



Wānaka Mountain Guides

Mountaineering Manual

Section 5: Equipment

Clothing systems

In New Zealand, a wide variety of terrain and conditions are likely to be encountered during a trip to the mountains. Quite often equipment will be a compromise between what will be best suited to the majority of likely and anticipated conditions and what will be specific to the objective. Aims when packing are to minimise weight, which will translate to movement efficiency - faster, further and safer. Every eventuality can't always be packed for, but some provision for emergency preparedness is prudent.

Temperature regulation

A necessary skill of mountaineering is the ability to regulate body temperature when exposed to a wide range of conditions and levels of activity. The aim is to maintain the optimum temperature, not being too warm or too cold. Overheating and sweating makes clothing wet which can conduct heat away much faster than dry clothing. When stopped, evaporation can also lead to rapid cooling. It also promotes dehydration, which reduces performance, increases fatigue, and impairs cognitive processes.

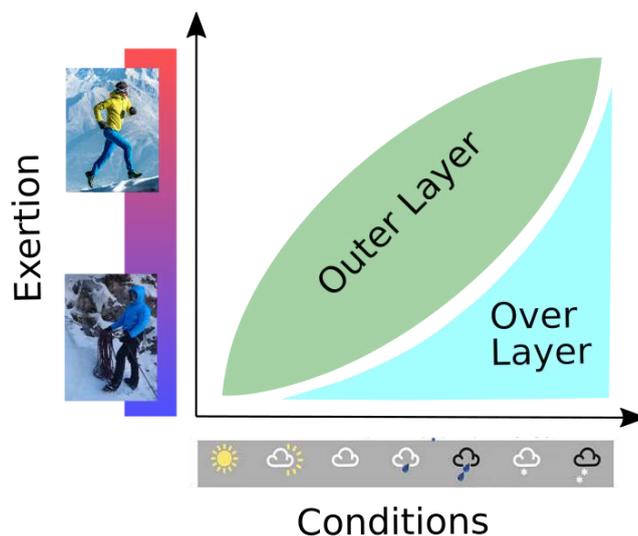
Layering

The benefits of layering clothing outdoors are well known. The traditional approach of having a **base layer** next to the skin, a **mid layer** for insulation and an **outer layer** for weather protection assumes that conditions and level of activity will remain relatively constant during the course of the day. With alpine climbing, this is far from the case and an alternative layering approach is often preferred.

For an alpine layering system, the **outer layer** is that which is anticipated to be used for the majority of the day. This takes into account required proofness and level of activity. Waterproofness is not as important unless the trip entails spending lots of time out in the rain. In winter, it will hopefully be snowing rather than raining, so a more breathable and less waterproof garment can be selected. The key is staying comfortable and being able to adjust body



temperature without stopping too often to take on and off layers, especially those underneath the outer layer. As conditions change during the day, and to avoid time spent stopping to remove layers, features to quickly adjust are useful. These include zips, as well as being set up to change between different weights of gloves or beanies.



Temperature regulation

An **over layer** allows a quick adjustment to add additional insulation or weather proofness for shorter durations of the day, such as cold, pre-dawn starts, breaks, belays or passing showers. This will generally be slightly oversized to fit over the outer layer and with a full length zip for quick changes. As this layer is an occasional item, durability isn't as important but weight and packability is; it will spend plenty of time in the backpack.

Fit and function

Modern technical materials have good performance. When choosing garments, material choice to some extent will be dictated by the compromise of durability versus weight. Fit and function is also important. Some manufacturers of technical clothing specify the fit of each garment with respect to whether it is sized as a base layer, outer layer or over layer. When selecting layers to use together, avoid bulk in high movement areas (like arms) and choose materials that move well next to each other to maximise your freedom of movement. For example fleece tends to 'stick' to other fleece layers but finely woven nylons slide well over fleeces.

Hoods are a great way of regulating temperature, but too many can get congested around the neck and head. Under-helmet hoods are best reserved for mid layers and over-helmet hoods work best for outer and over layers. Good insulation around the wrists, where the blood vessels are close to the surface, will help keep your hands warm, but too many tight cuffs will be



uncomfortable. Wide velcro-adjustable cuffs are good for overs layers and work well with bigger outer gloves.

