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This is a safety publication. These orders and procedures deal with actions designed to preserve human life. They are mandatory, require strict adherence and deviation is not permitted. Orders are clearly phrased as orders (for example, ‘must’ ‘is to’ or ‘are to’). Failure to comply with orders by ADF members, or lawful and reasonable directions by APS employees may result in administrative or disciplinary action, or APS Code of Conduct action respectively. Defence employees generally remain at all times subject to Work Health and Safety legislation and other safety legislation (except at certain times on warlike operations overseas), breaches of which may result in personal liability or civilian charges.

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AUSTRALIAN ARMY

LAND WARFARE PROCEDURES - GENERAL

LWP-G 7-6-3

ADVENTUROUS TRAINING – BACKCOUNTRY SKIING AND ALPINE SURVIVAL

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12 December 2018

Issued by command of
Chief of Army

ME Garraway, AM
Colonel
Commandant
Army Recruit Training Centre
Contents
AMENDMENT CERTIFICATE

Land Doctrine, Army Knowledge Centre is responsible for the management of this publication. The sponsor of this publication is Commandant Army Recruit Training Centre. The doctrine contained herein was approved on 12 December 2018.

1. Proposals for amendments or additions to the text of this publication should be made through normal channels to the sponsor. To facilitate this go to the Doctrine Online intranet website and select the ‘Feedback’ icon. Alternatively, there are amendment proposal forms at the back of hard copy versions of this publication.

2. It is certified that the amendments promulgated in the undermentioned amendment lists have been made in this publication.

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_LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018_
3. Changes have been made to this publication and a familiarisation with all of the content is highly recommended. Significant changes from the most recent rewrite are listed in the following table.

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<td>‘Safety Instructions for the conduct of adventurous training backcountry skiing and alpine survival’ was comprehensively revised, in order to clearly define duties, responsibilities and equipment required for the conduct of adventurous training.</td>
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<td>‘Alpine hazards’ have been included to incorporate a vast array of hazards associated with backcountry skiing and alpine survival.</td>
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<td>‘Backcountry skiing and alpine survival equipment’ has been comprehensively updated in order to modernise equipment, with emphasis placed on fitting and adjusting equipment.</td>
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<td>‘Basic skiing’ now includes snowshoeing skills.</td>
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<td>‘Rations for the alpine environment’ now includes a menu example for planning purposes.</td>
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<td>‘Alpine survival and snowcraft’ have been combined, with emphasis placed on practical survival.</td>
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<td>‘Interpreting weather conditions’ has been amended to reflect contemporary best practices.</td>
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<td>‘Emergency management’ has been amended to include information such as combined search, rescue and alpine first aid.</td>
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4. All superseded Amendment Certificates should be retained at the rear of the publication for audit purposes.
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SAFETY INFORMATION

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**PREFACE**

This publication supersedes *Land Warfare Procedures - General 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2011.*

**Aim**

1. This publication is the primary source of technical information required for backcountry skiing and alpine survival in the context of adventurous training. It provides guidance to Unit Adventurous Training Leaders at unit level, commanders and others concerned with designing, planning and conducting backcountry skiing and alpine survival activities.

**Level**

2. This is a procedural level publication for use by all Unit Adventurous Training Leaders who are backcountry skiing and alpine survival qualified.

**Scope**

3. This publication describes the fundamentals of backcountry skiing and alpine survival, alpine hazards, equipment, basic skiing skills, snowcraft, navigation, interpreting alpine weather conditions and emergency management.

4. Adventurous training, in the context of this publication, is confined to terrain where objective hazards associated with avalanche and glaciated terrain are removed.

5. This publication does not include other organised training activities involving skiing within patrolled areas. When skiing within a patrolled ski area, all participants are to adhere to the rules and requirements of that area (for example, Alpine Responsibility Code).

*LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018*
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Associated Publications

6. This publication should be read in conjunction with the other publications and documents, in particular:

a. Army Standing Instruction, Military Risk Management
c. Defence Instruction (General) Operational 47-1, Australian Defence Force Search and Rescue Operations – Command and Control Arrangements
d. Land Warfare Doctrine 7-6, Adventurous Training
e. Land Warfare Procedures - Combat Arms (Dismounted Combat) 3-3-8, Patrolling
f. Land Warfare Procedures - General 1-2-5, Army First Aid
g. Land Warfare Procedures - General 7-6-1, Experiential Learning and Adventurous Training
h. Land Warfare Procedures - General 7-7-2, Navigation.

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Gender

9. This publication has been prepared with gender-neutral language.
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<td>8-7</td>
</tr>
<tr>
<td>9–1</td>
<td>Wind Chill Chart</td>
<td>9-13</td>
</tr>
</tbody>
</table>
1. The principal source for Australian Defence Force terms and
definitions is the Australian Defence Glossary located at
contained within this publication are in accordance with the
business rules, guidelines and conventions for the Australian
Defence Glossary at the time of its release.

cornice
An overhanging crest of snow.

downhill ski/uphill ski
Identifies the ski that is on the uphill or downhill side during a
traverse, or within the confines of a standard transition between
turns.

fall line
The quickest route from the peak of a slope to the base, used
for building up speed.

mondopoint
A standard sizing used for ski boots, the mondopoint is based
on the length of a person’s foot in centimetres.

snowpack
The combined layers of snow on the ground at any one time,
which are bounded by the snow surface and the ground
surface.
ABBREVIATIONS

1. The principal source for Australian Defence Force abbreviations is the Australian Defence Glossary located at http://adg.eas.defence.mil.au/adgms. Abbreviations contained within this publication are in accordance with the business rules, guidelines and conventions for the Australian Defence Glossary at the time of its release. The following abbreviations are used throughout this publication; however, commonly used terms have been presented in their abbreviated format throughout the publication and have not been included in this list.

- **AC** activity commander
- **AR** allocated rations
- **AT** adventurous training
- **ATLI** Adventurous Training Leader Instructor
- **CRP** combat ration pack
- **DWR** durable water repellent
- **GL** group leader
- **PLB** personal locator beacon
- **SAR** search and rescue
- **UATL** Unit Adventurous Training Leader

2. The following abbreviations appear in tables and figures within the publication.

- **qty** quantity
- **SP** spur
- **wt** weight
- **XCD** cross-country downhill

3. The following are common shortened forms or symbols for names of measurements used throughout this publication.

- **kJ** kilojoule
- **mil** milliradian
CHAPTER 1
THE FUNDAMENTALS OF BACKCOUNTRY SKIING AND ALPINE SURVIVAL

SECTION 1-1. INTRODUCTION

1.1 Adventurous training (AT) is designed to develop the individual and group qualities that are required in battle. Drawing on the theory of adventure-based learning, AT places participants in situations of perceived risk and consequence. This facilitates the development of qualities that are beneficial for both the individual and the unit in accordance with LWD 7-6, Adventurous Training. A wide range of disciplines lend themselves to this purpose, including backcountry skiing and alpine survival.

1.2 Backcountry skiing and alpine survival can be employed as an AT activity in isolation. It is a mobile activity that has the capacity to accommodate a moderate number of participants with minimal training. It requires detailed planning and is conducted during winter in limited locations. The benefits gained from backcountry skiing and alpine survival are substantial when the activity is well planned and conducted correctly in suitable weather conditions.

1.3 Backcountry skiing and alpine survival may be undertaken for the following purposes:
   a. as an introduction to AT
   b. as a demanding AT activity in its own right with the potential to develop and enhance resilience and leadership
   c. as a foundation for more demanding and advanced activities.

1.4 Backcountry skiing is best conducted as an expedition-based activity. It is possible to conduct this activity over shorter
periods although it will not be as beneficial. A minimum of two nights is optimal. This is due to the value and benefit derived from an expedition-type activity in contrast to a day trip (unless the intent is to build skills in preparation for an expedition).
CHAPTER 2

SAFETY INSTRUCTIONS FOR THE CONDUCT OF ADVENTUROUS TRAINING BACKCOUNTRY SKIING AND SURVIVAL ACTIVITIES

SECTION 2-1. GENERAL SAFETY REQUIREMENTS

2.1 During the conduct of backcountry skiing and alpine survival AT activities, safety requirements are always to take priority over training objectives.

2.2 Disclosure of Risk. Backcountry skiing and alpine survival can be a potentially hazardous activity and must be led by personnel with suitable training and experience. The major risks associated with backcountry skiing and alpine survival are misjudging the weather and getting lost. Adverse weather conditions can negatively affect participants (e.g., groups being unable to travel for long periods of time, the increased possibility of cold weather injuries, the loss of visibility and moving in difficult snow conditions). Becoming lost may have escalating consequences over time where the group may find itself in inappropriate terrain and may fail to meet expected travel times. This may result in longer than expected expedition times and extended exposure of personnel to extreme cold weather.

2.3 These situations can lead to direct physical injury. However, the risk can be minimised by:
   a. being adequately equipped
   b. ensuring a gradual progression in training
   c. selecting appropriate terrain
   d. considering the effects of changing alpine weather conditions on the group

LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018
e. making allowances for contingencies when planning and conducting the activity
f. considering participants’ abilities.

2.4 A detailed risk assessment must be conducted prior to the activity, and a comprehensive risk management plan must be established in accordance with Army Standing Instruction, Military Risk Management.

2.5 Medical and Physical Requirements. The activity is to be planned and conducted in accordance with the participants’ abilities. Participants are to have medical clearance where there are pre-existing injuries that will affect their ability to participate in the activity.

2.6 General Equipment Safety Precautions. The following precautions apply to the inspection, transport and storage of backcountry skiing and alpine survival equipment:

a. All equipment must be inspected before, during and after use.
b. All issued and personal safety equipment is to be approved for use in accordance with Chapter 4.
c. All backcountry skiing and alpine survival equipment is to be transported and used correctly. Equipment is to be stored separately from general stores in a shaded, well-aired area away from fuel, chemicals or any other substances that are likely to cause them damage.
d. Any equipment found unserviceable or considered unsafe by a Unit Adventurous Training Leader (UATL) or Adventurous Training Leader Instructor (ATLI), or where the slightest doubt exists that the equipment is unserviceable or unsafe, it is to be tagged and immediately withdrawn from use.

2.7 Backcountry Skiing and Alpine Survival Equipment. The mandated equipment requirements for the conduct of any backcountry skiing and alpine survival AT activity are provided in Annex A.
SECTION 2-2. DUTIES AND RESPONSIBILITIES FOR PLANNING AND CONDUCT

2.8 Activity Commander. Typically an activity commander (AC) is not qualified as a UATL or ATLI; however, the AC will command the supported unit. Where there are a number of groups, the AC may appoint an OIC. In consultation with the OIC or group leader (GL) the administrative arrangements may be delegated; however, the AC is responsible for overseeing all administrative and planning requirements. These requirements are as follows:

a. Verify the qualifications and currency of all UATLs or ATLIs supporting the activity. This information is to be verified on PMKeyS; currency extends for a period of two years, if there is any doubt, the AC is to consult the AT Wing.

b. Ensure that all activity personnel understand the C2 architecture and orders prior to commencement of the activity, such as:
   (1) risk and safety instructions
   (2) medical treatment and evacuation plan
   (3) search and rescue (SAR) plan
   (4) incident management plan
   (5) communications plan.

2.9 Officer-in-Charge. An OIC may be appointed by an AC in complex activities or where there are multiple groups. Or where an enhanced level of coordination is required. The OIC is a qualified and current UATL or ATLI. The OIC is responsible for:

a. advising the AC on all matters concerning activity design, planning, safety and equipment

b. supervising all GLs to ensure that activity is planned and conducted in accordance with this publication and
c. validating group trip plans, with emphasis placed on contingency actions such as actions on and alternate routes within clearly articulated decision-making and physical boundaries prior to activity

d. obtaining and disseminating weather forecast information prior to the commencement of an activity

e. consulting with the AC and GLs prior to deployment into areas affected or likely to be affected by severe weather events; establishing decision points in advance (the experience of the participants will weigh heavily in these decisions)

f. leaving trip intentions proforma(s) with responsible emergency organisation (eg, civil police or National Parks) prior to deployment

g. during the conduct of the activity, being prepared to concentrate own forces to assist with SAR tasks supporting civil police SAR and/or other emergency services

h. confirming incident reporting procedures in accordance with current defence policy, prior to activity

i. ensuring that vehicles are prepared and operated in accordance with Chapter 3

j. ensuring that knowledge of the area is obtained before the activity commences, in particular the location of dangerous terrain, known hazards, sheltered areas/routes and emergency huts

k. ensuring that sufficient time and space is allocated to conduct the activity, including pre-activity and post-activity administration, front-loading and debriefing.

2.10 **Group Leader.** The GL is either an ATLI or UATL who is primarily responsible for the safety of their assigned group. GLs
are to work to the known level of ability of their participants and in terrain appropriate to their experience and training.

### 2.11 What distinguishes a GL in the AT discipline is not their technical skill but their decision-making and group management skills. The fundamental responsibility of the GL is the safety of the group and its members; this is enabled through a continuous appreciation loop on the part of the GL. Continuous monitoring of participants is required to ensure that they are appropriately dressed, cooking, eating and regularly conducting essential tasks, such as building wind breaks and clearing snow from tents.

### 2.12 Where the AT activity involves a single group, the GL assumes the responsibilities of the OIC and the following responsibilities:

a. Inspect all equipment taken by participants and the group to confirm it is serviceable, meets requirements for function, safety and that it fits correctly prior to deployment.

b. Prior to the activity, provide instruction on:
   1. the safe operation of in-service liquid fuel stove
   2. establishing a tent
   3. first aid training in the prevention and treatment of cold weather injuries.

c. Provide the OIC with a trip plan for all backcountry skiing and alpine survival activities in accordance with *LWP-G 7-6-1, Experiential Learning and Adventurous Training*. A template for a backcountry skiing and alpine survival trip plan is provided in Annex B.

d. Issue detailed safety brief prior to conduct of activity, daily in the field and when the situation changes in accordance with Annex C.

e. Ensure that group deploys with suitable communications equipment (with redundancy) and instructions to affect timely evacuation of casualties. If issued, verify registration of personal locator beacons (PLBs).
f. Conduct initial ski safety skills training in a safe area. This safety skills training includes, but is not limited to:

(1) falling and recovering
(2) snowplough brake
(3) snowplough turn
(4) climbing skills applicable to situation encountered (eg, side step/herringbone)
(5) other skills as the terrain warrants
(6) participants’ proficiency with self-arrest techniques prior to skiing across steep or difficult terrain.

g. Ensure that participants are wearing sunglasses or ski goggles at all times while in an alpine environment.

h. When constructed, inspect snow shelters prior to occupation for structural safety and ventilation.

i. Where applicable, ensure that participants are aware of snow bridge hazards and actions on when encountering or travelling across them.

j. Ensure that the group is postured to build, seek and/or improvise shelter (protection from elements) at any stage of the activity.

SECTION 2-3. SAFETY RATIOS AND GROUP SIZE

2.13 Safety Ratios. The GL/participant supervision ratio in backcountry areas is one UATL/ATLI to eight participants (1:8). The OIC may increase the number of UATLs/ATLIs or decrease the number of participants in a group based on the following considerations:

a. experience of the leader

b. expected capabilities of the participants (experience, competence, fitness, etc.)
2.14 **Group Size.** Group size is an essential component of group management. Group size must be carefully decided based on:

a. The minimum group size is four personnel.

b. The maximum span of control of a single GL is eight personnel (i.e., an ATLI with a UATL assisting cannot lead a group of 17 participants)

c. the objectives of the activity

d. specific restrictions imposed by the land manager (e.g., Parks Victoria)

e. expected environmental impact of the activity

f. the potential impact of other users

g. conditions (environment, remoteness, weather)

h. equipment available.

**Annexes:**

A. Backcountry Skiing and Alpine Survival Equipment Requirements

B. Backcountry Skiing and Alpine Survival Trip Plan

C. Backcountry Skiing and Alpine Survival Safety Brief
### ANNEX A TO CHAPTER 2

**BACKCOUNTRY SKIING AND ALPINE SURVIVAL EQUIPMENT REQUIREMENTS**

1. **Table 2–1** to **Table 2–5** provide the equipment requirements for backcountry skiing and alpine survival expeditions.

