	- Dangers	p. 32
- Walking poles	p. 6	- Risk	p. 32
- Ice axes	p. 6	- Risk taking	p. 32
- Harnesses	p. 7	<b>2-2 PREPARING AN OUTING</b>	p. 34
- Helmets	p. 7	- Have multiple objectives	p. 34
- Rucksacks	p. 7	- Collect as much information as possible	p. 34
- Food and drink	p. 7	- Technical difficulty, commitment and exposure	p. 35
- Safety and navigation equipment	p. 7	- Timing	p. 36
- Technical rack	p. 8	- Think ahead at the hut	p. 36
	p. 8	- Decision-making in the field	p. 37
		- What to do should an accident occur	p. 38
<b>1-2 GLACIERS and SNOW</b>	p. 10	<b>2-3 MOVING OVER SNOW AND ICE</b>	p. 38
- How glaciers work	p. 10	- Moving together	p. 38
- Formation of crevasses and snow bridges	p. 12	- Moving over snow	p. 40
- Textures of snow and ice	p. 14	- Moving over glaciers with few visible crevasses	p. 40
- Evolution of the snowpack during the summer	p. 15	- Moving over highly-crevassed glaciers	p. 40
		- Traversing under seracs	p. 41
<b>1-3 KNOTS</b>	p. 16	- Moving over mixed ground	p. 41
- Coiling a rope	p. 16		
- Overhand knot on the bight	p. 16	<b>III - SCENARIOS AND SOLUTIONS</b>	
- Lark's foot (girth hitch)	p. 16	3-1 Crossing a crevasse	p. 43
- Clove hitch	p. 17	3-2 Taking a break	p. 44
- Italian hitch (Munter hitch)	p. 17	3-3 Tripping over the rope	p. 45
- Tape knot	p. 18	3-4 Avoiding crevasses	p. 46
- Double fisherman's knot	p. 18	3-5 A crevasse that is too difficult to cross	p. 47
- Rethreaded figure-of-eight	p. 18	3-6 There is no track; where should I go?	p. 48
- French prusik	p. 19	3-7 The weather is changing and it is late	p. 48
- Tying in with a rethreaded figure-of-eight	p. 20	3-8 Belaying from a spike above a bergschrund	p. 49
- Tying in with a directional safety karabiner	p. 20	3-9 Progression along an easy ridge	p. 50
- Taking coils round the shoulder	p. 21	3-10 A technical section to descend	p. 51
		3-11 Crevasse rescue - the victim climbs out	p. 52
<b>1-4 WALKING TECHNIQUES</b>	p. 22	3-12 Crevasse rescue - the victim prusiks out	p. 53
- Clearing snow from crampons	p. 22	3-13 Crevasse rescue - assisted hoist	p. 54
- Walking on snow without crampons	p. 23	3-14 Crevasse rescue - unassisted hoist	p. 56
- Walking on snow/ice with crampons	p. 24	3-15 The game of chess is over, it is time to go home	p. 59
- Zigzagging	p. 25		
- Front-pointing	p. 25	LIST of ascents	p. 60
- Ice axe self arrest	p. 26	NOTES	p. 61
- Carrying an ice axe in a rucksack strap	p. 27	USEFULL INFORMATION	p. 63
		BIBLIOGRAPHY	p. 63
		INDEX	p. 64

It is easy to check if the knot is correctly tied:

- Not enough loops round the rope = simple overhand knot.
- Too many loops round the rope = figure-of-nine.

To make a loop, thread the other end of the rope through the knot, following the original knot in the opposite direction. The two ends should be at opposite sides of the knot.

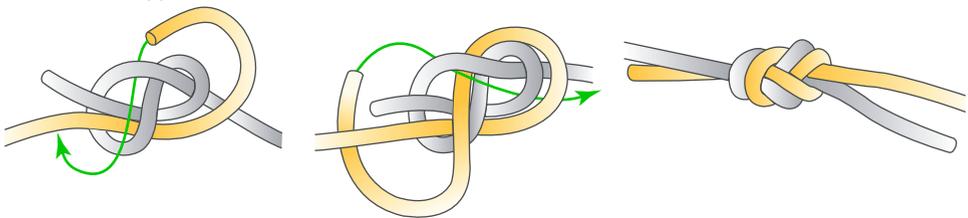
Checking the knot



Thread the other end of the rope through the knot in the opposite direction

Follow the line of the rope in the opposite direction

Tightened knot

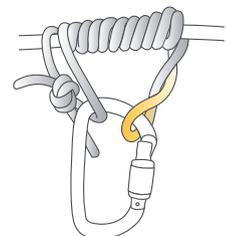
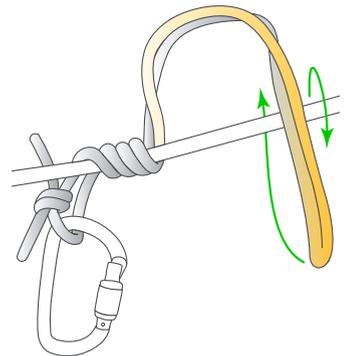


**FRENCH PRUSIK (MACHARD) KNOT**

This knot is used when abseiling and in rescue operations (e.g., crevasse rescue). It can be made with either a loop of accessory cord (45 to 60 cm) or a 60-cm sling.