Backpacks

Once the equipment has been selected, it needs to be packed and carried. Backpacks for alpine climbing should be simple and lightweight. Size is important-- not too big as it will not be ideal for climbing in, not too small or it won't have enough capacity for all the equipment required for NZ walk-in objectives. Alpine packs may not always be as comfy as tramping packs for the walk in, so consider designs with removable waist straps, frames, or lids that can be stripped off for the summit. When flying in, a separate duffel bag of equipment can be taken.

The primary aim of packing should be to keep the centre of gravity low. There is not necessarily a correct sequence to packing, but you should be avoiding empty space, therefore minimising the bulk of the backpack. These factors help to increase your comfort and balance and, therefore, efficiency in moving. Apart from certain heavier items, cramming things in and avoiding empty space will result in a relatively uniform density. A further consideration is accessibility.

Ideally, pack heavier items, such as crampons and ropes, as low as possible if not immediately required. Pack small and soft items around awkward, bulky items such as helmets, so that they can fit in your pack.

Avoid having stuff hanging from the outside (apart from awkward items such as ice axes and snow stakes). Any things on the outside should be light and well-secured so they don't affect your balance. If strapping a rope to the top of your pack, coil it 'butterfly style' so that the loops can be secured down on either side of the pack - keeping the centre of gravity low.

Technical equipment

Where a wide range of conditions can be anticipated there is unlikely to be a single piece of equipment that is ideal in every eventuality. There will have to be some compromise somewhere along the line. When investing in equipment and when selecting equipment for particular trips, it needs to be decided how it is going to be used the most. One of the principles of modern alpinism is a lightweight approach. Carrying less equipment allows mountaineers to move faster and for longer periods of time. Items taken on each trip need to be carefully selected with the goals of optimising performance and safety through minimising weight. Every eventuality can't be provisioned for but good research and planning will help you make good decisions and adjust what you are carrying for your particular objective.

There are obviously some items of technical equipment that can't be compromised. Lightweight items of equipment often severely compromise functionality and durability. There is a cost



premium associated with lightweight equipment, so realistically it is a balance of cost and benefit. Large, obvious items often provide the most opportunity for weight saving. Common items being sleeping bags, backpacks, and occasionally used waterproofs. Weight can be diligently shaved from every piece of equipment, from wire gate carabiners to polystyrene helmets, but won't have as big of an impact.

Boots

For climbing on steep snow and technical ice and mixed, a fully rigid (full shank) mountaineering boot is required. Single boots constructed from leather or synthetic materials (some models with an integrated gaiter) are suitable for conditions encountered during winter and spring in NZ. For general mountaineering, when only short sections of steep snow climbing is anticipated, then semi-rigid (3/4 shank) boots are fine. As wet snow can be encountered at any time of the year in the Alps, a 2-3 season boot performs best.

Crampons

For general mountaineering, crampons with horizontally aligned front-points work best, as they are less prone to slice down through softer ice and consolidated snow likely encountered in spring and summer.

The crampon binding system must be compatible with the boots. Some brands allow users to change between different binding systems allowing one pair of crampons to be used in a variety of situations.

Step-in (also known as clip on or fully automatic) crampons are only compatible with fully rigid boots;



Hybrid (also known as semi-automatic with a heel clip and toe strap) work well in most situations.





Strap-on crampons can also be used, though they don't perform as well for front-point climbing; but they are the only option for softer boots. Due to the variable NZ snow conditions, all crampons need anti-balling plates.

While general mountaineering crampons and axes can be used for ice and mixed climbing, a range of specialist ice gear is available. Crampons used for ice climbing need to be sharp so if you are using crampons for general mountaineering in the summer months, they will need to be sharpened for use on the ice. This eventually reduces their lifespan so if you plan on spending a lot of time ice or mixed climbing, having specialist gear can save money in the long term.

Vertically aligned front-points penetrate harder ice more easily with less shattering. Dual vertical front-points provide a more stable platform to stand on but in hard and brittle ice they can cause the ice to dinner-plate or shatter, requiring several more kicks to ensure a secure placement. Mono vertical front-points excel on hard brittle water ice where the points can be placed in the holes left by ice tool placements and allow very efficient and positive climbing. They are also good for mixed climbing and provide good balance on small rock features.