#### Table 2–1: Group A – Individual Equipment Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Available in Adventurous Training Equipment Loan Pools</th>
<th>Mandatory Y/N</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ski goggles</td>
<td>1 pair</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Sunglasses</td>
<td>1 set</td>
<td>N</td>
<td>Y</td>
<td>Wraparound type with securing strap. Must be compliant with the Australian standard to Category 3 or Category 4(1).</td>
</tr>
<tr>
<td>Ski boots</td>
<td>1 pair</td>
<td>Y</td>
<td>Y</td>
<td>75 mm Telemark ski touring boots or suitable cold weather boots when paired with snowshoes.</td>
</tr>
<tr>
<td>XCD skis</td>
<td>1 pair</td>
<td>Y</td>
<td>Y</td>
<td>Or snowshoes in lieu of skis.</td>
</tr>
<tr>
<td>Ski poles</td>
<td>1 pair</td>
<td>Y</td>
<td>Y</td>
<td>Not mandatory for snow shoeing activities.</td>
</tr>
<tr>
<td>Thermal underwear</td>
<td>1 set</td>
<td>N</td>
<td>Y</td>
<td>Compression tights or cotton thermals must not be worn.</td>
</tr>
<tr>
<td>Mid-layer jacket and trousers</td>
<td>1 set</td>
<td>Y</td>
<td>Y</td>
<td>Equivalent to 100 wt polar fleece.</td>
</tr>
<tr>
<td>Breathable/waterproof layer</td>
<td>1 set</td>
<td>Y</td>
<td>Y</td>
<td>Jacket with hood and trousers.</td>
</tr>
<tr>
<td>Socks</td>
<td>1 pair</td>
<td>Y</td>
<td>Y</td>
<td>Wool or synthetic.</td>
</tr>
<tr>
<td>Alpine gloves/mittens</td>
<td>1 pair</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Safety whistle</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Headlamp</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Beanie or balaclava</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2–2: Group B – Overnight Individual Equipment Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Available in Adventurous Training Equipment Loan Pools</th>
<th>Mandatory Y/N</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peaked cap</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td>Sun protection.</td>
</tr>
<tr>
<td>Water bottle</td>
<td>Min 1 L</td>
<td>N</td>
<td>Y</td>
<td>Wide mouth bottle preferred; however, any type will suffice.</td>
</tr>
<tr>
<td>Sun protection</td>
<td>Qty</td>
<td>N</td>
<td>Y</td>
<td>Sunscreen and lip balm.</td>
</tr>
<tr>
<td>Survival blanket</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td>Foil type.</td>
</tr>
<tr>
<td>Spare set of batteries</td>
<td>Qty</td>
<td>N</td>
<td>Y</td>
<td>Complete set for all electrical items taken.</td>
</tr>
<tr>
<td>High energy food</td>
<td>Qty</td>
<td>N</td>
<td>Y</td>
<td>Enough for planned duration plus extra day for emergency.</td>
</tr>
</tbody>
</table>

**Note:**

## Table 2–3: Group C – Overnight Per Pair Equipment Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Available in Adventurous Training Equipment Loan Pools</th>
<th>Mandatory Y/N</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating utensils</td>
<td>1 set</td>
<td>N</td>
<td>Y</td>
<td>Suitable for rations being consumed.</td>
</tr>
<tr>
<td>Toiletries</td>
<td>Qty</td>
<td>N</td>
<td>Y</td>
<td>Min required (eg, for brushing teeth).</td>
</tr>
<tr>
<td>Four-season tent, two-man</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td>With sufficient snow stakes per tent.</td>
</tr>
<tr>
<td>Fuel stove and cook set</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td>Where there is an odd number, a stove may be shared by three persons.</td>
</tr>
<tr>
<td>Matches or lighter</td>
<td>2</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Fuel bottle 1 L</td>
<td>Min x 1</td>
<td>Y</td>
<td>Y</td>
<td>Depending on planned duration.</td>
</tr>
<tr>
<td>Candle</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td>Only if planning to build snow caves/shelters.</td>
</tr>
<tr>
<td>Thermos 1 L</td>
<td>1</td>
<td>N</td>
<td>N</td>
<td>May be ordered by GL.</td>
</tr>
</tbody>
</table>
### Table 2–4: Group D – Group Equipment Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Available in Adventurous Training Equipment Loan Pools</th>
<th>Mandatory Y/N</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigation equipment</td>
<td>2 sets</td>
<td>N</td>
<td>Y</td>
<td>Waterproofed map and compass as a minimum.</td>
</tr>
<tr>
<td>Group first aid kit</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Repair kit</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td>See Chapter 4 for detail.</td>
</tr>
<tr>
<td>Communications equipment</td>
<td>Qty</td>
<td>N</td>
<td>Y</td>
<td>Tailored to availability and activity; however, follows the principles of PACE (primary, alternate, contingency, emergency).</td>
</tr>
<tr>
<td>Snowshoes</td>
<td>1 pair</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spare alpine gloves/mittens</td>
<td>3 pairs</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spare light source</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td>Small torch or headlamp.</td>
</tr>
<tr>
<td>Sled</td>
<td>1</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Climbing skins</td>
<td>1 pair</td>
<td>Y</td>
<td>N</td>
<td>May be ordered by GL for all participants.</td>
</tr>
</tbody>
</table>

### Table 2–5: Group E – Day Trip Equipment Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Available in Adventurous Training Equipment Loan Pools</th>
<th>Mandatory Y/N</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel stove and cook set</td>
<td>1</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matches or lighter</td>
<td>2</td>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel bottle 1 L</td>
<td>1</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Contents

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Available in Adventurous Training Equipment Loan Pools</th>
<th>Mandatory Y/N</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed-cell sleeping mat</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Bivouac bag</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Snow shovel</td>
<td>1</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Emergency shelter</td>
<td>1</td>
<td>N</td>
<td>Y</td>
<td>Shelter individual or tent.</td>
</tr>
</tbody>
</table>

**Note:**

In addition to all the items listed in Group A and Group D, for every four personnel these items are required for day trip expeditions.
ANNEX B TO CHAPTER 2

BACKCOUNTRY SKIING AND ALPINE SURVIVAL TRIP PLAN
### Australian Army Backcountry Skiing Trip Plan

#### GROUP AND PARTICIPANT DETAILS

<table>
<thead>
<tr>
<th>NAME/AGE OF GROUP LEADER (IN FULL):</th>
<th>MOBILE NUMBER (PRIMARY):</th>
<th>SATELLITE PHONE NUMBER/UPHF REG(S) (IF CARRIED):</th>
<th>ALLERGIES/ILLNESSES:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NAME/AGE OF 2IC (IN FULL):</th>
<th>MOBILE NUMBER (ALTERNATE):</th>
<th>ALLERGIES/ILLNESSES:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NAME/AGE OF MEDIC (IN FULL):</th>
<th>MOBILE NUMBER:</th>
<th>FIRST AID COURSE(S):</th>
<th>ALLERGIES/ILLNESS:</th>
</tr>
</thead>
</table>

#### TRIP DETAILS

<table>
<thead>
<tr>
<th>NAME SURNAME</th>
<th>MOBILE NUMBER</th>
<th>AGE</th>
<th>SURNAME</th>
<th>MOBILE NUMBER</th>
</tr>
</thead>
</table>

#### OUTLINED TRIP PLAN:

- Australian Army Backcountry Skiing Trip Plan

LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018
<table>
<thead>
<tr>
<th>REAR PARTY</th>
<th>COLOUR/MAKE/REGISTRATION AND LOCATION OF VEHICLES</th>
<th>PERSONAL LOCATOR BEACON HEX ID OR UNI</th>
<th>SUMMARY OF EQUIPMENT TAKEN</th>
<th>START LOCATION</th>
<th>DATE/TIME:</th>
<th>FINISH LOCATION</th>
<th>DATE/TIME:</th>
<th>MAPS USED:</th>
<th>PROPOSED NIGHT LOCATIONS</th>
<th>ALTERNATE CONTINGENCY ROUTES:</th>
<th>SAR TIME/DATE:</th>
</tr>
</thead>
</table>

LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018
### ACTIONS FOR REAR PARTY WHEN GROUP HAS RETURNED BY SAR TIME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Primary Phone Number</th>
<th>Alternate Phone Number</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ACTIONS FOR REAR PARTY WHEN GROUP HAS NOT RETURNED BY SAR TIME:

<table>
<thead>
<tr>
<th>Location</th>
<th>Primary Phone Number</th>
<th>Alternate Phone Number</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### REAR PARTY CONTACT DETAILS:

#### PRIMARY POINT OF CONTACT:

<table>
<thead>
<tr>
<th>Location</th>
<th>Primary Phone Number</th>
<th>Alternate Phone Number</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### SECONDARY POINT OF CONTACT:

<table>
<thead>
<tr>
<th>Location</th>
<th>Primary Phone Number</th>
<th>Alternate Phone Number</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RELEVANT EMERGENCY CONTACT NUMBERS:

<table>
<thead>
<tr>
<th>Location</th>
<th>Primary Phone Number</th>
<th>Alternate Phone Number</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ANNEX C TO CHAPTER 2
BACKCOUNTRY SKIING AND ALPINE SURVIVAL SAFETY BRIEF

BACKCOUNTRY SKIING AND ALPINE SURVIVAL SAFETY BRIEF

1. SITUATION.

A. TOPOGRAPHY
   (1) CURRENT LOCATION
   (2) GENERAL AND SPECIFIC LOCATIONS

B. WEATHER
   (1) SUNRISE
   (2) SUNSET
   (3) CLOUD COVER
   (4) ANTICIPATED VISIBILITY
   (5) LIKELIHOOD OF PRECIPITATION/SNOW
   (6) LIKELY WIND DIRECTION AND SPEED
   (7) TEMPERATURE
   (8) LIKELY EFFECTS ON ACTIVITY (PREVAILING CONDITIONS)

C. FRIENDLY/FLANKING UNIT LOCATIONS

D. OTHERS IN THE AREA
2. **MISSION.** (UNIT NAME) WILL DEMONSTRATE (LEADERSHIP/RESILIENCE) DURING THE PERIOD (DTG FROM–TO) AT (ACTIVITY SITE) IN ORDER TO DEVELOP THE INDIVIDUAL AND GROUP QUALITIES REQUIRED FOR BATTLE OR THE AIM OF THE ACTIVITY.

3. **EXECUTION.**
   A. GENERAL OUTLINE (PHASES ONLY IF REQUIRED)
   B. OUTLINE OF DAILY ACTIVITIES, DESTINATIONS/GOALS
   C. GROUPING AND TASKS (INCLUDE BUDDY ALLOCATION)
      (1)
      (2)
      (3)
   D. COORDINATING INSTRUCTIONS
      (1) TIMINGS:
         (A) PRELIM MOVES
         (B) START
         (C) OTHER TIMINGS
         (D) END
         (E) SAR INITIATE ACTION
      (2) ROUTES/LOCATIONS
         (A) PROPOSED ROUTE TO CAMPSITE/OBJECTIVE
         (B) SKI ROUTES IN/OUT
         (C) EXIT ROUTES IN CASE OF EMERGENCY
ORDER OF MARCH

ACTIONS ON:

(A) ON LOST PERSONNEL
(B) ON SEPARATION OF PERSONNEL FROM THE GROUP
(C) WHISTLE BLAST AND RESPONSE
(D) UATL INCAPACITATED
(E) APPROACHING HAZARDOUS/AVALANCHE-PRONE AREAS
(F) HALTS
(G) ANY OTHER ACTIONS ON REQUIRED

4. ADMINISTRATION.

A. TRANSPORT

(1) DRIVERS
(2) EQUIPMENT TO REMAIN IN VEHICLE
(3) PLAN FOR PICK UP/DROP OFF
(4) LOCATION OF VEHICLE KEYS

B. RATIONS/EMERGENCY RATION REQUIREMENTS

C. WATER QUANTITY, PURIFICATION AND SOURCES

D. DRESS AND EQUIPMENT

E. RUBBISH REMOVAL REQUIREMENTS

F. ABLUTIONS

(1) DISPOSAL (EG, WAG BAGS)
Contents

(2) LOCATIONS OF ABLUTIONS IN AREA
(3) DISTANCE FROM WATER SOURCES/HUTS/TENT SITE

G. MEDICAL AND CASEVAC PLAN

(1) THE TRIP AND/OR GROUP MEDIC
(2) MEDICAL FACILITY, LOCATION, ROUTE AND TIMES TO FACILITIES
(3) ACTION ON CASUALTY
(4) THE EVACUATION PLAN FOR PRIORITY ONE AND TWO CASUALTIES
(5) THE EVACUATION PLAN FOR PRIORITY 3 CASUALTIES:
   (A) THAT ARE ABLE TO WALK AND/OR EXTRACTED BY THE GROUP (INC ASSISTANCE FROM NEARBY GROUPS)
   (B) THAT ARE NOT ABLE TO WALK AND/OR BE EXTRACTED BY THE GROUP
(6) RESCUE APPOINTMENTS AND CONSIDERATIONS
(7) OVERVIEW OF LOCAL SAR CAPABILITIES AND RESTRICTIONS
(8) DECISION POINT FOR CALLING EXTERNAL RESCUE AGENCIES
(9) PROCEDURE FOR REQUESTING EMERGENCY ASSISTANCE
(10) COMMUNICATION CARD
H. GROUPS/SPECIALIST EQUIPMENT AND LOCATION:
   (1) INDIVIDUAL, PAIR AND GROUP STORES ALLOCATED IAW DOCTRINE (SEE SEPARATE CARD)
   (2) THE SAFETY VEHICLE
   (3) THE KEYS FOR THE SAFETY VEHICLE
   (4) THE LOCATION AND CONTENTS OF THE SAFETY CASE
   (5) COMMUNICATIONS EQUIPMENT
   (6) OTHER
I. INSPECTIONS (WHEN/WHERE/WHAT)
5. COMMAND.
   A. OIC
   B. TRIP/GROUP LEADERS
   C. UATLS
   D. LOCATION OF HQ/REAR LINK (INC POC AT OTHER END)
   E. SENIORITY AND CHAIN OF COMMAND
F. COMMUNICATIONS PLAN:
   (1) MOBILE PHONE AND RECEPTION AREAS. INCLUDE PIN/UNLOCK CODES
   (2) THE ROUTE TO THE NEAREST LANDLINE
   (3) SATELLITE PHONE
   (4) RADIOS AND THE FREQUENCIES BEING USED
   (5) PLB
(6) SCHEDS (RADIO OR SATELLITE PHONE)

(7) METHODS OF RECHARGING/SPARE BATTERIES

QUESTIONS:
CHAPTER 3

ALPINE HAZARDS

SECTION 3-1. INTRODUCTION

3.1 Traditionally, backcountry skiing hazards are generally divided into two categories: subjective hazards and objective hazards. Subjective hazards are those which the GL and/or group have control over. Objective hazards are those independent of the GL’s decisions, such as weather and avalanche.

3.2 To understand their meaning within the military risk management framework, it would be more useful to describe these hazards in terms of risk source categories.

SECTION 3-2. THE NATURAL ENVIRONMENT

3.3 The fundamentals of navigation remain unchanged when operating in an alpine environment and therefore many techniques described in LWP-G 7-7-2, Navigation can be adopted.

Planning for Terrain Conditions

3.4 During the planning phase, GLs should spend time studying the map to gain an appreciation of the terrain, identify areas that could potentially increase danger if visibility reduces and where applicable make decision points. If a GPS is being used, it is far safer to add all relevant waypoints during the planning phase than in the middle of a blizzard.

3.5 Poor Visibility. The conditions of reduced visibility brought about by inclement weather are an enduring feature of the alpine environment (see Figure 3–1). Two common extreme weather conditions that create poor visibility are:

a. Whiteout. A whiteout is a weather condition in which visibility and contrast are severely reduced by snow. The horizon disappears completely and there are no
reference points at all, leaving the individual with a distorted orientation. No surface irregularities of the snow are visible, but a dark object may be clearly seen.

b. **Blizzard.** Blizzard conditions are defined as strong winds in conjunction with blowing or falling snow causing a reduction in horizontal visibility to less than 200 m.

![Figure 3–1: Travelling in Limited Visibility](image)

3.6 The most prudent course of action in conditions with poor visibility, when combined with the likelihood of travelling on dangerous terrain, is for the group to halt and establish shelter, and wait until conditions improve. However, as this is not always possible, the GL must be able to draw on a number of techniques and devices to assure safe travel throughout the trip:

a. ‘**Dead Reckoning**’. The fundamental navigational technique of ‘dead reckoning’ (navigating with just a map and compass and no visible landmarks) is a valuable technique to use, especially in poor visibility. Using this
technique requires a known current position to be established, and the skill to navigate by following a compass bearing. On flat terrain, most people will travel round in circles. To combat this, the group should travel in single file with the last person carrying the compass and the first person acting as a reference point. Regularly check the compass bearing against the leading person and adjust their direction left or right as required.

b. Use of Altimeters to Aid Navigation. Barometric altimeters are common features in many GPS units and watches. In order to attain the necessary benefit from these devices, they must be regularly calibrated against known reference point(s) (ie, against a definite point on a map or a place of known altitude such as a car park). When traveling up or down large uniform slopes and ridges, accurate altitude information can be used to determine your exact position. An equally useful technique is being able to accurately follow a contour line. See Figure 3–2, where a group is shown maintaining a constant altitude of 1750 m in order to reach their destination (Laoghaire Hut) and avoid the most dangerous aspects of the re-entrant.

Figure 3–2: Use of Altimeter to Reach Destination
c. **Handrail.** A handrail is a prominent feature that is easily followed in good and bad weather (e.g., ridges, gullies). Great care must be taken when handrails a steep edge, if there is a chance that it will be corniced.

d. **Aiming Off.** Aiming off (or attack point) means to deliberately aim for one side of a long feature, such as a stream, to reach a destination. When the feature is reached, the group can then take the proper direction to reach the destination.

e. **Up or Down.** In a complete whiteout, where there is no apparent up or down, a strong sense of vertigo can be felt and changes in slope angle such as cliff bands can be notoriously difficult to see. Rolling snowballs, throwing a cord or even filling a small bag with snow attached to a cord and throwing it ahead of you can provide some depth perception and indicate slope angle and direction. This serves two purposes:

   (1) It makes a mark on the snow providing something to focus on and as a reference point, and use as a feature.

   (2) It may help to determine how close is an edge by simply marking a track for a short distance and then disappearing.

f. **Estimating Distance.** In a whiteout or in other types of poor visibility conditions, the traditional reliance on counting paces (unless on snowshoes) is unreliable. Estimating distance based on elapsed time may be sufficiently accurate when based on the combined experience of the GL and group; however, this technique should only be relied on in favourable conditions. Tying a rope/cord of a known length between two individuals and then sending the first individual out on a bearing/route until the rope is taught and subsequently moving in a caterpillar fashion is one method of recording distance travelled. This method may be
necessary in situations where there are no handrails or aiming off (attack points) available.

Terrain Hazards

3.7 **Steep Slopes.** Steep slopes are unavoidable when travelling in the backcountry. Care is to be taken when travelling along steep ridges, especially in icy conditions and white outs. Be aware of triggers for avalanche. GLs are to consider the exposure (distance a skier could slide versus the consequence) and ensure that participants know how to self-arrest.

3.8 **Wooded Areas.** Travelling in wooded areas (see Figure 3–3) can be dangerous, as the consequences of hitting a tree at speed in these areas can be serious. Therefore, GLs must carefully evaluate the ability of the group and identify areas for movement. Equipment strapped to packs must be carefully assessed and participants are to remove their hands from ski pole straps. If sleds are taken then suitable consideration must be given due to their limited manoeuvrability.