A prusik knot that locks too quickly is as problematic as a knot that does not lock at all. Generally, it is necessary to twist the accessory cord 4 to 6 times round the rope, but the optimum number of turns will depend on the thickness and state of both the rope and the accessory cord.

The greater the difference in the diameters of the rope and the accessory cord, the quicker the knot will lock (e.g., 7-mm accessory cord on a no-longer-new 8.6-mm rope). Slightly worn accessory cord locks more easily than new cord. It is possible to “take the shine off” new accessory cord by gently rubbing it across a piece of rock.



To release a prusik knot that has been under tension, simply “knead” the rope to gradually loosen the knot. The knot can then be slid along the rope, taking care to prevent it over-tightening.

## 1-4 WALKING TECHNIQUES

On easy-angled ground (up to  $15/20^\circ$ ), it is possible to walk directly up or down the slope and the ice axe can be held with the blade facing either forwards or backwards. The main reason for using an ice axe or walking poles is to help with balance. In addition, the rope can be on either the uphill or the downhill side of the climbers. On easy-angled ground, it is possible to walk straight up or straight down the slope.

When descending, press down slightly on your heels to ensure the soles of your boots get a good grip on the snow.

On steeper slopes (more than  $15/20^\circ$ ), keep the rope on the downhill side ① and carry your ice axe (or walking pole) in your uphill hand ②. This means having to change everything round each time you change direction. If you prefer using walking poles to an ice axe, one of the poles can be carried on your rucksack to keep a hand free for dealing with the rope.

Keep the ice axe blade as close as possible to, and pointing into the slope (and to the snow), so it is facing the right direction if you need to quickly plant it in the snow to stop a slide (see ice-axe braking p. 26).

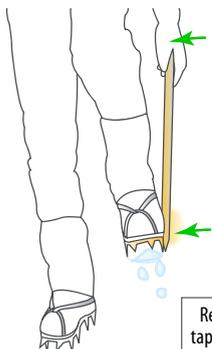
Walking roped up, whether with an ice axe or with walking poles, is a compromise between moving easily and moving safely.



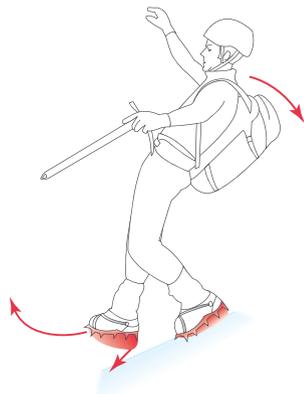
### CLEARING SNOW FROM CRAMPONS

Snow sometimes “balls up” on the bottom of crampons. When this happens, knock the snow off by tapping the side of your foot with the shaft of your ice axe or walking pole. In the worst cases, this has to be done at every step!

“Balling-up” can be exacerbated by the position of your foot on the snow. For example, if you realise that your crampons are balling up during a descent, it is tempting to press more firmly on your heels, leaving the front of the crampon in the air.



Remove the snow by firmly tapping the side of the boot.



**WHAT to do SHOULD an ACCIDENT OCCUR**

If a member of the party is injured but the injured person can still walk, the best thing to do is to descend as best you can, if necessary, stopping off at the hut. If the injured person cannot walk and you are unable to rescue him/her yourself, you will need to call out the rescue services for the area you are in (see useful information, p. 63)

If you suspect a spinal injury (head, back or pelvis), the injured person should not be moved unless the risk of staying in the same place (serac fall, stone fall, weak snow bridge) is greater than the risk of moving him/her. If you have to move the injured person, try to keep his/her back immobilized.

**Giving the alert:**

- By mobile phone (if there is a signal)
- By radio (e.g., via a guide with another party)
- If there is no other way of getting help quickly, split the party in two (if there are four people in your group) or ask another party to give the alert via a hut warden or from the valley (write the details the rescue services will need on a piece of paper). The people who descend may get a mobile phone signal or meet a guide with a radio before they get to the valley.
- If your party is alone and cannot split up, use a whistle (or head torch at night) to attract attention.