Ice axe



For general mountaineering, a straight shafted axe with a classic pick (some models have interchangeable picks) is best for plunging in the snow and self-arresting. A longer axe provides better balance and support on moderate ground, and even the more difficult ascents have approaches and descents where this is helpful. Classic axes will have an adze for cutting steps or stances.



For steep or firm snow conditions a second axe is useful, and it is common for this to be a shorter technical tool with a technical pick and a slightly bent shaft. The profile of technical picks can make them too 'grabby' for self arresting, but it performs better in firm snow and ice. A second axe will have a hammer that is used for hammering in snow stakes and pitons.



Leashes provide more confidence and security on steep ground but are often tucked away on easier terrain. When not being used, leashes must not dangle loosely where crampons could get snagged resulting in a trip hazard. Spinner leashes are only useful in technical terrain.

Snow stakes

There are two main types of stakes used for snow anchors. The T cross-section shaped stakes (MSR Coyote®) are more resilient and resist deforming when pounded into very hard snow. They are always placed with the upright of the T pointing in the direction of load. The V shaped stakes (Aspiring Safety) are wider and therefore offer a greater surface area so they are more useful in softer snow. Whenever using snow stake anchors it is important to keep the direction of pull low.

Alpine rock

An alpine rock climbing rack of protection will depend on the objective and rock types. Some rock types will favour particular items of protection. Established routes on compact rock types such as in the Darrans will often have bolts for protection and anchors. Long technical pitches will require a full range or even double-ups of cams and nuts. Shorter or easier pitches will need less gear. To keep loads light, it is best to minimise the amount of gear carried and use equipment that can be used for a variety of situations (such as extendable quickdraws). Minimising the gear placed (and removed) on a pitch also saves time that adds up on longer routes.

When climbing in the mountains, it is common to find pieces of fixed or in-situ protection (mainly slings or pitons) that have been left behind by previous parties, especially on established abseil descents. It is important to thoroughly check any fixed protection before trusting it, especially old, worn or UV damaged slings. Always carry a knife and spare sling so any suspect slings can be replaced. Please remove old and surplus slings rather than cluttering up the mountainside.

On long rock routes go for a comfortable shoe that can be worn all day without having to take it off. Taking shoes off after every pitch can add up to a lot of time.



Extendable quickdraw



Lightweight alpine rock rack

Ice tools



On steep water ice, modern highly curved ice tools make a big difference, especially when making placements over bulges and generally minimising effort on steep terrain. Dedicated ice tools are shorter than general mountaineering axes and the curve and any handle will make it more difficult to plunge into the snow for security on the approach and descent.

When using curved ice tools with ergonomic handles, wrist leashes are often not used at all. This makes it easier to recover, place ice screws and opens up a variety of techniques to make things more efficient on technical climbs. If climbing without a wrist leash, an umbilical leash is recommended as they provide the benefits of leashless climbing whilst still maintaining an attachment and limiting the potential to drop the tools. Dropping ice tools could be a potentially serious issue on a long mountain route.

Wrist leashes, whilst not as popular since the arrival of umbilicals. They provide support and can promote a more relaxed grip on the ice tools which conserves effort but makes placing ice screws more awkward. Clipper wrist leashes allow the leash to be quickly detached from the tools, providing the benefit of having wrist leashes while making it easier to place ice screws and shake out tired arms.

Ice screws

Ice screws are used almost exclusively on pure ice routes. They come in a number of different designs but most modern options have a fold out handle that helps screwing them in and out. They come in a variety of sizes up to 22cm long. The strength of the ice screw placement comes from the thread so longer ice screws do not necessarily make for a strong placement, but just engages the thread deeper and through the softer surface ice.

Emergency equipment

First aid

It is highly recommended that all team members have undertaken a first aid course before venturing into the mountains. The duration of the mountain trip and the remoteness of the venture will dictate the size of the carried first-aid kit; it should be kept lightweight and at a minimum.

Repair kit

Equipment commonly breaks, and being able to make repairs whilst out can make the difference between being able to continue on with the objective or having to turn around.