![Figure 3–3: Travelling in Wooded Areas](image)
3.9 **Snow Bridges.** A bridge of snow (see Figure 3–4) that has formed over a stream is a typical feature of the alpine environment. The issue of crossing on skis or on foot is a complex one because of the difficulty of assessing the strength and stability of the bridge. Crossing on skis is generally preferred as it is quicker, smoother and results in less forces being applied onto the bridge. When crossing a snow bridge, cross one at time, quickly, and prepare equipment (ie, undoing binding leashes, ski pole and pack straps), so that it can be easily ditched if required.

![Figure 3–4: Snow Bridge](image-url)
3.10 **River Crossings.** River crossings are potentially one of the most dangerous undertakings when conducting AT. When crossing rivers and streams in snow covered areas, GLs should be aware of cold and exposure injuries. The real risk of such injuries increases exponentially when the current and depth of the water at the time of a river crossing are included as risk factors. Even ankle-deep water flowing in a creek can sweep a strong participant off their feet. This type of emergency necessitates specialised training and equipment. During the planning phase, GLs must confirm all information regarding river crossings by seeking out information specific to the planned route. GLs must be attentive and diligent at all times when conducting river crossings. If in doubt do not cross.

3.11 **Cornices.** Cornices are deposits of snow on the lee edge of a ridge (see Figure 3–5). They are particularly hazardous because they are overhung, forming an unstable mass that could break off by human disturbance or natural causes. Falling cornices are possible triggers to an avalanche. When travelling over or near cornices, care is to be taken to move swiftly when underneath. When travelling along a cornice, stay on the windward side.

![Figure 3–5: Cornice](image)
Avalanche Hazards

3.12 Avalanches are responsible for numerous deaths worldwide. In Australia, avalanches may occur less frequently than elsewhere, and they may be, arguably, less severe; however, what remains indisputable is that they do occur in Australia, and in areas where AT is likely to be conducted.

3.13 GLs and groups are not equipped or trained to conduct AT in areas where there is a heightened likelihood of avalanches occurring. The following information is provided to guide GLs to consider all aspects relating to the identification of avalanche hazards in order to deliberately avoid travel into areas that may be affected:

a. **Definition of an Avalanche.** An avalanche is a mass of snow moving downslope that may also contain ice, soil, rocks or other debris.

b. **Snow.** Once snow has fallen it will undergo a process called metamorphosis whereby the structure of the snow crystals will change owing to a combination of effects such as moisture, ground temperature, snowpack temperature and air temperature. Additionally, freshly fallen snow can be described by terms such as dry/wet, powdery and light/heavy.

c. **Snowpack Layers.** As snow settles on the ground it forms into layers of different strengths. These layers start to bind together forming the ‘snowpack’. Not all of the layers stick to adjacent layers with the same quality. Some will bind together well, and others relatively poorly. To have a layer of weak snow underneath a stronger layer can be a recipe for a potential slab avalanche. These stronger and weaker layers are not evenly laid out across the terrain. Some places will have more layers than others, and the depths of the layers can vary from place to place. These variations are heavily influenced and modified by changes in wind, temperature, solar radiation, and humidity. During high winds, the wind can strip the snow away in places and pile it up in others.
Different parts of the mountains will receive more or less snow depending on which direction they face (aspect), and how high up they are (altitude/elevation). In Australia, it is not uncommon to receive a mixture of rain and snow even at high elevations during the winter months. Once snow has settled to the ground the story does not end. The snowpack continues to be under the influence of the weather; winds can shift snow. What might have been fresh loose snow in the morning, can get stripped back to reveal an old hard layer below by the afternoon (wind transportation) or the sun can heat the snow surface during the day making it damp, only to have a cold overnight temperature refreeze it, turning it into a hard icy crust the next morning (melt/freeze). The weather is always changing, so it is reasonable to expect that the snowpack’s layers are also always changing because of the influence from the weather. These changes can occur quite fast and produce dramatic results that are easy to notice (eg, the wind pushing loose snow to fill in freshly made tracks). Change can also happen slowly and be more difficult to spot because the clues are hidden below the snow’s surface.

d. **Triggers.** Most avalanches are triggered when slopes become overloaded with snow or have a weight placed on them that is unsustainable. There are two types of triggers:

   (1) **Natural Triggers.** These triggers occur without any human intervention. Some examples of natural triggers are large snowfall ‘dumps’ on slopes that are susceptible to avalanche; warming temperatures or rain that affects the structural integrity of the various layers of snow; cornice or ice fall dislodging and initiating an avalanche.

   (2) **Artificial (Human) Triggers.** An artificial trigger has an element of human involvement that is either direct or indirect. Some examples of artificial triggers are people on skis, snowshoes or
snowmobiles who travel on avalanche-prone slopes. Professional intervention for preventative measures may include using explosives such as hand charges, artillery or recoilless rifles in potential avalanche risk areas. These measures are usually applied to inbound ski resort areas where there is a great deal of human traffic.

3.14 Avalanche Types. Avalanches can vary in depth between layers near the surface through to full depth where the whole snow cover slides off the ground. They may also be dry or wet depending on how much water is in the snow. However, avalanches generally fall into one of two categories:

a. Point Release or Loose Snow Avalanche. Properties can vary between loose dry (sluff) through to loose wet type avalanches. The avalanche occurs from loose surface snow building up to a point which the angle of the slope can no longer accommodate (see Figure 3–6). Loose dry avalanches generally occur when fresh snow fails to bond on existing frozen layers, as such loose wet avalanches may occur on slopes exposed to the sun during the warmest part of the day or from rainfall. These avalanches can originate from relatively small snow deposits; however, they can gain significant momentum once initiated from a single point and fan outward. Loose wet avalanches are considered to be more powerful owing to their density and are the most common type encountered in Australia.
Figure 3–6: Point Release or Loose Snow Avalanche

b. *Slab Avalanche.* A slab avalanche occurs when a plate or large slab of cohesive (strong) snow begins to slide as a solid mass. As the momentum increases, the large slab breaks apart and splinters into smaller chunks or fragments. Following a slab avalanche, a distinct line of fracture is visible at the start point (see Figure 3–7 and Figure 3–8). This is known as the fracture line or ‘crown’. The slab’s release is triggered as a result of the stresses caused by the weight of a slab and/or the weight of people exceeding the strength of the weakest layer in the snowpack.
Figure 3–7: Slab Avalanche
3.15 Avalanche Terrain. It is extremely important when backcountry skiing that GLs are able to recognise areas susceptible to avalanches. These areas may be indicated by:

a. **Slope Angle.** One of the most important factors in ascertaining potential avalanche sites is the angle of slope. If the angle of a slope can be determined, it can be used in conjunction with other data collected and observations made in order to make an assessment. Avalanches occur most frequently on slopes between 30° and 45°, with 38° being the most common angle where a slab avalanche occurs. If the angle is greater than 60°, any avalanches will usually be small sluffs; however, these may act as possible triggers for other
avalanches. Conversely, loose wet avalanches are possible at lower angles from 25° (see Figure 3–9).

Figure 3–9: Slope Angle

b. **Aspect.** Aspect is the direction a slope faces in relation to exposure from the wind and sun. Heat gain or loss from a snow surface depends on the direction it faces. Northern aspects generally receive more heat from the sun compared to southern aspects. Moderate warming can stabilise a snowpack, whereas intense sun can weaken the snow on these aspects. Conversely, new snow takes a lot longer to stabilise on shaded or southern aspects and any weaknesses in the existing snowpack can persist. Leeward slopes can be very dangerous as they are subject to a rapid accumulation of snow during a storm or during fine but windy weather. Such slopes are often overhung by cornices, which can break off and trigger an avalanche on the slope below. Windward slopes or slopes that are exposed to wind tend to receive less snow deposition. The resulting shallow snowpack may result in the formation of depth...
hoar\(^1\), but usually the snow is more firmly compacted by wind action.

c. **Common Trigger Points.** Many avalanches start where there is some change in slope profile. The composition or structure of the slope’s size and shape, in conjunction with the slope angle, will have an effect on an avalanche’s potential to release. The two main factors to consider regarding slope size and shape are whether the slope profile is convex or concave:

1. Convex slopes are rounded outward at the top of the peak or ridge (see Figure 3–10[a]). This type of terrain feature can be the trigger zone for slab avalanches, which is due to the weight of the snow. Any small disturbance is sufficient to trigger an avalanche.

2. Concave slopes are rounded inward (see Figure 3–10[b]), and are generally considered to be safer than convex slopes, but this is not always the case. A leeward concave slope, with a cornice at the top, can be just as treacherous. In the absence of soft slab, the snow at the bottom will tend to support the snowpack higher up. If the lower layer of the snowpack is depth hoar, there is a danger that any undercutting, either by a ski track or wind erosion, for example, will bring the whole slope down.

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1. Large crystals occurring at the base of a snowpack that form when uprising water vapour deposits onto existing snow crystals. Depth hoar crystals bond poorly to each other.
Figure 3–10: Effects of Convexity and Concavity

In this zone, gravity pulls snow down the hill, pushing it into the compressive support zone.

In this zone, gravity pulls snow into the ground or lower layers, helping to anchor it.

Compressive support zone:

In this zone, gravity pulls snow into the ground or lower layers, helping to anchor it.

Tension zone (easier trigger)

In this zone, gravity pulls snow down the hill, pushing it into the compressive support zone.

In this zone, gravity pulls snow away from the low angle, anchored snow above.

Compressive support zone:

In this zone, gravity pulls snow into the ground or lower layers, helping to anchor it.

Convex

Concave
d. **Terrain Traps.** Terrain traps (see Figure 3–11) are places that increase the likelihood of injury or deep burial. Even a small point release avalanche that funnels a victim over or through a cliff, gully, rocks or trees can be fatal.

![Figure 3–11: Terrain Trap](image)

Source: Parks Victoria

Figure 3–11: Terrain Trap

e. **Weather and Conditions.** The weather and conditions may increase avalanche hazards in terrain, as follows:

1. **Rain.** Significant rain within a 24-hour period can weaken the snow bonding properties and overload the snowpack. Rain, however, can stabilise the snowpack on re-freezing.

2. **Snowfall.** Heavy snowfall over a 24-hour period or where snow accumulates at a rate in excess of 2.5 cm per hour may also overload and weaken the snowpack. As the snowpack cannot rapidly consolidate the additional weight, most avalanches that trigger naturally do so during or immediately after a storm. Similarly, most avalanches that are triggered by people are done so immediately after a storm when the weather...
clears; however, the snowpack remains to be consolidated.

(3) **Wind.** Wind can rapidly redistribute snow and load the lee side of features or redistribute snow across slopes (see Figure 3–12).

![Figure 3–12: Wind Direction and Loading](image)

(4) **Temperature.** Rapid increases in temperature can weaken the snow bonding properties causing unstable conditions. Sources of temperature
increase may be as a result of direct exposure to the sun, particularly on northern aspects or the movement of warm air as part of weather patterns.

**Safe Travel Techniques**

3.16 While it is the GL’s responsibility to ensure that AT is conducted away from known avalanche hazards, the following safe travel techniques\(^2\) should always be adopted as normal practice when conducting backcountry skiing and alpine survival activities:

a. **Spacing.** Spacing allows the group to distribute the weight along the snow pack, minimising the possibility of triggering an avalanche; however, if an avalanche were to be triggered, this technique reduces the exposure of the whole group.

b. **Visual Contact.** Maintain visual contact among the group members. Always watch each other from safe spots in case rescue is required.

c. **Island of Safety.** An island of safety is a safe spot, usually a terrain feature that is not susceptible to the effects of a potential avalanche. It is acceptable to regroup and stop in these locations.

d. **Safe Travel Routes.** The outcomes of most AT can be achieved in relatively low angled terrain or along broad ridges. If the terrain travelled on, or travelled below, is less than 30° then the likelihood of exposure is significantly reduced. While this travel technique may seem simplistic, it is the most practicable solution for GLs who are neither trained nor equipped to travel in environments of heightened avalanche risk.

e. **Communication.** GLs are to ensure that their intent is continually conveyed, and conversely allow participants to voice concerns and observations.

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2. For further information see the New Zealand Avalanche Advisory at https://avalanche.net.nz
3.17 Route Selection. During the planning phase, GLs must draw on a variety of resources in order to prepare a proposed route. They should also develop an alternative route to allow for contingencies such as changing forecasts in the area of the activity:

a. Weather Forecasts. Not only is it important to maintain situational awareness preceding a trip, the effects of weather prior to and during an AT activity should be assessed with a view to the avalanche hazards.

b. Avalanche Forecasts and Terrain Mapping. There are various online sites that offer comprehensive information about backcountry travel conditions, weather effects, avalanche risk, snowpack structure, and provide avalanche terrain maps for the Australian alpine areas. Another way to conduct simple terrain mapping or evaluating the steepness of the terrain is to study a topographical map. The information provided in Table 3–1 presumes that contour intervals are 20 m apart and that the map is 1:50,000 scale, by counting the contour lines over 1 cm (500 m), the average slope angles can be deduced.

c. Local Knowledge. Detailed information can be gained from other GLs, local police, ski patrol, park rangers and rescue groups. The collective quality of their information is typically immediately relevant to the planned activity, whereas information from other sources may be more general.

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3. For example, see http://mountainsportscollective.org for further information.
3.18 In the field, GLs should learn to recognise avalanche terrain and choose a route that avoids this type of terrain. It is best to stay clear of obvious avalanche terrain by taking advantage of dense timber, rocky outcrops, broad ridges, wide valley bottoms.

3.19 Skiers should take advantage of sun or temperature factors and travel at night or early in the morning. In warmer temperatures, the party should avoid cornices, if possible.

3.20 The group should have a pre-agreed alternative route in case of unforeseen contingencies. Sometimes it is better to sacrifice time and drop down to the valley floor or climb to the ridgeline, rather than cross the middle of a slope. Above all else, the party should avoid a route that takes them into the starting (trigger) zone of an avalanche, or linger in a likely deposition area.

### Table 3–1: Evaluating Slope Angles

<table>
<thead>
<tr>
<th>Contour Lines</th>
<th>Slope Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 lines</td>
<td>7°</td>
</tr>
<tr>
<td>5 lines</td>
<td>11°</td>
</tr>
<tr>
<td>8 lines</td>
<td>18°</td>
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<tr>
<td>10 lines</td>
<td>22°</td>
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<tr>
<td>12 lines</td>
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</tr>
<tr>
<td>15 lines</td>
<td>31°</td>
</tr>
<tr>
<td>20 lines</td>
<td>38°</td>
</tr>
</tbody>
</table>

**Note:**
Presume the map scale is 1:50,000, and the contour lines are 20 m apart.
Sources of Water

3.21 Water is commonly gained by melting freshly fallen snow, either by placing in water bottles where the existing water melts the fresh snow or by melting during the cooking process. However, water sourced from creeks or rivers in Australian alpine areas is notoriously contaminated with *E. coli* and *Giardia lamblia*. Any water gained from these areas must be treated by boiling for 2 to 5 minutes, iodine-based chemicals or an appropriate means of filtration.

Driving in Alpine Areas

3.22 Driving in alpine areas can be hazardous, and although military-owned vehicles are subject to regular servicing, alpine environments may highlight existing minor faults, particularly in the electrical system, cooling system (antifreeze), minor windscreen damage and condition of tyres. If in doubt, vehicles are to be inspected and any faults rectified prior to the commencement of the AT activity.

3.23 A recommended checklist for what to carry in the vehicle when driving in snow and icy conditions is as follows:

- a snow shovel
- a tow rope
- a plastic ice scraper to remove the ice from the windscreen
- a torch
- a ground sheet
- a pair of rubber gloves/ripping gloves for fitting chains

3.24 **Wheel Chains.** When driving in snow and icy conditions, vehicles need to be fitted with the correct wheel chains in order to achieve maximum road grip and safety. Practice fitting chains before departing to ensure that they are the correct size for your tyres.

3.25 **Fuel.** Before driving to alpine areas, drivers should check that the fuel tank is full in case of lengthy delays in bad weather when the motor must be kept running. If the vehicle is diesel-powered, drivers should fill the fuel tank with alpine mix diesel available from a service station within alpine regions to avoid fuel freezing. Drivers must plan on refuelling at least two-thirds of a tank for alpine mix diesel to be effective.\(^5\)

3.26 **Applicable Road Laws.** When planning an AT activities in alpine areas, GLs are to verify laws and regulations applicable to the training area. At the time of writing, the following state laws and regulations apply to New South Wales and Victoria:

a. **New South Wales.** All 2WD vehicles are to carry properly fitting snow chains and fit them when directed; drivers of 4WD vehicles are directed to engage 4WD. While drivers of AWD/4WD vehicles are exempt from carrying snow chains, it is recommended as best practice.

b. **Victoria.** In accordance with Victorian road laws, specified roads leading into alpine areas are proclaimed as hazardous during a specified period. Drivers of vehicles that have 13 or more seats (including the driver) are to have undertaken hazardous area training and hold a current Hazardous Area Authority. Further information is available from the VicRoads website.\(^6\)

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relating to the carriage and fitting of chains differ to those from New South Wales. All vehicles including AWD/4WD are to carry snow chains and fit them when directed. Resort regulations may prohibit towing of trailers during conditions that necessitate fitting of chains.

c. **All Areas.** Before leaving an alpine area, clear any snow from the car roof to avoid creating a road hazard to other vehicles.

3.27 **Snow and Ice Conditions.** There are basic rules to follow when driving in snow conditions. Driving in snow and ice conditions is an acquired skill. Extreme care is required when driving on alpine roads in winter. Planning is essential to ensure that the vehicle is in good condition and that all the necessary equipment is included for a safe journey.

3.28 Observe local speed limits in resorts, chain fitting bays and elsewhere. Drive cautiously with gradual pressure on the accelerator to avoid wheel spin. The speed is not necessarily the slowest possible; sometimes a more optimum speed can help momentum through snow drifts or traveling up hills.

3.29 Avoid unnecessary gear changes. Engage first or second gear on level ground (including in automatics) before ascending or descending hills in snow or ice conditions.