To speed up the rescue process **it is essential to provide the following information:**

**Yes**

Yes, I need help

**No**

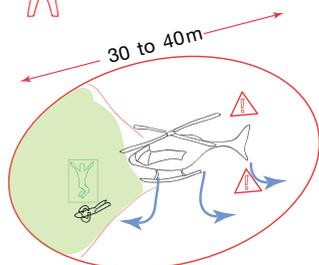
No, I don't need help

- Name and telephone number of the person calling (in case the rescue team need to call back)
- Precise location of the accident (valley, summit, face, name of the route, where on the route, altitude)
- Nature and time of the accident
- Number of people injured
- Type of injuries (consciousness, visible fractures, etc.)
- For the rescue team – visibility, cloud cover, wind, presence of a possible helicopter landing area

If a helicopter lands:

One person kneels beside the victim, facing the pilot and with their hands held up in a Y. Wait for instructions from the pilot.

Clear all unsecured items from a 30 to 40-m diameter area around the landing zone. Make sure rucksacks are closed and held down. If the injured person has been placed in a survival blanket, remove it at the last minute. Prepare an easily visible cow's tail with a screwgate karabiner that can be used to winch the victim if necessary.

**2-3 MOVING OVER SNOW AND ICE**

Beginners should avoid walking with coils of rope in their hands, as it is much more difficult to stop a fall or slide using this method. Techniques for walking carrying coils and for navigating in poor weather (with map, compass and altimeter) will be discussed in volume 2 of this manual: *Mountain Essentials - Ice and Mixed Routes, Level 2 Advanced*, (in preparation, go to [www.sebastien-constant.com](http://www.sebastien-constant.com) for publication details).

In most cases, the leader (the person with the most experience, not the person with the strongest character) goes first when climbing and last when descending.

The choice of which belay method to use, the distance between the people on the rope and the mode of progression will be a compromise between speed and safety.

Part of making choices is learning how to anticipate the next move. As in a game of chess, it is a question of ensuring you keep the upper hand and of avoiding excessively difficult situations you are not used to coping with.

### III - SCENARIOS AND SOLUTIONS

Because decisions made in the mountains can only be as good as the information on which they are based, the following pages present the scenarios most commonly encountered during glacier travel, describing their potential dangers and suggesting suitable solutions. These scenarios will help you reduce the risks you take, widen the range of options open to you and ensure your days in the mountains are even more enjoyable. By helping you build a better picture of “reality”, they will enable you to avoid falling into traps you may otherwise have created for yourself.

Each scenario is presented with just one solution that is suitable for people setting out on their mountaineering careers. However, these are not “obligatory” solutions that must be applied at all costs; other options may be equally valid, depending on the exact nature of each situation.

I often draw a parallel between mountaineering and a game of chess. Parts 1, **Technical Information**, and 2, **A Day in the Mountains**, present the rules of the game and the ways in which the pieces can be moved. Part 3 describes the strategies that can be adopted to successfully negotiate different phases of the game.

Each outing in the mountains is a new “game” involving billions of possible combinations. As in chess, it takes time to gain the experience needed to make the best strategic choices and to progress from the “**beginner stage**” to the “**expert stage**”.

The solutions described in the scenarios leave open the possibility of giving up and turning back should you feel you are getting out of your depth and into a situation requiring “**expert**” skills you have not yet acquired.

While still in the “**beginner stage**”, you should not try to tackle technically difficult routes (harder than PD-/PD), and you must not forget that even a usually straightforward “normal route” can sometimes be technically challenging, for example, at the end of a dry summer.

When climbing, you have to be able to make your own decisions. If you are unsure as to which decision to take, which route to follow, it is probably time to turn round – you can always come back to finish the game another time.

In addition, you should not necessarily try to base your decisions on those taken by mountain guides, who are seasoned “**experts**” with the skills to deal with difficult situations. Guides will not make the same decisions as beginners and they will react very differently should an incident occur.

If you feel that the solution described in one of these scenarios is not right for a specific set of circumstances, you must be able to adapt or change your approach to suit the situation.

If the conditions in the mountains are poor (open crevasses, bad weather, etc.) and you do not have the skills and experience to safely complete the climb in such conditions, turn back.

Life is much more precious than a day in the mountains or reaching a summit.

The situations mountaineers may have to face have been colour-coded as follows:

Situation	
	LOW RISK
	CAUTION
	INCIDENT
	ACCIDENT

**Green situation:** Situation presenting **low risk** (minimal) due to the nature of the terrain and/or the strategy adopted by the climbers

**Amber situation:** Presence of an obstacle or a section of technical climbing. The strategy chosen to overcome this obstacle must be chosen carefully (**caution**) in order to avoid taking unnecessary risks.