Useful items include



- Cable ties
- Spare shoelaces
- Multi-tool (eg Leatherman®)
- Hose clamps and pole splints
- Duct tape
- Spare batteries for head torches, avalanche transceivers or GPS
- Wire
- Sewing kit
- Thermarest® repair kit (if carrying)
- Stove repair kit

Emergency shelters

An unplanned bivy is not a desirable outcome of any day spent within the mountains. It means that at least one mistake has been made in the planning and/or the execution of the climbing activity. This could be carrying too much weight, not moving fast enough, making a bad route choice or being caught out by bad weather.

It could also mean that an incident has happened that stops the team from carrying on and you need to call for outside help. A head torch is mandatory for any trip regardless of the apparent ease and safety of the activity, as it allows continued movement after dark. With a bit of skill, good judgement and luck, it may be possible to get back to more agreeable shelter. However if unsure of what to do, injured or exhausted, then staying put with an emergency bivy might be the safest course of action.

Emergency bivvies are an attempt to find a modicum of shelter from the elements. They can be as desperate as crouching beneath a rock or sitting on a backpack, or might be a tent, bothy, bivy bag or tarp you've carried. In colder conditions, insulation from the ground is as important, so a bit of closed cell foam could be carried, or you could improvise with the rope. Many people have sat out storms by retreating into crevasses and bergschrunds, or if time, energy, and conditions have permitted, building a snow shelter.

Emergency communication

In the event of an incident, timing may be of the essence, and although a member of the team could be sent out to get help, the fastest course of action is to carry a form of emergency communication. There are many different options available with advantages and disadvantages, so it may take a bit of planning to work out the best solution for each particular trip.

Cell Phones - do get coverage in some parts of the Southern Alps and are well worth carrying in these areas. This can be predicted to some extent by determining if there is line of sight to known



cell phone towers, though it becomes unreliable at large distances. Local guides will have a good idea of what works where.

PLB (Personal Locator Beacon) - is a one-way communication device which, once triggered, sends a signal that is picked up by satellite, and alerts the authorities of location and need for help. PLBs can be hired from many of the DOC Offices for quite reasonable fees. The carrying of PLBs is becoming much more commonplace. If a PLB is set off, it is also very useful to initiate some form of two-way communication to communicate the nature of the incident, so that the rescue services can better plan the rescue.

Satellite phones - are becoming cheaper each year and are the most common form of communication for many professionals. They can also be hired and are useful for receiving weather forecasts. Networks use either geostationary or geosynchronous satellites and are subject to coverage limitations, especially in deep and steep sided valleys.

Hut Radios - High mountain huts in New Zealand usually have a hut radio that can be used to get in contact with DOC. Radio scheds are usually the best source of weather information, though rely on proximity to the hut to raise the alarm.

Spot® or Inreach® - Communication technology is a fast moving field and two-way and emergency satellite messaging devices are becoming more widespread. Most require a paid subscription and can be set up to send out location and tracking information.



Summer Mountaineering Course Equipment List

Body

- Base layer top and bottoms (merino or polyprop, no cotton)
- Mid layer top (fleece or windproof)
- Insulating jacket (synthetic fill)
- Waterproof jacket and trousers
- Softshell climbing or trekking trousers

Head/Face

- Sunhat or cap
- Warm hat & neck gaiter (eg Buff®)
- Category 4 (glacier rated) Sunglasses
- Goggles

Hands

- Lightweight gloves
- Warm climbing gloves

Accessories

- Backpack, around 50 liter capacity, with ice axe attachments and the ability to carry overnight gear
- Water bottles (1.5 to 2 liters capacity)
- Small container of sunblock & lippy

Feet

- Mountaineering boots: Full shank November/December (eg La Sportiva Nepal Evos®) or $\frac{3}{4}$ shank from January onwards (eg La Sportiva Karakorum®)

Technical gear and safety (can be provided)

- Ice axe and hammer
- Boot crampons
- Climbing/ mountaineering helmet
- Lightweight harness
- Long (120cm) and short (60cm) prusik loops
- 120cm length sling
- Belay device (eg Black Diamond ATC Guide®)
- 4-6 carabiners
- Ice screw

Overnight

- 2 season sleeping bag and liner
- Head torch and spare batteries
- Personal toiletries (blister kit & personal medication)
- Bivi bag and sleeping mat (trip dependant)

Recommended

- Progress Capture Pulley (eg Petzl Microtraxion®)

Optional

- Own ropes
- Snow stake
- Traditional rock protection