3.30 Brake gently as front and rear wheels can lock easily causing loss of steering and control. Avoid braking when cornering. Brake before the corner while the wheels are straight.

3.31 Keep well away from snow clearing machines. It is often necessary to reverse these machines, and snow clearing operators may have limited visibility of other vehicles in snowdrift or falling snow conditions. Also, be aware that the fountain of snow coming from the blowers may contain ice chunks and stones causing a damage or a hazard to passing vehicles. Do not overtake clearing equipment until they have stopped blowing snow.

3.32 Be patient approaching large vehicles, such as buses, and only overtake if visibility is good.

3.33 Poor Visibility. If minimum visibility (whiteout) conditions occur and the road ahead and snow poles are not visible, bring the vehicle to a stop, leave the motor running and switch on the hazard lights. Travel in daylight hours whenever possible. It is difficult to judge distances in snow at night. In poor visibility conditions, drive with the headlights on low beam. Use front and rear demisters, with air-conditioning on, to ensure that windscreens are clear at all times.

3.34 Braking and Skidding. On icy or snow covered roads always use the brakes gently, and drive slowly. If the vehicle loses traction, it is better to control it by steering rather than braking. If the vehicle hits the bank or gets stuck in a snow drift, it is better than going over the edge. Keep some distance from vehicles in front of the vehicle, and allow plenty of time to stop.

3.35 Parking. Always follow directions from resort staff and road signs. Take note of the following recommendations:

   a. Park only where directed or run the risk of another vehicle or snow clearing vehicle running into what looks to the other driver like just another drift of snow.

   b. Do not apply the handbrake; moisture can freeze the cables and brake linings.

   c. Leave the car in gear with the front wheels turned away from the slope.

   d. Always park as close to the bank as possible to leave room for two-way traffic.

   e. Do not use rocks to chock wheels as they may damage snow clearing machines.

   f. Do not use wooden chocks, as these tend to slip on icy surfaces.

   g. Lift wipers from windscreen or place in a plastic bag to ensure that wipers do not stick to the windscreen.
h. Even if chains were not required to enter the area, it is advisable to fit them when parking. It is much easier to fit them first, rather than trying to fit them later for the return trip if weather conditions change or the vehicle is snowbound.

i. Before attempting to drive away from snowfields, clear all glass and mirrors of ice. Carry an ice-scraper to clear the bulk of the snow. When demisting the front windscreen, use the vehicle’s heater and fan and air-conditioner; never use hot water as this could cause the glass to crack.

j. Remove wheel chocks from parking area when leaving.

3.36 Chain Fitting. Fit chains at bays where there is a ‘fit chains here’ sign. Always fit chains to driving wheels only. When required, chains should be fitted to the front wheels of 4WD vehicles. Chain fitting bays are level and make fitting easier, whereas chains are hard to fit on slopes. It is best to avoid fitting chains in locations other than fitting bays or level, clear areas to avoid obstructing other vehicles and snow clearing equipment. The basics of fitting and driving with snow chains are as follows:

a. Fit chains to driving wheels only.

b. Always test-fit chains before a trip.

c. Fit chains at fitting bays on level ground.

d. If chains fall off or loosen when a vehicle is in motion, stop and check the brake lines for damage before re-tensioning.

e. Keep speed below 40 km/h.

f. Carry a torch, plastic garbage bag and gloves to make fitting chains easier.

g. Use correct fitting chains.

h. Tyres must be in good condition with minimal wear.

i. The use of diamond pattern chains is recommended.
j. After removing chains from vehicles, the handling may feel different. When driving after chain removal, take time to readjust to the feel of the vehicle.

SECTION 3-4. ORGANISATIONAL COMPLEXITY

3.37 Military groups conducting AT within alpine areas have limited capability to evacuate casualties and are therefore reliant on external SAR agencies. GLs are to gain a detailed understanding of the roles and capabilities of applicable SAR agencies when planning an AT activity.

SECTION 3-5. RESOURCES

3.38 Employment of serviceable equipment that is fit-for-purpose is one of the key and fundamental approaches to reducing risk sources. The requirements relating to inspection, maintenance and employment are provided in Chapter 2 and Chapter 4.

SECTION 3-6. PERSONNEL

3.39 Participants. Backcountry skiing and alpine survival AT activities are physically demanding and place significant stress on shoulders, lower back and lower limbs of the participants. While Defence members who are medically classified as J1 or J2 are normally fit for AT, members whose medical classification fall outside of these classifications will require clearance from a Defence medical officer to participate in AT activities. The requirements of this clearance extends to participants who harbour pre-existing injuries likely to be exacerbated during the conduct of backcountry skiing and alpine survival AT activities, regardless of a participant’s medical classification. However, in planning AT activities, GLs must carefully consider and design an appropriate activity for such participants who form the target audience.
CHAPTER 4

BACKCOUNTRY SKIING AND ALPINE SURVIVAL EQUIPMENT

SECTION 4-1. INTRODUCTION

4.1 Backcountry skiing is conducted in terrain that can vary significantly from gentle, rolling hills to steep slopes where the consequences of a fall may be catastrophic. When operating in harsh, mountainous environments susceptible to unforgiving and constantly changing weather conditions, it is imperative that all of the equipment used for the activity is in excellent condition. This chapter identifies the equipment required for backcountry skiing activities and includes instruction on correct use, fitting and sizing, care and maintenance, and storage, as well as safety considerations.

Materials

4.2 The typically cold temperatures experienced in alpine environments have led to extensive research and development dedicated to the design and manufacture of clothing and equipment suitable for skiing and backcountry touring. The range of available equipment is constantly being improved and upgraded.

SECTION 4-2. SKIS

4.3 The technology and techniques used for creating modern touring skis are complex. AT equipment loan pools hold cross-country downhill (commonly known as XCD) skis. These skis are constructed with robust touring cable bindings, which offer the best option for Australian backcountry alpine skiing conditions.
XCD skis are sourced based on the following characteristics:

a. **Side Cut.** The curved shape on the edge of the ski is called a side cut (see Figure 4–1). When the ski is tilted onto an edge, this curve will try and lead the ski around a circular path.

![Figure 4–1: Side Cut Ski](image)

b. **Camber.** Most skis are arched so that the area under the binding is above the snow when there is no weight on the ski. Combined with the flex of the ski, this enables an effective downward ‘kick’ to engage the traction or kick zone of the ski (see Figure 4–2), as well as releasing and keeping the traction zone off the snow during the glide phase. When the skier puts weight on the ski to initiate a turn, the force used is distributed along the entire edge of the ski. In effect, much of the edge pressure applied to the snow is transferred out to the shovel and tail (see Figure 4–3).

![Figure 4–2: Kick Zone](image)
c. **Length.** When a suitable length of ski is being determined, the ability of the ski to glide and float in various snow conditions must first be ascertained. The longer a ski is from the tip to the tail, the greater the speed achieved in the glide and the more floating experienced. A compromise needs to be established between speed and the ski’s ability to turn. Skis that are too long for a particular individual will make it more difficult for them to control the skis and, more importantly, to turn. The weight of the skier is usually used to determine the appropriate length of ski to be used. This information can be obtained from the manufacturer’s product information.

d. **Flex.** A soft flex in the tip or front section of the ski will allow the tip to rise above, or float, in deeper snow conditions. Stiffer tips are better suited to hard-packed snow or ice. The most suitable tip flex for touring is a medium flex, but will depend on the type of conditions in which the ski will be used. Stiffer flexing tips will make it more difficult to turn as they tend to bury themselves in softer snow pack conditions.

e. **Torsion.** The torsional rigidity of a ski is determined by the amount of resistance the ski exhibits to twisting along its long axis. A touring ski should have little or no twist, so that the ski will hold an edge while turning or on hard-packed snow.

f. **Materials and Techniques.** The materials and techniques used in the construction of skis will greatly affect their characteristics, including performance,
g. **Lamination.** Modern touring skis are generally laminated rather than a solid block of wood. Laminated touring skis are extremely strong and rarely break. Skis are manufactured for specific roles or snow conditions.

### Inspection

**4.5** Inspect skis for serviceability, as follows:

a. The tips and tails should be inspected for damage such as splits, cracks or exposure of the core.

b. The base and top of each ski should be both visually and physically inspected. This will help identify any cuts, gouges or base separation (delamination) that has occurred. It will also identify if the core of the ski is exposed through the base, which will allow moisture to penetrate and damage the ski.

c. The binding should be inspected; in particular, the mounting screws and all fittings. It is important to check that the cables of the binding are in good condition.

d. The edges are to be checked for damage and separation from the ski.

### Fitting and Sizing

**4.6** The size or length of the skis will affect their performance in various conditions. Generally speaking, the shorter the skis, the slower they will travel or glide. Shorter skis will provide less flotation in softer conditions as they cannot support the weight of the skier; however, shorter skis are easier to manoeuvre than longer skis.

**4.7** The correct ski length to be used will be determined by the weight of the skier. Shorter skis for lighter skiers and longer skis for heavier skiers. When referring to the manufacturer’s guide, where there is an overlap in recommended ski length, choose the shorter ski length.
Care and Maintenance

4.8 Correct care and maintenance of skis will increase their life span and serviceability. All skis should be cleaned and the base waxed after each use and before long-term storage. Wax integrates with the polyurethane base of the ski, helping to prevent oxidisation.

4.9 The top and bottom ski surfaces need to be cleaned and dried, including the binding. The use of solvents should be minimised as they can breakdown the various layers of the ski as well as dry out the material used in the base of the ski. Any excess wax or trail debris should be removed using a plastic scraper (white spirits may be used sparingly to aid removal, especially excess wax).

4.10 A guide to waxing skis is provided in Table 4–1. Recommended equipment required for this task includes the following items:
   a. a waxing iron
   b. universal glide wax
   c. a bronze brush
   d. a nylon brush
   e. a groove scraper
   f. a plexi scraper
   g. a tube of universal glide wax paste.
Table 4–1: A Guide to Waxing Skis

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base conditioning</td>
<td>Scrape storage wax away with a plexi scraper. Make 10 passes with bronze brush to renew and clean the base, ensuring maximum wax absorption.</td>
</tr>
<tr>
<td>Hot wax application</td>
<td>Set the waxing iron to the recommended temperature shown on the wax package. The wax should melt easily without smoking. Remember, no hot wax in the kick zone of the ski.</td>
</tr>
<tr>
<td>Ironing</td>
<td>Go from tip to tail, constantly moving the iron to prevent overheating the base. Let the skis cool for 5 to 10 minutes.</td>
</tr>
<tr>
<td>Groove scraping</td>
<td>Remove all wax out of the groove with a groove scraper (on skis with grooves).</td>
</tr>
</tbody>
</table>
4.11 Universal glide wax paste may be applied to the kick zone to prevent balling up that occurs when fresh snow sticks to the base, stopping the ski from gliding. GLs should always carry a spare tube of universal glide wax paste when conducting backcountry skiing activities to prevent this.

4.12 As the majority of modern touring skis are constructed with metal edges, it is important to dry the ski to prevent surface rust from occurring. The edges should be inspected to identify any

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
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<tbody>
<tr>
<td>Base scraping</td>
<td>Scrape the base with a sharp plexi scraper. Do not press too hard.</td>
</tr>
<tr>
<td>Brushing</td>
<td>Brush the base with a bronze brush from tip to tail approximately 20 times, followed by 10 times with a nylon brush to polish. This will remove wax from the base structure (grinding pattern) to give better glide. Note: Do not brush in the kick zone of the ski.</td>
</tr>
<tr>
<td>Kick zone</td>
<td>Apply universal glide wax paste to the kick zone to prevent ‘balling up’.</td>
</tr>
</tbody>
</table>
hairline cracks, separation or nicks. If identified, skis may be serviced or repaired by an authorised ski repairer.

4.13 Bases are to be inspected to identify gouges or scratches. While minor scratches in the base are acceptable, deep gouges particularly where the core is exposed necessitate repair by an authorised ski repairer. If identified, the skis should be tagged and quarantined from use.

Storage

4.14 Prior to returning skis to AT equipment loan pools or in preparation for long-term storage at the end of the season, skis need to be cleaned, dried and serviced (if required). The base is to be coated in wax, leaving the wax on as opposed to scraping it off (which is the procedure when preparing for skiing). Velcro® straps are commercially available to hold a pair of skis together and should be used at the tip and tail areas of the ski. A pair of skis should not be stored with a compression strap around the centre or mid-section as this will eventually affect the spring of the camber if stored this way for long periods.

SECTION 4-3. BINDINGS AND SKI LEASHES

4.15 Modern bindings that are used for backcountry skiing are generally cable bindings and are available from AT equipment loan pools. The development of the construction of bindings is ongoing, particularly for cable binding.

Construction

4.16 Research and development in bindings has seen the introduction of lightweight, high-strength materials, which add to reliability, response and longevity of the skis. The materials used in the construction of bindings include:

a. aluminium
b. stainless steel
c. steel (wire cables)
4.17 Cable bindings operate through the use of a cable and springs, or compression cartridges. The cable holds the skier’s boot in place while still allowing for flexibility, response and feel to be received from the ski (see Figure 4–4).

Figure 4–4: Cable Binding

**Inspection**

4.18 Inspect bindings for serviceability, as follows:

a. check the condition of the cable at the swage and thread junction

b. check the condition of the spring cartridges or springs (as fitted)

c. check the security and integrity of anti-ice plate, heel plate and heel throw

d. check the binding mounting screws are tight
e. check the fitting and condition of ski safety leashes (see Figure 4–5).

**WARNING**

Runaway skis can strike individuals and have been responsible for serious injuries and a number of deaths. When using skis fitted with cross-country touring or ‘free heel’ bindings, skis must be fitted with a safety leash to prevent a ski from detaching from the skier.

![Ski Safety Leashes](image)

**Figure 4–5: Ski Safety Leashes**

**Fitting and Sizing**

**4.19** Bindings need to be securely fitted to the skis and the skier. A binding should not be adjusted to the point where it is fully extended when fitted to a skier’s boot. Doing so will cause damage to the binding by preventing it from moving through its full range of motion and its non-release in the instance of a serious fall can cause major injury.
4.20 For G3 Targa bindings, adjustments to the binding length is achieved by a combination of the following:

a. Cable routing within the base plate (see Figure 4–6), and adjustment will necessitate removal of anti-ice plate.

![Figure 4–6: Adjusting Cable Length](image)

For adjustments to other types of bindings refer to the respective manufacturer’s instructions.

4.21
Care and Maintenance

4.22 Attention to bindings will maintain their serviceability and may extend their longevity. Bindings must be cleaned and dried after use. They must be inspected for wear or damage, which can be further reduced if time is spent fitting the binding correctly. Cables need to be replaced if the outer sheath of plastic is damaged and the inner cable is exposed. Heel throws need to be replaced if worn, especially before an activity commences.

Storage

4.23 When storing bindings, it is imperative that all aspects of care and maintenance of bindings have been addressed (see paragraph 4.22) and that the bindings have been thoroughly dried.

SECTION 4-4. CLIMBING SKINS

4.24 Climbing skins (see Figure 4–8) are used as an aid when ascending a feature, gaining uphill purchase or when conducting long, uphill hauls with a sled. Skins are available in a range of lengths and widths that allow the skier to slide the ski forward but not slip back. This is possible because of the construction and direction of the material’s pattern. For example, similar to running a hand over a dog’s coat, the hand glides freely in one direction, but encounters resistance in the other direction.
Construction

4.25 While originally made from sealskins, modern skins are constructed of materials such as nylon, mohair or rubber. The nylon plush pile or natural mohair fabric is connected to a base layer of rubber or a similar flexible material. The plastic or rubber skins have no nylon or mohair and are generally available only in full lengths that fit the ski from tip to tail.

4.26 Adhesive skins are available from AT equipment loan pools. This type of skin sticks to the ski using non-setting, renewable, multi-use skin glue. Most adhesive skins have tip loops and tail hocks for fitting.
Inspection

4.27 Skins should be inspected with the skis that they are to be fitted to, ensuring that:
   a. the width of the skin does not protrude past the metal edge of the ski
   b. the skin is the correct length for the ski
   c. the integrity of the adhesive
   d. the condition of the tip/tail bail or hook
   e. a general inspection of the skin surface.

Fitting and Sizing

4.28 New adhesive skins need to be correctly sized for the ski to gain maximum climbing performance. The tail of the skin needs to be rounded and trimmed using scissors to prevent fraying. To obtain the correct width for a particular ski, the user measures the ski at its narrowest point (the waist) in millimetres. This is the correct width of the skin required.

4.29 After inspecting the skins, they are to be fitted to the tip of the ski first, carefully laid on the base of the ski ensuring that the skin does not protrude past the metal edge of the ski. Finally, affix to the ski using the tail clip or bail.

Care and Maintenance

4.30 If an adhesive skin’s contact surface is exposed to snow or extremely cold temperature, it may not stick as well as one which has not. Therefore, when not in use, maintain as follows:
   a. Skins are to be removed from the ski, taking care not to get any snow on the glued surface. If a ‘skin saver’ is not provided, the best method is to fold them back on themselves (i.e., adhesive against adhesive). When removed for long downhill traverses, they should be carried close to the body so that the glue remains supple due to body heat.
b. Where possible, skins should be dried (applying no direct heat) to assist in performance. This can be achieved by simply placing the skis upright in the snow, facing the sun when not in use.

c. Skins should not be placed over areas of the ski that have excessive amounts of wax as this will affect the skin’s ability to adhere to the ski. If expedition-based activities are more than 7 to 10 days in duration, extra glue should be carried.

d. Any fraying or cuts in the attachment straps are to be repaired if possible or the skin may need to be replaced.

e. If the adhesive properties of the skins have degraded, they will need to be re-glued by a competent UATL.

Storage

4.31 Glue-on skins are to be stored using the ‘skin saver’ or with the adhesive side of the skin folded back on itself (ie, adhesive against adhesive). They are to be stored in their pairs so that skins of different lengths are not mixed.

SECTION 4-5. SKI POLES

4.32 The purpose of the ski pole is to help to push the skier along when on flat terrain and when climbing hills, as well as to aid balance.