**Red situation:** A potentially dangerous situation in which an **incident** can occur at any moment. When still in the “beginner stage” it is better to avoid this type of situation.

**Black situation:** When an incident turns into an **accident**. No one, not even a mountain guide, can predict the outcome of an accident.

### 3-1 CROSSING A CREVASSE

These three climbers are in a **Red situation**  :

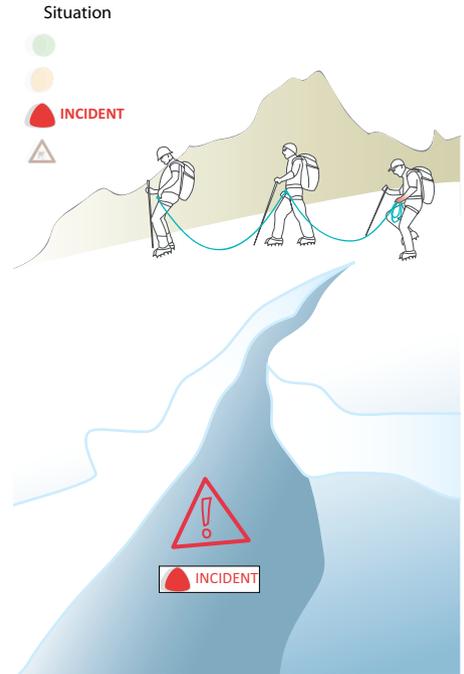
- They are roped-up too close together for moving over a crevassed glacier.
- There is too much slack in the rope as they cross the crevasse.
- They are not wearing helmets or gloves.

The situation could turn into an **accident**  at any moment.

This scenario occurs very frequently in the Alps, for example, when climbing/descending to/from a hut on the edge of a glacier, or at the end of a glacier that appears to be crevasse-free.

Beginners also see other climbers roped-up like this and tend to do likewise.

Remember that guides and experienced climbers have the skills to extricate themselves from difficult situations - do not try to emulate what they do.



To get back to an **Amber situation**  , as shown by the climbers below:

- Increase the distance between the climbers (moderate distance).
- Keep the rope tight when crossing the crevasse.
- Wear a helmet and gloves.



When there is no choice but to cross/jump over a crevasse (Amber situation), do so where the crevasse is narrowest, even if other tracks go over wider parts of the crevasse.

The first person to jump must have enough slack to reach the other side of the crevasse.

This is a delicate moment, as it means having a relatively large amount of slack in the rope, so as not to hamper the person jumping, despite there being a non-negligible risk of the jumping climber falling into the crevasse. Consequently, the other member(s) of the party **must be alert and ready to hold a fall**.

When it is the second's turn to jump, the leader should turn round and walk backwards, in order to keep the rope tight, while watching the person jumping – holding the rope in her hand and keeping her hips parallel to the line of the potential fall.

On an easy-angled but highly crevassed glacier, it is best for two parties of two to join forces and form one rope of four with a **moderate distance between the climbers**. This requires a 60-m rope.

### 3-5 A CREVASSE THAT IS TOO DIFFICULT TO CROSS

This climber is at the foot of a steep wall of snow, with no nearby ice in which to place an ice screw. The second waits lower down the slope, keeping the rope snug (Amber situation).

The leader does not have the technical ability or experience to comfortably cross this overhanging crevasse. In such situations, discretion is the better part of valour.

In addition, such obstacles are much easier to climb with two more-technical ice axes (**advanced technique**).

This type of scenario most frequently arises in the middle of summer, when the crevasses are more open. Beginners confronted with such situations should turn back - even if they safely cross the crevasse

on the ascent, it will be much more difficult to get back across during the descent because it is almost impossible to down-climb such terrain. As a result, they would have to set up an abseil from a deadman (in the snow). Such situations are best left to more experienced parties.

The most sensible way to get back into a **Green situation** is to turn back and go down the ascent route. To do this, all the climbers need to do is reverse their roles, so:

- The leader (at the foot of the crevasse) is at the back during the descent.
- The second goes down first, following the up track (as long as it is reliable).



After jumping over the crevasse, the person in front turns round to watch the second, remaining ready to hold a fall (Glacier de la Girose - Ecrins Massif / France).



On some of the more popular routes, guides will occasionally leave gear in-situ to help people cross difficult sections - in this case, a ladder and a runner (Dôme des Écrins Normal Route - Ecrins Massif / France).