Construction

4.33 Modern ski poles are made of aluminium, carbon fibre or a mix of both, and share the following characteristics:

a. Length. Ski poles available in the AT equipment loan pools are adjustable (see Figure 4–9).

b. Tip Design. Poles have sharp tips for security on hard snow and ice.

c. Baskets. Baskets are fairly large, around 80 to 100 mm in diameter, for use in soft snow. Basket designs include
a small solid disk, a snowflake shape, a cylindrical or modified disk and the traditional outer ring design. Plastic is generally the material of choice.

d. Handles. Pole handles incorporate an adjustable strap and an ergonomic grip that aids comfort and security, and allows for efficient pole swing.

Figure 4–9: Adjustable Ski Poles

Inspection

4.34 Ski poles should be inspected for:

a. the condition of strap and handle noting that many poles designs are paired (ie, left and right hand)

b. the general condition of shaft sections to ensure that the pole is not bent

c. the functionality of the locking mechanism

d. the condition of the basket and tip.

Fitting and Sizing

4.35 For general touring use, the traditional method of adjusting a pole that fits under the armpit with the point of the pole on the ground is an effective guide. An alternative method of calculating the right length is to use the skier’s height, minus 35 cm, to produce the same result. A shorter pole is recommended for downhill skiing. A suitable length may be determined when the basket of the pole is on the snow, when held with the forearm parallel to the ground. Adjustable poles are advantageous when undertaking downhill skiing.
Care and Maintenance

4.36 Grease, dirt, grime and corrosion will reduce the clamping effect of the internal locking cones, rendering the poles ineffective for normal use. Poles are to be separated and wiped clean with a dry rag.

4.37 Broken or missing baskets can be replaced by a UATL.

Storage

4.38 Skiers should ensure that all poles are fully separated after use then washed down and dried completely before storage.

SECTION 4-6. BOOTS

4.39 The most important issues to consider, especially when touring, is the fit of the boots. Ski boots are the link between the skier’s feet and the skis.

Construction

4.40 The plastic boot (see Figure 4–10) has significantly changed the nature of skiing, both on and off piste. It offers downhill performance and durability. The boot has an inner bootie that fastens with laces or Velcro straps and an outer shell of plastic with buckles and plastic locking straps. The shell is made from various types of plastic that offer strength and stiffness, yet, in certain sections of the boot, flexibility. The outer shell is waterproof. However, as they have little to no ventilation, sweating may occur.

4.41 Plastic boots are available from a number of manufacturers in a range of styles, shapes and sizes. Higher, stiffer boots are designed for downhill skiing, and short boots are designed for touring.

1. A groomed/prepared trail or slope; piste is often combined with the word ‘off’ (ie, off-piste), which describes backcountry skiing, or skiing on ungroomed, unmarked terrain.
Contents

4-18

Figure 4–10: Plastic Boots

Inspection

4.42  Boots should be inspected prior to issue, as follows:

a. Remove and inspect liner to ensure that the size matches the shell and are correctly paired (ie, left and right liner).

b. Check that the heel block is in place.

c. Check the footbed inside the liner.

d. Check the condition of buckles, laces and power strap where fitted.

e. Check the condition of sole to ensure that it is not separating from boot.

f. Check the condition of ski leash attachment point.
g. Where fitted, check the condition of heel lock or walk mode mechanism.

**Fitting and Sizing**

4.43 When fitting boots, avoid trapping clothing inside the boot or bunching up socks. There should be a small amount of room near the toes as there is a natural tendency for feet to expand during the activity; the boot liner may expand to some extent as well. Therefore a pair of boots that are comfortable while fitting may soon prove to be too large. When standing upright, pressure may be felt against the toes; this is acceptable. Conversely this pressure should ease as the skier leans forward into the tongue of the boot. What should be apparent at this point is that if the heel lifts from the rear of the boot, this indicates a smaller boot is required. Boots should be sized and fitted using the actual socks the skier will wear, as insulation is an inherent property of the liner, thin wool or synthetic socks are preferable.

4.44 Boot manufacturers use various and inconsistent sizing conventions. The common term ‘mondopoint’ is used in ski boot sizing. Simply put, the mondopoint is the length of the skier’s foot in centimetres. Start by measuring a skier’s foot on a piece of paper and consulting the respective manufacturer’s sizing chart to find the correct boot size. This is necessary, as not all boots are marked or stamped with the mondopoint size (refer to Table 4–2).
<table>
<thead>
<tr>
<th>Scarpa Boots T4</th>
<th>Mondopoint Size (cm)</th>
<th>Garmont/Scott Excursion</th>
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<tbody>
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<td>3</td>
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<td>Scarpa Boots T4</td>
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<td>Gamont/Scott Excursion</td>
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</tbody>
</table>
Scarpa boots are commonly marked and tracked according to the UK size.
This chart is a guide; foot length is only one of many factors for correct fitting.
Shaded areas denote a shared shell size (eg, Scarpa MP 26.5 and 27 use the same shell).

<table>
<thead>
<tr>
<th>Scarpa Boots T4</th>
<th>Mondopoint Size (cm)</th>
<th>Gamont/Scott Excursion</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Men</td>
<td>US Women</td>
<td>UK Size</td>
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<td>US Men</td>
<td>US Women</td>
<td>US Men</td>
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<td>US Women</td>
<td></td>
<td>US Women</td>
</tr>
</tbody>
</table>

**Note:**
Care and Maintenance

4.45 To increase the life span of any ski boot, there are a number of simple steps that can be taken. It is important to regularly inspect and allocate time to care and maintain them, both in the field and when not in use. The key considerations for maintaining plastic boots are as follows:

a. remove the liner and inner sole to air and dry it out away from direct heat
b. clean plastic boots using a non-petroleum-based product to remove any dirt or mud from plastic shell
c. inspect buckles, clips, straps and bellows for wear
d. inspect the inner boot, the laces and the outer boot soles for wear.

Storage

4.46 Ensure that the liner and footbed are completely dry before replacing.

4.47 All buckles should be tightened to a mid-range setting.

4.48 Boots should be stored in a dry, well-ventilated area, away from direct heat.

SECTION 4-7. CLOTHING

4.49 Alpine clothing must perform a difficult job. While on the move, skiers generate a great deal of heat and often do not need to wear much clothing. Clothing must be able to keep out wet snow and wind while allowing for the speedy passage of body moisture from the skin to the outside air to enable the skier to stay dry and comfortable.

Construction and Design

4.50 The best way to deal with different clothing requirements is to have several layers of clothing rather than one or two thick garments. This method of layering allows skiers to cope with
the widely varying conditions without overheating or shivering. The layers are broken down to three main areas as follows:

a. **Base Layer Clothing.** The main function of the base or first layer of clothing, despite being termed ‘thermal’ underwear, is to keep the skin dry rather than warm. The following aspects should be considered:

   1. Cotton soaks up perspiration and takes a long time to dry, so avoid cotton next to the skin. Importantly, insulating properties are removed once wet.

   2. Synthetic base layer fabrics remove moisture quickly by transporting, or wicking, it away from the skin. Heat from the body pushes moisture through the fabric to the outside. If a person sweats a lot, they will feel damp and clammy at times no matter what they are wearing, but because synthetic fabrics absorb little moisture and dry quickly, the wearer will soon feel dry. Synthetic base layers tend to hold body odours, although there are now a number of manufacturers that incorporate various methods to reduce odours.

   3. Woollen merino base layer fabrics promote excellent temperature regulation. When it is cold, the fibres keep the skier warm because of the fine crimped structure that retains insulating air. When it is warm, the wool has a cooling effect due to its high breathability. Merino wool inhibits body odour as it inhibits bacterial growth. When a skier becomes saturated, they will feel damp and cold, and wool in particular is much slower to dry than any synthetic fabric.

b. **Mid-layer Clothing.** The main function of mid-layer jacket (see Figure 4–11) is to keep the skier warm. The
following types of mid-layer clothing fabrics should be considered:

1. Synthetic-filled clothing has the advantage of being breathable and being resistant to losing loft if it gets wet. Synthetic clothing is more suitable for the wet and humid conditions often experienced in Australian alpine regions. Synthetic clothing is easy to maintain as it can be washed in a normal washing machine. Similar to down clothing, synthetic-filled clothing should not be stored under compression, as this will reduce the lofting and reduce the life of the garment and the insulation will be less effective.

2. Pile and fleece garments are warm, lightweight, extremely hard wearing, almost non-absorbent, quick drying, breathable, comfortable, and easy to maintain. Pile wicks away moisture almost as fast as the base layer garments and warms the body more quickly than anything else. This type of clothing tends to be less insulating, so these garments should be layered up or used with a layer of synthetic clothing. Generally AT equipment loan pools hold pile and fleece clothing for use by groups, due to its robustness.

3. Softshell garments are similar to pile and fleece clothing with the exception that softshell garments have an outer layer that offers some water and wind resistance. As with pile and fleece garments, softshell clothing is not as warm as down or synthetic insulated garments, and are bulky when packed.

4. Down garments offer the best weight to warmth ratio of any clothing. The disadvantages of down garments are their loss of insulating properties once damp or wet, and they are difficult to wash and maintain. AT equipment loan pools generally do not hold down garments due to the difficulty of
maintaining them. Down-filled clothing should not be stored under compression, as this will reduce the lofting and reduce the life of the garment, and the insulation will be less effective. Some down garments are available that have had the down treated to reduce the effects of water wetting the down and reducing the lofting.

Figure 4–11: Mid-layer Jacket

c. **Outer Layer (or Shell Layer) Clothing.** The outer layer of clothing is crucial because it is the layer that has to keep out the snow and wind. Some breathable wet weather clothing that is adequate in normal conditions could fail in alpine conditions. New materials are being continually developed to improve their properties such as weight, waterproofing and breathability of materials. There are a myriad of waterproof/breathable fabrics on the market.
AT equipment loan pools will have suitable shell jackets and trousers for AT activities.

(1) An outer shell jacket (see Figure 4–12) will have an integral hood, may have zippers to allow venting, and must be of adequate length to provide overlap between the trousers to enable protection of the lower back area.

Figure 4–12: Outer Shell Jacket

(2) Outer shell trousers are also waterproof/breathable and have adjustable braces with a drop-seat design for personal ablutions. The trousers will have full-length zips on the outer leg to allow the trousers to be taken down without removing boots and other clothing. They have built in snow cuffs, and some are capable of being fitted with kneepads into the pre-fitted knee pockets (see Figure 4–13).
4.51 **Gloves.** The layer principle also applies to gloves. Wool, thermal and/or fleece gloves form a base layer. Waterproof/breathable shell gloves, or over-mittens then form the outer layer (see Figure 4–14). Gloves should be worn at all times when skiing to protect the hands from abrasive injuries in the event of a fall. Females tend to have poor circulation to their extremities, so the use of mittens is recommended, as mittens will assist to keep their hands warmer.
4.52 **Headwear.** As a significant proportion of heat may escape from the head, adequate headwear such as a wool beanie is an important part of the clothing ensemble. Conversely, on warm sunny days, protection from sunburn is also important.

**Inspection**

4.53 Prior to issue, the functionality of all zippers, fastenings and Velcro should be checked, as well as a general check of the garment to identify any tears or holes.

**Fitting and Sizing**

4.54 The performance of the clothing ensemble relies on the successful integration of all layers. Therefore when fitting and sizing, participants are to wear their complete set of layers to ensure that all items fit correctly when worn together.

**Care and Maintenance**

4.55 Most waterproof/breathable fabrics associated with AT activities, are made of synthetic fabrics and are affected by heat. Naked flames are to be kept away from all clothing.

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*LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018*
4.56 Base- and mid-layer clothing, such as pile and fleece and synthetic fabrics, should be washed using the manufacturer’s recommended instructions. As a general rule, these types of garments can be washed normally in a washing machine, on a delicate cycle, using nondetergent-based products such as commercially available wool-wash products, or pure soap flakes for delicate garments (e.g., Lux). The use of a dryer should be avoided; however, if necessary, use the lowest heat setting.

4.57 Shell clothing can be washed in cold water on a delicate cycle preferably using a product such as wash-in cleaner and proofer, or alternatively using nondetergent-based products such as commercially available wool-wash products, or pure soap flakes for delicate garments (e.g., Lux). The use of fabric softeners are to be avoided as the chemicals in fabric softeners will remove the durable water repellent (DWR) on the exterior of the garment. The DWR is a chemical layer applied to the outer fabric of the garment during manufacture to help water bead off and improve breathability. Specialist detergents are available for washing clothing that has had a DWR treatment applied. Garments with a DWR generally require the DWR to be rejuvenated after about 10 washes; there are various products available to reapply the DWR. The DWR can also be rejuvenated by washing the garment then putting in a dryer on low heat (30 °C) for about 30 minutes.

4.58 Gloves, depending on their construction, may be hand washed. If gloves are designed with leather patches, the leather should be protected by using a leather treatment on those sections, such as a beeswax-based product (e.g., Sno Seal).

Storage

4.59 Clothing and garments are to be stored completely dry in a well-ventilated area away from direct heat and sunlight.
SECTION 4-8. EYEWEAR

4.60 Snow blindness (sunburnt eyes) is a problem encountered by personnel in snow-covered terrain. Snow blindness is painful and requires medical assessment, and can occur even in low light or overcast conditions. One of the following types of eyewear must be worn at all times during an AT backcountry skiing and alpine survival activity:

a. Sunglasses are to comply with Category 3 or Category 4 lenses in accordance with the Australian standard2. Wraparound-style sunglasses (see Figure 4–15) with securing strap are preferred.

Figure 4–15: Sunglasses

b. Ski goggles (see Figure 4–16) are suitable on overcast days, when the light conditions are challenging or in extreme wind conditions. Goggles offer 100 per cent UV protection and some designs may have photochromatic lenses which adjust to prevailing light conditions.

2. AS/NZS 1067.1, Eye and face protection - Sunglasses and fashion spectacles – Requirements.
Sunglasses and goggles should be visually inspected for fit, and any apparent damage. The importance of inspecting these items should not be overlooked. For example, a participant with a set of goggles that do not function in a blizzard is an immediate liability.

Care and Maintenance

Sunglasses and goggles should be washed in warm water using a mild soap, and then dried in a cool place. Exposure to heat may distort them. Solvents or abrasive cleaners must not be used. The lenses should be wiped clean with a soft cloth and checked for cracks and scratches. The main body, including the headband, should be checked for damage. When not in use, sunglasses and goggles should be stored in a carry case.

SECTION 4-9. TENTS

Tents for winter camping are selected based on their ability to withstand strong winds and shed snow easily (with a four-season rating). They are to be easy to pitch with gloves on, in a blizzard, and have adequate space for two people as the occupants may spend a long time inside. Generally, tents have a large vestibule(s) for storing damp gear and for cooking safely under cover.
Construction and Design

4.64 Tents available for snow camping include:
   a. geodesic domes
   b. tunnel tents.

4.65 Dome tents, with poles that cross at the apex, are not suited for snow camping as they tend to deform badly in high winds and sag in heavy snowfalls. In general, the more poles there are and the more often they cross each other, and the less unsupported fabric there is to catch the wind, therefore the more stable the tent. As heavy snow can flatten a tent with a flat or gently sloping roof, winter tents require a steep wall system designed to shed snow easily.

4.66 Tunnel tents generally have an external frame and are designed to be placed longitudinally to the wind (see Figure 4–17). Stuff bags for storage, poles and pegs are equipment included with a tunnel tent. Snow pegs will need to be obtained separately. The inner and outer shells are attached using a number of different attachment methods and these should be checked before deploying on a backcountry skiing activity. When carrying the tent on expeditions, it can either remain attached together or may be carried separately for ease of packing.

Figure 4–17: Tunnel Tent
4.67 In alpine conditions, keeping warm and dry are important considerations. Double-skin tents are less prone to condensation than single-skin tents. Air trapped between the two layers makes the tent warmer.

4.68 Strong poles are required in order for the tent to withstand strong winds. Poles should be shock-cord linked to make handling them easier in bad weather. New tents now use aluminium alloy in the manufacturing process and are strong and reliable when used correctly. It is important that pole segments are fully engaged to maximise strength.

4.69 **Snow Pegs.** Pegs designed to stake tents in snow should be used, as standard pegs will not hold a tent in the snow.

**Inspection**

4.70 Tents are to be fully erected to assure completeness, and inspected as follows:

a. Check all the stress points, especially the pole locator eyelets and all of the stitching.

b. Inspect all attachment points to ensure that they are serviceable.

c. Check all of the joints, bungee cords and tip ends of the poles, pole connection segments can be sprayed with silicon spray to stop sections freezing together.

d. Check the guy ropes to ensure that they are present and serviceable.

e. Inspect the zips and screens for serviceability and alignment.

f. Conduct general inspection of all fabric materials for holes and tears.

g. Check seams and stitched areas.

h. Ensure that the snow pegs are present and serviceable.
Care and Maintenance

4.71 Personnel should scrub the tents with a light soap and water and completely air-dry them after each activity. Components of each tent will need to be identified and accounted for. Tent pieces are not interchangeable as poles are cut to specific lengths. Therefore, it is important to ensure that each tent is packed and stored separately, with no interchanging of any components. Replacement poles are available from the manufacturer or supplier. Separating the tent when drying will allow for a thorough inspection and drying of the tent.

4.72 Silicone nylon tent fly fabrics, which feel slick and slippery, should be repaired with the appropriate product, such as SilNet™. Polyurethane tent fly fabrics, which feel less slippery, should be repaired with the appropriate product, such as Aquaseal. Note that for some tents, the fly is a mixture of silicone nylon coated fabrics and polyurethane coated fabrics. It is recommended that repair kits have both products available, and that GLs know the difference.

Storage

4.73 Tents are to be stored completely dry in a well-ventilated area away from direct heat and sunlight.

SECTION 4-10. SLEEPING BAGS, INSULATION MATS AND BIVOUAC BAGS

4.74 Sleeping bags, insulation mats and bivouac bags (commonly known as bivvy bags) combine to form an effective sleeping system.

Construction and Design

4.75 Sleeping Bags. The sleeping bags available for the alpine region vary from rectangular to mummy-shaped. All sleeping bags need to be rated from mild to extreme alpine conditions down to -20 °C, and can be filled with either synthetic material or down. Mummy-shaped bags are designed to hug the body in order to trap the warmth inside the bag (see Figure 4–18).
Some sleeping bags have a water resistant outer fabric or DWR treatment to reduce dampness affecting the filling. It is a hygiene requirement to use a silk liner with a down sleeping bag; silk liners will also reduce the need to wash the sleeping bag more regularly.

Figure 4–18: Mummy-shaped Down Sleeping Bag

### 4.76 Sleeping Mats

A sleeping mat (see Figure 4–19) can be made of closed-cell foam or can be a self-inflating mattress with an open-cell foam core, as well as various other fillings and baffles. Normal foam mats can be used but do not insulate as well as an inflatable mattress. Thick foam is effective but as it will not deflate, it is bulky to carry. A self-inflating mattress needs to be accompanied by a repair kit. The GL is to assess whether a single closed-cell foam mattress is likely to provide effective insulation; it is recommended that an additional self-inflating or closed-cell mattress is included for AT activities. Sleeping mats include:

a. **Self-inflating Mats.** Self-inflating mats are generally reliable and may only require minor inflation once rolled out. These mats tend to be somewhat bulky compared to air mats as they use internal foam as the prime method of insulation.

b. **Air Mattresses.** Air mattresses rely on various methods of insulation, such as reflective layering, internal baffles, down and thin layers of expanding synthetic insulating material to achieve the required insulation levels and comfort. Air mats are inflated by a person’s breath or by the use of various types of stuff sack air pumps. Ideally air mats should be inflated using a stuff sack air pump to reduce moisture from building up in the internal baffles.
Air mats that utilise any expandable internal insulating material should be stored inflated, particularly ones containing down.

c. 

Closed-cell Foam Mats. Closed-cell foam mats offer the best reliability as they do not rely on air to keep them inflated. Some foam mats include a reflective layer that will improve the insulation properties of the mat. Due to the size of closed-cell mats, they will normally have to be carried externally on a pack whereas self-inflating mats or air mattresses can be carried inside a pack. Closed-cell mats are particularly good for use if there is a requirement to treat a patient on the snow as these mats are ready to use straightaway, and there is not the risk of puncturing the mat.

Figure 4–19: Sleeping Mats

4.77 Bivouac Bags. A 100 per cent waterproof/breathable bivvy bag is designed for emergency shelter use, or for extra protection in extreme conditions (see Figure 4–20). To help with the insulation process, it is suggested that the sleeping mat and the sleeping bag are placed inside the bivvy bag when sleeping on the snow. When sleeping in a tent, the sleeping
mat should be outside the bivvy bag to allow the bivvy bag to breathe better and keep the sleeping bag dryer.

Figure 4–20: Bivouac Bag

Inspection

4.78 A visual inspection of sleeping bags is to be conducted, paying particular attention to:
   a. all stitching, draw-cords and toggles for damage
   b. the inner and outer shell for small tears and cuts
   c. any repairs required, such as covering any damage with tape to prevent loss of down until repairs can be done.
4.79 Inspect bivvy bags and sleeping mats paying attention to:
   a. the condition of zippers, draw strings and valves
   b. any damage to sleeping mats; they should be inflated for a period of time to check for leaks.

**Care and Maintenance**

4.80 **Sleeping Bags Care and Maintenance.** Spot cleaning for sleeping bags can be done with soapy water and a soft brush or cloth. The sleeping bag is to be air dried before storage. Users should check the manufacturer’s recommended washing instructions. Specialist cleaning of down sleeping bags is recommended after prolonged use.

4.81 Sleeping bags are to be inspected and maintained as follows:
   a. Never wash a down sleeping bag in a washing machine; the baffles in the sleeping bag will be destroyed. Down sleeping bags need to be cleaned by specialist drycleaners; be aware that most drycleaners have no experience with cleaning down bags and may damage the sleeping bags in the cleaning process.
   b. Damp sleeping bags can be dried in a dryer on a low heat setting below 30 °C. Never dry down sleeping bags in direct sunlight as this can damage the shell fabric and the down filling if direct sunlight is too hot.
   c. Synthetic sleeping bags are best washed by hand to reduce the risk of damage. Although synthetic sleeping bags do not have internal baffles like down sleeping bags, they are made from lightweight fabrics that can be easily damaged. Check the manufacturer’s recommended washing instructions.

4.82 **Bivouac Bags Care and Maintenance.** The care and maintenance of the bivvy bag is the same as for a waterproof/breathable jacket. Users should ensure that the bag is completely air dry before storage, checking the entire bag for rips, burns or cuts. The function of the zips and other closures should also be checked. The DWR on bivvy bags can be
reprooed or rejuvenated using the same method as for shell clothing.

4.83 Inflated mattresses may be washed with soapy water and a soft brush or cloth. Where leaks are detected, consult the manufacturer's repair instructions.

Storage

4.84 Sleeping bags are to be stored completely dry in a well-ventilated area away from direct heat and sunlight. Ensure that sleeping bags are completely dry before storage. Both synthetic and down sleeping bags should never be stored compressed; if stored compressed, the down or synthetic filling will not loft back to its full loft, which will shorten the life of the sleeping bag. Ideally sleeping bags should be stored in the large storage bags that are generally supplied by the manufacturer.

4.85 Sleeping mats are to be stored completely dry in a well-ventilated area away from direct heat and sunlight. Self-inflating mats should always be stored inflated with the air valve open so that the internal foam does not become compressed. Storing the mattress with the air valve open will also assist with the internal foam drying out if it had been manually inflated by breath.

4.86 Bivvy bags (like shell clothing) are to be stored completely dry in a well-ventilated area away from direct heat and sunlight.

SECTION 4-11. STOVES

4.87 There are many types of stoves that are suitable for use in the alpine environment. The most common stove available for AT backcountry skiing activities is the Trangia stove (see Figure 4–21) using methylated spirits. The Trangia stove is selected for its ease of use, reliability and safety.
The Trangia stove has the following features:

a. an adjustable flame control

b. a durable construction

c. the ability to burn in low temperatures and in windy conditions
d. stable pot supports that fold in

e. compact

f. an integral aluminium windscreen and heat reflector to increase cooking power and heat efficiency

g. requires minimal maintenance and is easily cleaned

h. fuel is readily available.

**Inspection**

4.89 The stove should be visually inspected and function tested as follows:

a. The O-ring for the fuel burner should be checked for serviceability.

b. Users must visually inspect all components to ensure that they are free from dirt and carbon.

c. Function test by lighting a small amount of fuel to ensure that all jets are free from obstructions.

d. All components are to fit together correctly and check that the unit is complete.

e. Fuel bottles must be checked to ensure that they do not leak, and are filled with the correct fuel.

**Care and Maintenance**

4.90 Users must thoroughly clean the stove after use. As the pots may be hard anodised or have a non-stick coating, caution is required. A soft sponge or cloth and detergent is to be used; under no circumstances are abrasive materials to be used.

4.91 Do not screw the burner lid back onto a hot burner as the O-ring will be damaged and fuel will leak.

**SECTION 4-12. PACKS**

4.92 The mountaineering pack has an adjustable anatomical harness system. Packs come in a variety of sizes and
capacities. Most packs also come with a harness size and can be adjusted to fit the user. A dry bag or heavy duty garbage bag(s) should be used as a pack liner to ensure waterproofing of the contents.

**Construction**

4.93 Pack can be constructed of heavy nylon or canvas fabrics (see Figure 4–22. Adjustments for correct fitting and security are affected by a combination of zips, drawstrings and plastic buckles).

Figure 4–22: Mountaineering Pack
Inspection

4.94 Packs should be inspected as follows:

a. Check fabric, zips and closures for damage.

b. Check the condition of internal frame bars.

c. Check the condition of all buckles and adjusters.

d. Check the condition of stitching, particularly around critical areas such as shoulder straps.

Fitting and Sizing

4.95 Packs are available in a range of sizes that refer to the wearer's back length and not necessarily the internal capacity of the pack. Most packs can be adjusted to suit an individual's back length. Refer to the manufacturer's instructions for obtaining the correct pack size.

Care and Maintenance

4.96 The pack should be washed or scrubbed with a mild soap and water as required.

Storage

4.97 Ensure that packs are to be stored completely dry in a well-ventilated area away from direct heat and sunlight.

SECTION 4-13. SLEDS (PULKS)

4.98 A sled (see Figure 4–23) is a means of transporting bulk equipment. The sled is attached to a skier using a harness and pole system. Equipment stored inside is accessed through a full-length zipper with two sliders. A sled can be attached in addition to a skier's pack or, on longer expeditions, can be taken by each individual skier in lieu of a pack.
Sleds are made from heavy-gauge, high-density polyethylene, which is virtually indestructible. The rigid harness consists of a padded hip belt with leg loops and aluminium shafts that come apart for stowing inside the sled. Nylon sled covers have two compression straps that stabilise the load inside.

Inspection

Sleds should be inspected as follows for:

a. the condition of harness and buckles
b. the condition of poles and harness connections
c. the condition of hull and runners
d. the condition of brakes (if fitted)
e. the condition of cover, retaining straps and fastenings
f. the contents of the spare parts kit.

Care and Maintenance

The sled should be washed in cold water using a mild soap as required. The rails should be cleaned of burrs, and ensure that all spare parts are present.
**Contents**

**Storage**

4.102 Sleds are to be stored completely dry in a well-ventilated area away from direct heat and sunlight.

**SECTION 4-14. SNOWSHOES**

4.103 Snowshoes are a traditional aid to snow travel that over time have been updated into small, lightweight designs. Bindings hold boots onto the snowshoes, and metal claws or crampon-like devices improve traction on hard snow and ice (see Figure 4–24). Snowshoes can be worn with a variety of footwear including ski boots. Taking a pair of snowshoes on a skiing activity will give the GL the ability to potentially walk an injured skier out. The other advantage of taking snowshoes on an activity is that some alpine locations in Australia are better suited to snowshoes due to the terrain and vegetation. The use of snowshoes on an AT activity may alleviate the extra time required to train participants on how to ski.
Construction

4.104 Snowshoes are constructed from a variety of materials ranging from high density polyethylene with nylon and Velcro fastenings through to designs incorporating articulated bindings and crampon points for traction.

Inspection

4.105 Noting that snowshoes are constructed using a variety of methods and materials, they should be inspected for:
   a. fitting with the boots that will be worn
   b. the condition and security of attachments
c. the condition of flexible materials such as webbing, plastic and cables.

**Fitting**

4.106 Prior to any activity, snowshoes are to be fitted to confirm suitability with the footwear to be used during the activity.

4.107 For a planned snowshoe activity, ski boots may be worn; however, it is recommended that robust waterproof hiking boots and gaiters are worn with snowshoes (see Figure 4–25).

![Figure 4–25: Snowshoes Fitted to Boots](image)

**Care and Maintenance**

4.108 Snowshoes should be washed in cold water using a mild soap as required. Snowshoes can be repaired by manufacturer supplied parts.

**Storage**

4.109 Snowshoes are to be correctly paired and stored completely dry in a well-ventilated area away from direct heat and sunlight.
SECTION 4-15. SNOW SHOVELS

4.110 A snow shovel (see Figure 4–26) is used for building shelters, preparing camp sites and in rescue situations.

![Snow Shovel]

Figure 4–26: Snow Shovel

Construction

4.111 Snow shovels are typically made from aluminium and will have a removable or collapsible handle.

Inspection

4.112 Snow shovels should be assembled or extended to ensure that all fittings lock into place and remain secure.

4.113 If not already fitted, it is recommended that an attachment loop around or through the handle is created to secure the item to the pack.

Care and Maintenance

4.114 The shovel should be washed as required.

4.115 Snow shovels should not be levered into the snow as they are generally not strong enough and will be damaged.
Storage

4.116 Snow shovels should be stored completely dry to prevent the internal metal locking clips from corroding.

SECTION 4-16. PERSONAL LOCATOR BEACON

4.117 A PLB (see Figure 4–27) is an electronic device that when activated because of a life-threatening situation, assists rescue authorities to search for and to locate those in distress. When activated, a PLB transmits a signal that can be detected worldwide by the international SAR satellite system, Cospas-Sarsat. The signal is detected by a rescue coordination centre that will coordinate a response. The time it takes for SAR to reach the activated PLB and provide rescue, depends on a number of factors, including the weather, time of day (day or night), the terrain, available assets, and accessibility to the rescue location. The more remote the location of the distress incident, the longer the response time may be. In all instances, be prepared to survive.

Figure 4–27: Personal Locator Beacon

4.118 Satellites cannot detect PLB signals through mountains, trees or buildings. If the PLB has not been deployed correctly with the aerial vertical in a clear open area, or the location is in a valley,
geostationary satellites are unlikely to detect the signal. In these cases, wait for polar-orbiting satellites to pass overhead, which may take several hours.

4.119 PLBs owned by Defence are managed and audited in accordance with DI(G) OPS 47-1, Australian Defence Force Search and Rescue Operations – Command and Control Arrangements.

Inspection

4.120 AT equipment loan pools hold PLBs for use on approved AT activities. The following checks should be conducted prior to the conduct of an AT activity:

a. Ensure that the PLB battery is still in date, the expiry for the battery should be printed on the device.

b. Check that the PLB is functioning correctly by conducting the test function of the device. The instruction for the test function should be on the device or confirmed through the manufacturer’s product information.

c. Verify that the PLB is currently registered with the Australian Maritime Safety Authority3 using the 15-character hexadecimal identifier or Unique Identification Number (known as the HexID or the UIN), which is the code that is programmed into the PLB, and can be found on the label affixed to the device.

d. Ensure that all personnel on the activity have been briefed on the correct use of the PLB.

SECTION 4-17. REPAIRS IN THE FIELD

4.121 A comprehensive repair kit should always be carried when conducting alpine activities in the backcountry. A repair kit that

can be added to or reduced as required for an activity is suggested as follows:

a. a multitool
b. fabric repair tape for clothing, tents (e.g., Kenyon or Gear Aid brands)
c. polyurethane fabric repair (e.g., Aquaseal or Seam Grip)
d. silicone fabric repair (e.g., SilNet)
e. two tent pole repair sleeves
f. 3 mm cord (parachute cord)
g. cable ties (various)
h. sewing kit (dental floss and needle)
i. sewing awl
j. ski binding cable(s)
k. ski binding heel throw(s)
l. ski binding cartridge
m. ski binding leash
n. universal glide wax paste
o. cloth-backed tape
p. O-rings for stove and fuel bottles
q. spare buckles for backpack (e.g., Sea to Summit)
r. set of screwdrivers or ski binding tool (e.g., Black Diamond Binding Buddy)
s. aluminium sheet/flashings (used for improvised ski pole repair)
t. two hose clamps
u. ski pole basket
v. fast curing epoxy
w. section of hacksaw blade.

4.122 The suggested repair kit contents (see paragraph 4.121) will cover most contingencies associated with backcountry skiing. Prior to an activity, the GL must have a basic understanding of how to repair common breakages that may occur. These range from broken ski poles, tent poles, torn tent and clothing fabric, broken pack buckles, punctured self-inflating mattresses, and ski binding breakages.
CHAPTER 5

BASIC SKIING AND SNOWSHOEING SKILLS

SECTION 5-1. INTRODUCTION

5.1 Basic skiing skills are fundamental to the success of any planned activity. These skills provide a foundation for intermediate and advanced skills in backcountry skiing. For the majority of activities, most participants will achieve only a very basic level of skiing skill. It is imperative that the basics of skiing are taught before the conduct of any activity. Once the basic skills have been taught, the best way to improve and advance skills is to practise. This chapter covers the basic skills and techniques required for backcountry skiing.

5.2 Factors such as the weather, snow conditions, terrain, objectives for the activity, and the level of progression of the participants will influence the training sequence. For instance, it may be a requirement that participants are to be taught the skill of walking forward in skis in order to make their way to and from an area where other skills will be taught. It is up to the UATL to assess each situation, in isolation, and to teach various skills at the appropriate time in accordance with individual experience and requirements.

SECTION 5-2. SKI TEACHING PRINCIPLES

5.3 It would seem obvious that a UATL’s primary goal is to ensure that participants learn and improve in an enjoyable environment. However, in a backcountry skiing environment safety always has the highest priority. In other words, if it means reducing enjoyment or slowing the learning process, the UATL’s first priority must be always to ensure the safety of their pupils. Once safety is assured, it is preferable the participants enjoy the experience and learn a little, rather than receive a lot of information and have a miserable time.
SECTION 5-3. FACTORS OF LEARNING

Maximum Class Activity

5.4 People learn far more easily by ‘doing’ rather than by watching or listening. This is especially true when learning a physical activity like skiing. As such, explanations and demonstrations should be kept as short as possible, allowing maximum opportunity for participants to try the activities.

Sense of Achievement

5.5 Both enjoyment and motivation are affected by the individual’s sense of achievement. When enjoyment and motivation are absent from a learning experience, participants become disheartened and eventually lose interest. A sense of achievement does not always rely on technical improvement. It can come from the satisfaction of stopping to enjoy a view, exploring the environment, or discovering how an already learned technique can be used in a new situation.

Goals and Goal Setting

5.6 Instructors are to clearly state the goals for any lesson, making sure these are realistic in terms of the participants’ level of fitness and aptitude, the terrain and conditions where lessons will take place, and the time that is available.

Lesson Variety

5.7 Lengthy repetition of any activity eventually leads to boredom and loss of interest. In a learning situation, repeated failure of a particular skill will also produce frustration and a loss of motivation. However, spending too little time practising a new skill can also be counterproductive. A certain number of repetitions is required before learners can develop an understanding of what they are trying to achieve and get a feel for the action. Therefore, in order for lessons to be both effective and enjoyable and maintain learner engagement, a balance is required between allowing sufficient practise time and the need to move on to the next exercise.
5.8 Whenever exercises are being practised in isolation or on a limited area of terrain, the activity should be interspersed with periods of continuous skiing. This helps both to put the exercises into context and to prevent the lesson from becoming monotonous. When designing practice sessions, it is useful to include a degree of variation in how the action is performed. This is due to the constantly changing nature of the terrain, where participants must develop adaptability in order to perform effectively.

Standards and Experience

5.9 The participants’ technical standard and level of experience may be established either by direct questioning or by observation of their skiing. When relying on verbal information, the number of weeks’ skiing experience and activities are often a more accurate guide than a stated technical level. In general, it is best to observe participants skiing directly in order to obtain an accurate picture of their technical ability.

Fitness

5.10 As well as technical suitability, activities should be appropriate to the participants’ state of fitness. Tasks that are within an individual’s capability will enhance both performance and sense of achievement; those that are too physically demanding can result in injury and demoralisation.

5.11 When planning sessions, consider the effects of terrain, snow conditions and weather in relation to the physical demands of the activities.

From the Known to the Unknown

5.12 The willingness to try something new (to explore the unknown) depends on the participants’ confidence and commitment. Even individuals committed to learning a new skill generally have more success when a new skill builds on what has already been learned. Not only is confidence likely to be greater, the learner will also have a clearer picture of the action or task to be performed.
Where a new activity does not relate directly to an earlier learned skill or experience, the principle of building on a known skill or experience can often still be used. For example, in an introductory lesson, there are no previous skiing activities to which the tasks can be related; however, participants have many other experiences to draw on (ie, walking, shuffling, stepping and jumping are all actions, which people can already do). Virtually all of the movements of skiing can be related to other more familiar activities. Such similarities often benefit from the use of imagery in teaching (eg, ‘stand like a goalkeeper/tennis player’) for basic posture.

If the learner has no ‘known’ skiing activities on which to build, try to find points of reference in the learner’s previous experience. Thus moving from the known to the unknown will strengthen the learning process.

SECTION 5-4. LESSON DESIGN

Site Selection/Terrain

Correct site selection plays an important part in the success of introductory ski instruction. Introductory skills should be taught in a relatively flat area where the site is appropriate for the skills being taught, and where there are no dangerous run-outs or other hazards that the inexperienced skier may be unable to avoid.

The instructional area must be well defined and suitable for the planned activities. The terrain, snow conditions, weather and abilities of the participants require careful consideration. In some instances, this may mean conducting initial lessons in areas devoid of snow, such as grass.

Warm-up Activities

Skiing is a physically demanding activity that can place great demands on the muscles and the cardiovascular system. Instructors should consider planning a pre-activity fitness program well before conducting the activity.
5.18 Warming up, stretching and cooling down are essential components of any skiing session. These components play an important role in reducing the risk of injury and preparing the participant both physically and mentally for the activity ahead. Before each lesson commences, the participants should be warmed up, concentrating on major muscle groups such as the shoulders, arms and legs. The warm-up should consist of 5 to 10 minutes of low intensity rhythmic activities to increase muscle and body temperature. These activities could be as simple as having the participants walk on skis up a hill to the training area or playing a short game on skis. Warm-ups will also help participants to practise putting on their skis and assisting to develop ski coordination.

5.19 Stretching activities should be performed only when the muscles are warm, and stretches should be specific to the activity being conducted. Stretching should occur gently and slowly, without bouncing or jerking movements. UATLs should consult a physical training instructor for specific stretches appropriate for a skiing activity. Ski poles can be used to assist balance during the warm-up and stretching activities.

5.20 Warm-ups can include:
   a. crouching front and rear
   b. thrusting and sliding alternate legs rearwards and forwards while crouching
   c. lifting alternate heels to the buttock
   d. lifting alternate legs to the side
   e. moving the legs and skis to the front and the rear carefully (without getting tip or tail stuck).

Revision

5.21 A key principle of ski teaching is always to move from the known to the unknown. By starting with activities that are known to the participant, they are more likely to feel confident and to succeed. By going straight into previously untried (or
unknown) activities, the participants are more likely to fail and become disheartened.

**Session Activities**

**5.22** Session activities form the main body of the lesson. Each session activity should develop a specific aspect of performance. The sequence of the activities should have a clear logic so that each participant's performance is developed gradually towards the overall goal.

**SECTION 5-5. LESSON STRUCTURE**

**5.23** Lesson structure involves a number of key ingredients: an explanation of what is to be done; a demonstration of the action; the opportunity to try; the provision of feedback to refine; further practice to allow learning improvement to occur.

**Lesson Framework**

**5.24** A model that provides a framework for UATLs to create and provide effective lessons is the EDICT model, which is:

a. **E** = explanation
b. **D** = demonstration
c. **I** = imitation
d. **C** = correction
e. **T** = trials.

**5.25** **Explanation.** Explanation is to be clear, accurate and concise. Avoid jargon and over technical or long-winded statements. People learn far more by doing than listening. The main value of explanation to the learner is not in providing a detailed analysis of how the task or manoeuvre works, rather it is to help focus attention on what they are about to watch or attempt for themselves.

**5.26** **Demonstration.** The demonstration should be performed at full power and speed, as this is essential to demonstrate the full range of movement. Demonstrations must be very clear and
complementary to the explanation. They should also be appropriate to the task and the participants’ ability. Where participants are making inappropriate movements or have misunderstood the task, additional demonstrations and explanations may be needed. It may be useful to change the position or orientation of the demonstration for the participants to obtain a clearer picture.

5.27 Imitation. After listening to the explanation and watching the demonstration, it is time for the participants to try the action/activity for themselves. The aim is for the participants’ to imitate what they have been shown. Remember that in the early stages of learning, a fairly crude attempt is often to be expected.

5.28 Correction. Where the participants’ performance needs only slight adjustment, correction may take the form of verbal feedback. More significant changes may require further explanation and/or demonstration to enhance awareness and understanding. Be aware that the instructor does not need to correct every attempt. Feedback is important; however, giving too much feedback can be as counterproductive as giving none at all. It is enough simply to praise a good performance. Feedback principles are:

a. Correct only one point at a time.
b. Correct only those aspects which the participant is focusing on.
c. Give feedback intermittently, rather than on every attempt.
d. Praise effort as well as achievement.

5.29 Trials. In the EDICT model, each attempt or practice by an individual is called a trial. As practice continues, the standard of performance (hopefully) improves. Where the aim is to develop adaptability or versatility, both task and terrain should be gradually changed.

5.30 The EDICT model is a repeating loop. The number of steps in a sequence within a given cycle depends on the needs of the
As the learner continues to practise, they may receive feedback or praise or correction; they may be given additional demonstrations to clarify or alter the task; and they may be offered further explanations to improve their understanding or shift their focus.

5.31 A variation on the EDICT model is the demonstration, explanation, demonstration, imitation, correction and trials model (known as the DEDICT model). Depending on the complexity of the skill, or if the skill to be taught is completely foreign, it may be worth considering using the DEDICT model, which provides an initial clear demonstration and a further more focused demonstration.

**SECTION 5-6. INTRODUCTORY LESSON**

5.32 It is important that the participants become accustomed to the equipment, its use and any associated safety issues. The participants need to be aware of how to carry the skis and poles safely, and the dangers associated with the metal edges on the skis and the tips of the ski poles.

5.33 The introductory lesson should cover:

a. Skis. Participants are to be instructed in how to put on skis and how to release the boot from the binding. This should cover both flat terrain and how to use the fall line across a slope.

b. Poles. Participants should learn the correct way to grip poles and how to correctly place the straps on the hands.

c. Ski Care. Participants are to be instructed on how to care for skis, especially when falling, and working in confined areas, in order to minimise damage.

d. Personal Safety – How to Fall. Participants should learn how to fall safely on the flat and on a small slope. The technique of falling safely is provided in paragraph 5.36. Participants must have sufficient confidence to fall over
in order to avoid a collision with a person or object, and to do so before they lose control.

e. **Standing.** The instructor should emphasise the flexibility of having a free heel and should teach participants to have less reliance on the ski poles to get up. Instruction should include standing up on the flat and on the slope. This technique is described in paragraph 5.37.

**SECTION 5-7. BASIC SKIING TECHNIQUES**

**Basic Principles of Skiing**

5.34 Skiers need to know the five basic principles of skiing technique. These basic principles are:

a. **Flexion and Extension.** Flexion involves flexing the legs and body in order to absorb bumps and initiate turns; extension refers to the straightening of the legs and body.

b. **Counter-rotation.** Rotating the body one way and the legs the opposite way is the principle of counter-rotation.

c. **Edging.** Tilting one or both skis onto either edge, usually to prevent slipping, is the principle of edging.

d. **Pressure Control.** When the skier’s body mass is applied to one ski or to both skis, this is the principle of pressure control. It is also known as weighting.

e. **Angulation.** When a body position is used to maintain balance while edging and skiing downhill by pushing the knees and hips up into the slope and tilting the head and upper body to lean out, this principle is known as angulation.

**Fall and Self-arrest**

5.35 Beginners must be taught how to fall, as it is an inevitable part of skiing. There is no dishonour involved in falling, and even good skiers fall. There are times when a person does not want
to fall, such as when a slope is extremely icy or dangerous. In normal conditions, however, a fall should cause no concern.

5.36 Beginners must learn that the best way to fall is sideways or rearwards. Poles are to be kept clear of falling, similar to a parachute landing or ‘buttock arrest’. The techniques for the instructor to emphasise are:

a. If falling sideways, skiers should try to keep their knees from hitting the snow first as this will tend to twist them. Instead, skiers should attempt to land on their buttocks.

b. Skiers should not resist the fall too much. When taking a high-speed crash, they should try to roll with it as ‘swallow’ diving into the snow can be harder than expected.

c. Skiers should attempt to stop sliding as quickly as possible by bringing their legs below them, so that they can use their feet, with or without skis, in order to brake to a halt.

d. Skiers should only jam in the poles to stop if their hands are out of the straps and are using the poles as a means of self-arrest.

5.37 In order to stand up after any fall, the first thing to do is to bring the skis together at 90° to the fall line. Skiers can either slide the skis around or roll over on their back. Once the skis are below them, the skier can stand up by kneeling on one ski at a time, or for the more athletic individual, by kneeling on both skis together. Skiers should avoid overusing the poles.

Star Turns

5.38 Star turns are a method of changing directions, which can also be used as an exercise for developing coordination. The technique gives beginners a way of getting around while they become accustomed to movement on skis.

5.39 Star turns are a static exercise and are taught as follows:

a. Participants are taught to move their feet so that the skis move in similar fashion to the hand of a clock.
b. The heel of the ski is kept down by maintaining heel/boot pressure.

c. Explain to the participants that they must ensure that the foot and pole closest to the direction of movement goes first, followed by the other. This is repeated until the skis are pointing in the required direction. The direction may be reversed by simply changing the foot to be moved first.

d. Moving the heel first is to demonstrate incorrect technique; this incorrect technique shows the learner how difficult it is to change direction if they lift the heel and not the tip.

e. Star turns are taught as an introduction to step/kick turns.

**Side Stepping**

5.40 Side stepping is used to move sideways on a slope. Skis are stepped uphill or downhill progressively at right angles to the fall line (see Figure 5–1). Teaching this technique early assists beginners to develop a feel for what the edges of the skis are doing. The progression for teaching side stepping is as follows:

a. Commence training on flat ground and move gradually to steeper slopes.

b. Participants are to practise weight transfer by being taught to move their body weight from one ski to the other while focusing on the amount of weight transfer.

c. Provide exercises that develop awareness of edges and how much edge to use on a given slope, which is essential when side stepping on firmer snow.

d. Explain that pole use is optional and can be simultaneous with each step, or alternate step, and teach participants how to conserve energy and how to balance using careful and controlled movements of the poles.
Participants are to learn how to flex the knees, which will increase their level of confidence in their side stepping ability.

demonstrate what happens when the skis move away from being perpendicular to the fall line, thus emphasising the importance of keeping them across the slope.

Figure 5–1: Side Stepping

Kick Turns

Kick turns are used for a 180° change of direction while stationary on the flat or on a steep incline, using the poles as support. It is possible to kick turn facing either uphill or downhill, but facing downhill is the preferred method for novices. Coordination and positioning are important, especially if being
performed on steep slopes while carrying a pack. The kick turn is taught as follows:

a. Participants are to start by standing perpendicular to the fall line with their skis parallel to each other. The poles should be at their side with the tips in the snow.

b. Move the downhill ski pole back and push it into the snow just behind the hips. Use the poles for balance while the kick turn is carried out (see Figure 5–2[a]).

c. Putting all of the body weight on the uphill ski, the downhill ski is lifted and the leg is extended in front of the body, so that the knee is straight up. Put the tail end of the ski in the snow, approximately even with the uphill ski tip (see Figure 5–2[b] and Figure 5–2[c]).

d. Leaning slightly uphill while using the ski poles for balance, pivot the downhill ski on its tail until it is 180° from the starting position.

e. Participants are now to be standing with their body weight evenly distributed on both skis. The uphill ski is pointing forward and the downhill ski is pointing backward. Shift all the body weight onto the downhill ski while slightly bending the downhill knee.

f. Once the downhill leg is supporting all the weight, lift the uphill ski off the snow and swing it around until it is next to the original downhill ski. The skis should be parallel to each other. Lift the ski poles and return them to their original position on either side of the body (see Figure 5–2[d] to Figure 5–2[f]).

5.42 The participants must maintain the ski edge throughout the kick turn by using angulation. The edges of the skis need to maintain biting contact with the snow, especially on hard snow and steep slopes. This technique should be taught on progressively steeper slopes. If required, a combination of both side stepping and kick turns may be used.
Figure 5–2: Kick Turn
Herringbone Technique

5.43 The herringbone technique (see Figure 5–3) is a method used to climb a moderate slope that is too steep to stride up, but not steep enough to require side stepping. Alternating steps form a herringbone or “V” pattern with the tips of the skis pointing outwards. The herringbone technique is taught as follows:

a. Instruct the participants to bend their knees forward and towards the slope, in order to edge the skis, which are spread apart in a V-shape with the widest section at the tips.

b. Knees are to be forced together to cause the inside edge of the skis to dig into the snow and the outside edge to be facing up.

c. Instruct the participants to alternate pole plants in order to maintain balance and position. The pole is to be planted behind the foot and body.

d. Instruct participants to maintain heel contact with the ski, but the ski is to be lifted in order to move it up the slope. The aim is to not let the back of the ski drop as this will change the angle of the ski in relation to the slope, which will lead to sliding.

e. Participants are advised to look up towards the top of an incline or slope, not down at their skis. The positive consequence of looking uphill is to shift their weight towards the rear, versus looking down to their ski tips which moves their weight forwards.
A tack turn is used to change direction (by about 135°), while moving diagonally up a slope, without altering pace, by performing a variation of the kick turn (see paragraph 5.41) (facing mostly uphill). Tack turns or switchbacks are a safe way to descend or ascend a feature through trees or on a steep slope. They are best taught while touring to allow the technique to be put into perspective.
5.45 For the downhill tack turn, the technique used is the same as the downhill traverse (see paragraph 5.75); at a point where a turn is required, wash off excess speed by going uphill. Once stopped, the skier completes a kick turn and continues down the feature.

5.46 To climb a feature, the participants traverse at an angle to ensure that they do not slide backwards. At a point where they wish to turn, they can either kick turn or step turn. This depends on the steepness of the feature.

SECTION 5-8. CLASSIC TECHNIQUES

Double Poling

5.47 The double poling technique (see Figure 5–4) is used to assist forward movement. Pushing with both poles at the same time performs the required action. Double poling is used on a slight downhill or where extra stability is desirable. The progression for this technique is as follows:

a. Double poling is best taught initially on a slight downhill track so that momentum can easily be maintained. The participants should stand with their skis parallel and plant their poles well in front of their feet. The instructor then asks them to try to propel themselves forward by simply pulling on the poles.

b. Having discovered the most comfortable position for the pole plant (remembering that it will vary depending on terrain and the speed of the skier), the efficiency of that pole pull can be heightened by locking the elbows to the rib cage and repeating the forward movement. Bending at the waist is then required to achieve any movement at all.

c. The instructor must emphasise the need to plant poles rearwards and swing the arms in a long arc towards and beyond the thighs, pushing out to the rear.
d. The relationship between the arms and the upper body is important in order to have an effective pull. The angle between the upper body and the arms should remain at around 90° to work efficiently.

e. Correct tempo is important in order to maintain an efficient action. The participants must slow down the action and compare its efficiency with a much faster action. It is to be remembered that skiers’ natural tempos will vary from one individual to the next.

f. The instructor should encourage a continuous movement of the arms, back and forth in an arc, watching for a delay as the poles are brought forward and swung into the air. It takes extra effort to hold the poles even momentarily above the snow so this should be avoided. Poles that are too long or too short can have a detrimental effect on technique. A quicker tempo will often reduce the ‘time-delay’ seen in a slower poling action.

g. The instructor may advise the participants to rise up onto their tiptoes as the arms swing forward, allowing an even greater compression of the upper body onto the poles. Most skiers can learn the correct technique without having to do this. The participants should also note that a slight backwards and forwards split of the feet enhances stability.

h. Poles work most effectively when planted parallel to the body. The participants should exaggerate the arm spread by pushing the arms out wide as they are brought forward to encourage this. Fast tempo or sprint double poling is easier with the arms held well out from the torso.

i. By pushing (not pulling) the pole grips away from the body and down towards the ski tips, the participants should feel a levering action with the upper body with the shoulders being projected forward. When applied
correctly this technique relies less on arm strength and more on upper body strength.

Figure 5–4: Double Poling
To enhance teaching of the double poling technique, the following exercise may be used:

a. The instructor should ask participants to pair up and stand on their skis without poles, facing each other. The tips of the skis should touch or overlap.

b. Participants then simultaneously fall toward each other until their palms meet, push off and stand up again. As the participants’ confidence increases, the distance between pairs can be increased.

Faults for instructors to identify and then correct when teaching the double poling technique include:

a. sitting during the pushing phase
b. no push and follow through (arms stay at the side)
c. no use of body weight in the initiation phase
d. the poles flicked out and planted too far forward.

Diagonal Stride

Diagonal striding (kick and glide) (see Figure 5–5) is one of the most fundamental techniques required for backcountry skiing and it is possible to learn the diagonal stride in a few moments. However, perfecting the best technique may elude some beginners for many seasons. For general touring, a casual walking stride extended to a slight kick and a glide while using an economical style will enable most individuals to cover considerable distance. The progression for this technique is as follows:

a. The instructors should introduce a new ski skill to the participants by utilising tracks or any flat area or roadway, or a very gentle incline.

b. Diagonal stride instruction usually begins by focusing on the feet and the lower body action. Poles should not be used initially unless required by students for stability and security over rough terrain, their introduction is usually left until later.
c. The participants should be encouraged to experiment between stiff ‘robot-like’ movements and relaxed ‘gorilla-like’ movements.

d. The participants should alter the tempo, but not the stride length, and observe the effect. Conversely, does increasing the stride length affect the tempo? Participants should try to avoid pausing between each stride; the leg action should be similar to that of a cycling motion. Legs should always move backwards or forwards. It is important at this stage of instruction to develop a good sense of timing in each participant’s movements and not to be too concerned with the overall appearance.

e. The transfer of the body mass from one foot to the other is also moving the centre of mass from side to side – a lateral weight transfer. This is often mistaken as being the key to efficient diagonal striding when in fact it is the simple act of weight transfer from foot to foot that is instrumental.

f. The hips have an important role in the diagonal stride. Mass transfer from foot to foot can be considerably enhanced if each hip is allowed to swing forward as the leg also swings forward. This action assists in placing body mass over the ball of each foot, thus increasing the power of the stride. The instructors should encourage the participants to maintain striding without letting their heels come into contact with the ski. This exercise will bring body mass further forward and enhance the gliding motion.

g. The overall body position needs little attention at this stage. Some skiers prefer a more upright stance than others. The only instruction necessary is to correct skiers from leaning too far forward, especially those who lean only their upper body and leave their hips behind. The instructors should encourage the more upright participants to engage the hips, as described in
paragraph 5.50f, in order for them to feel the extra power that can be gained from striding efficiently.

h. Many beginners stride better without poles, and in most cases, they should be encouraged to spend as much time as possible diagonal striding without them. The arms should naturally swing in a regulatory fashion to balance out the leg movement and should continue to do so when poles are attached to the end of them.

i. A method used to encourage participants to introduce arm movements to the diagonal stride, is to pretend that they are carrying a bucket of water in each hand and swing the arms while the legs make similar movements to those described in paragraph 5.50h. The action of swinging the weight of the bucket pulls or drives the person forward. The participants should be aware of the weighting of the kick ski and aware of the glide position.
Figure 5–5: Kick and Glide
Combining Poles

5.51 To combine poles from the diagonal stride, the participants should concentrate on the stride first and then develop the arm and leg coordination. They should develop a feel for the poles by holding them horizontally and balanced in the hands, and get used to swinging the arms in a rhythm to match the legs. Use of poles should be introduced gradually, beginning with planting the poles but using no push action. The participants should be instructed to gradually increase the amount of push as they become more confident in their skiing ability. The technique is taught as follows:

a. instruct the participants to plant the poles midway between the boot and the ski tip
b. they are to push all the way rearward and glide forward.

5.52 This action can then be carried out on one ski in order to improve technique.

5.53 The poles are combined as follows:

a. Participants are to keep their skis in contact with the snow at all times.

b. The arms are to be moved together, alternating with the legs moving together to produce a forward motion.

c. Participants are then to kick downwards with one leg and glide forward on the other, combining this with the steps laid out in paragraph 5.51a and paragraph 5.51b.

d. It is necessary to lean forward with the body weight over the front ski.

e. The body weight is to shift from one ski to the other when the feet pass each other (see Figure 5–5), using the poling technique described in paragraph 5.51a and paragraph 5.51b.

5.54 Some common faults associated with this technique are:

a. a lack of pole and leg coordination (eg, square gaighting)
b. poor weight transfer (eg, weight too far back)
c. a late kick and slapping skis
d. the body not relaxed.

5.55 The following exercises can be used to overcome problems encountered while learning the diagonal stride techniques and to remedy poor weight transfer:

a. Practise ‘scootering’, initially with one ski off, then on two skis, hold the poles horizontally in both hands as ‘handle bars’.
b. Take very short strides.
c. Ski downhill on one ski to get used to the glide position.
d. Ski uphill, as an even, gentle 50 to 100 m uphill slope will assist with forward lean and help with poor synchronisation.

5.56 In order to remedy unsynchronised arms and legs, and poor rhythm, the exercises in paragraph 5.55a to paragraph 5.55d should be carried out as well as these additional exercises:

a. Ski at an unnaturally fast tempo – ‘jogging’ on skis. There is no time to get unsynchronised at the faster tempo. Having now learned synchronisation of arms and legs by skiing at a much faster pace, the participants should now be encouraged to ski at a slower pace; repeat the exercise if necessary.
b. Participants are to practise walking uphill with poles and no skis at home or in camp.

SECTION 5-9. DOWNHILL TECHNIQUES

Downhill Running

5.57 The downhill running technique (see Figure 5-6) involves skiing straight down the slope (fall line). Downhill running is used to develop confidence and balance and to assist in the participants’ ability to negotiate undulating terrain and make the
necessary adjustments to technique, speed and direction. It is important that all participants master this skill; failure to do so will inhibit their ability to master more difficult skills.

Figure 5–6: Downhill Running

**5.58** The instructor should select an area that has a gentle incline with a safe run out for the first phase of this skill. This technique is taught as follows:

a. Advise the participants that their stance and balance are important in order to adopt the correct position.

b. Instruct participants to adopt a relaxed position, with the knees slightly flexed.

c. Poles and hands are to be placed forward.

d. Ensure that the tips of the poles are pointed towards the ground.

e. Advise participants to look ahead, not at the ski tips.
In order to enhance the participants’ understanding of balance using a wide stance, the instructor could demonstrate each of the following balancing exercises:

a. flexing deeply the knees and ankles  
b. reaching down to touch the boots and then standing up  
c. sliding alternate skis forward  
d. reaching down to pick up items  
e. bending underneath hurdle gates made from ski poles  
f. telemark running.

To improve the participants’ coordination, the instructor can utilise the following exercises:

a. lifting each heel alternately while the ski tips maintain contact with snow  
b. hopping both ski heels off the snow  
c. bending and stretching through bumps.

Common faults associated with poor coordination are:

a. a stiff or cramped position  
b. a failure to look ahead, which causes a loss of balance.

Snowplough Glide and Brake

The snowplough glide and brake is used to control a skier’s rate of descent in a stable position by placing the skis in a convergent or snowplough position (an inverted ‘V’ stance) and using pressure and inside edging to control speed. Before skiing downhill, static exercises that will help develop the snowplough technique are as follows:

a. forcing the skis out into a wide V-shape, which is the snowplough position  
b. holding the position and rolling the knees in and out to achieve some feel for the skis’ inside edges
5.63 The instructor should encourage the participants to perform a few downhill runs in order to warm up and get used to moving again after the static practice. The technique for the snowplough glide (see Figure 5–7) is as follows:

a. Participants are to do a straight run and then start pushing out into a gliding plough (ie, the skis are in a plough position, but no pressure is applied to the edges).

b. Instruct participants to move from a snowplough glide into a slightly unweighted (or standing position) and then move into a wider angle braking plough.

c. The pole tips should be pointed to the ground and the hands are to be about shoulder width apart.

d. Participants are to practise the rhythmic changing from a gliding plough to a braking plough in succession.

e. Participants then they are to practise hopping out into the plough and back into a straight running mode in succession.

f. The snowplough glide requires rhythmic opening and closing of the legs in order to plough and run parallel.

g. Repeat these exercises using slalom poles or sticks as markers.
The instructor should ensure that the following faults are corrected:

a. over-edging on the inside of the skis
b. moving only one leg into the correct snowplough position and angle
c. pressing the knees in towards one another
d. a body position that is too rigid; arms and legs stiff and a tendency to sit back
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e. legs too wide into the plough position, as a result ski tips lock, legs straighten and body weight goes too far back
f. looking at ski tips rather than direction of travel
g. bending forward at the waist.

Snowplough Turn

5.65 The snowplough turn is used to change direction while moving and also to control the speed of descent in most snow types by putting more weight over one ski than the other while holding the basic snowplough position (see Figure 5–8).

Figure 5–8: Snowplough Turn

LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018
The technique required for a snowplough turn is taught as follows:

a. On a gentle downhill section with a good run out, the participants ski downhill in the snowplough glide position.

b. Once the speed is controlled, they are to sink down more on one leg and push the same knee further forward and into the turn while transferring their weight to the outside ski.

c. Initially the participants practise while static and the instructor demonstrates how the body mass shifts from side to side. The instructor also demonstrates how, when the turn is performed correctly, edging occurs on the outside ski.

d. The participants then practise the technique on downhill running, moving gently into a snowplough glide, then turning to one side in a very gentle arc. The size of the arc can be decreased as the participants become more confident.

The participants should observe the correct pole position, and the normal stance should be maintained. The following faults in technique should be avoided:

a. the ‘F1-11’ approach, with arms splayed out attempting to slow the body as it comes in for landing

b. the inside leg being too stiff

c. the upper body tense and not relaxed

d. the upper body over turning (skiers should always look downhill).
5.68 The stem turn (sometimes called the stem Christie or wedge Christie) is a turn with a wedge but finishes with the skis parallel (see Figure 5–9). The technique is taught as follows:

a. The participants are to start in a downhill traverse (see paragraph 5.75), ensuring that their skis are parallel and that their weight is slightly forward and to the downhill side. Start to bring the skis into a wedge position and begin to turn into the fall line with weight on both skis.

b. The body weight is then transferred to the outside ski by leaning out. This will start the turn out of the fall line.

c. While returning to a traverse, participants will bring the new uphill ski back to the parallel position with the downhill ski while keeping weight on the downhill ski.
Figure 5–9: Stern Turn

5.69 Some common faults associated with the technique required for a stem turn are:

a. not weighting the outside ski on the turns

b. leaning back, as it is important to make sure that weight is kept in the middle of the ski

c. too much weight on the uphill ski at the completion of the turn preventing the return of the skis to parallel.
Parallel Turn

5.70 Parallel turns are an efficient means of turning; however, these turns are difficult to master initially. They require consolidated training progression, exacting balance and timing. Parallel turns are not as stable as other turns when a large pack is being carried.

5.71 The technique required to conduct a parallel turn (see Figure 5–10) is taught as follows:

a. To initiate a turn, the participants should rise up from a flexed knee position and extend their legs to lighten the weight on the skis. It is important to use vertical movement (extension) to aid lateral movement.

b. As the skis are momentarily flattened, the skis are rotated using the boots, driving the knees into the turn and across the fall line.

c. As the turn progresses, the skier compresses into the turn. This up and down movement is crucial to successful turns.

d. Participants are to drive their knees and hips into the slope ensuring that the upper body remains upright. Hips and shoulders face downhill throughout the turn.

e. Initiate the next turn as described in paragraph 5.71a to paragraph 5.71d.
Initiate the turn by extending upwards and leaning forwards.

Traverse across the slope.

Start pushing on the outside ski once the skis are travelling straight.

Let the skis slide to control your speed.

 Traverse out of the turn with your weight on the downhill ski.

Keep your shoulders turned slightly down the slope once you have crossed the fall line.

Keep your shoulders turned slightly down the slope once you have crossed the fall line.

Keep your shoulders turned slightly down the slope once you have crossed the fall line.
Some common faults associated with the technique required for a parallel turn are:

- the hands are too high (they should be kept low)
- not keeping the upper body upright and leaning back.

**Step Turn**

A step turn is an extremely useful movement. Skiers can use it to turn downhill across the fall line on gentle slopes, to stop a traverse, to round corners on a trail and to avoid rocks or trees. The step turn is basically a star turn done on the move. The technique required to conduct a step turn is as follows:

- Ask the participants to lift the tip of the inside ski, that is, the ski that will be on the inside of the turn. This movement is not to be abrupt.
- The ski is to be pointed in the required direction. The hands are kept low, and the arms are slightly pointed in the direction of the turn (let the hands lead).
- The weight is to be placed on that ski (not abruptly). Then step the other ski next to the first ski that was moved.
- Steps are to be kept short in order to avoid crossing the tails of the skis and a number of steps may need to be taken to have the skis pointing in the desired direction.
- For sharp turns, several steps may be required.

The most important step in this series of manoeuvres is the first one. Unless the inside ski moves first and maintains edge control the turn will be difficult to perform. Subsequent weight transfer and edge control to each newly-stepped ski is also important throughout the turns. Participants should practise the step turn on a gentle incline with a good run out.

**Downhill Traverse**

The downhill traverse is used to descend steep terrain in a controlled manner by skiing diagonally across the fall line. It is an effective way to descend hills while carrying packs.
(especially when used in conjunction with the kick turn [see paragraph 5.41]). On an easy gentle slope, skiers adopt a similar body stance position as is used in side stepping (see paragraph 5.40). The downhill traverse technique is taught as follows:

a. Participants are to edge their skis.
b. Knees are angulated towards the slope.
c. Upper bodies are to be kept upright.
d. The uphill leg and arm should be slightly forward.
e. The shoulders are to be slightly downhill and the hands are to be parallel to the slope.
f. Remind participants to be aware of their angulation.
g. Instruct them to ski diagonally across the fall line and look downhill.

Side Slipping

5.76 Side slipping is a technique that requires good balance and edge control. The side slipping technique is taught as follows:

a. Instruct the participants to flatten their skis onto the snow by rolling their knees and hips towards the downhill slope, allowing the skis to skid downhill.
b. In order to stop slipping, the knees are to be rolled up into the hill and need to be set back onto their edges.
c. Explain that, if the technique is correctly executed, the body weight should be on the downhill ski.

Telemark Running

5.77 Telemark running is a method of descending rough, unpredictable terrain in a straight line by maintaining a flexible telemark stance (see Figure 5–11). The technique for conducting telemark running is taught as follows:

a. While running downhill on a gentle slope at a comfortable speed, the participants are to stride forward
on one foot while lowering the body until the rear knee is halfway down the forward leg approximately 10 cm.

b. If the slope allows, the participants should stand up and repeat the action on the opposite side. This is practised until they can comfortably stride between sides.

Figure 5–11: Telemark Running

5.78 It is important for participants to achieve a correct stance from the beginning of their instruction. If turning is attempted before the participant is in control of the basic stance, faults will be magnified and will be difficult to eradicate. The following points should be emphasised:

a. stride smoothly between stances (lead changes)
b. hold the arms wide for balance
c. feet should be hip-width apart
d. feet are positioned one in front of the other
e. both knees are flexed comfortably
f. rear heel is raised off the ski
g. body weight is distributed evenly between ball of the rear foot and the whole of the front foot.
Telemark Turn

5.79 The telemark turn occurs when pressure is applied to the inside of the leading (downhill) ski to initiate turns while the heel on the trailing (uphill) ski is lifted up in order to complete the turn (see Figure 5–12). The turn is designed for use in powder snow but has some advantages in Australian snow conditions, especially when carrying a pack. The telemark turn can be introduced once the participant has become competent conducting the telemark run (see Figure 5–11). The telemark turn technique is taught as follows:

a. Participants are to point or roll their leading knee across the front or into the turn; that is, left knee leading – right turn, right knee leading – left turn. By applying turning pressure to the inside ski edge, it will begin to carve or turn. If the skis are evenly weighted, the rear ski will skid around to follow the arc of the front ski.

b. The participant’s head and hands should continue to face downhill during the turn to prevent over turning. They should practise small turns in each direction until they are confident to try and link the turns using smooth lead changes.
Some common faults associated with the technique required for a telemark turn are:

a. the stance is too far spread, with the rear leg trailing
b. the hands are held too high or are too far to the rear
c. the skis are unevenly weighted
d. the uphill ski edges are not being engaged together
e. the upper body is leaning too far forward
f. the skier’s stride is elongated.
SECTION 5-10. SNOWSHOEING TECHNIQUE

5.81 Snowshoes permit efficient travel in soft snow, where otherwise walkers would laboriously posthole (sink deeply with each step). Although travel on snowshoes may be slower than travel on skis, snowshoes can be used in brushy or rocky terrain where skis would be awkward. They are also an option when an individual is finding it difficult to travel over snow on skis or an alternative to skiing in itself.

5.82 If a person can walk, then they can snowshoe. The basic techniques used on skis can be used when using snowshoes. The following points must be remembered when using snowshoes:

a. Ensure that both fitting and removal of snowshoes is practised prior to any activity.

b. Snowshoes have a wider footprint. Adjusting to a wider stance will allow a smooth gait without steeping on or catching the participant’s own snowshoe when moving.

c. As with skis when turning, the inside foot should be moved first (step turning, star turning) and remember to pick feet up slightly higher to avoid the rear of the shoe catching the snow.

Poles

5.83 The use of poles helps to stabilise the upper body improving balance and stability on difficult terrain. Poles should be adjusted to the terrain as follows:

a. Climbing. Poles should be made slightly shorter to provide better balance and support on the steeper terrain in front.

b. Descending. Poles should be adjusted slightly longer for balance and control.

c. Traversing. It may help to have the downhill pole longer. It may be easier to hold the uphill pole further down the shaft.
Climbing

5.84 When climbing a slope the following techniques can be used:

a. *Stomping*. Keep the weight on the forefoot (using the poles for balance and support); kick in (‘stomp’) the snowshoe into the snow and press down to make a step. Stomping will ensure that the crampons are fully punched into the snow providing maximum grip.

b. *Herringbone*. In the same way as when ascending a hill on skis, the herringbone technique can be used when snowshoeing (see Figure 5–13). The principles are the same as described in paragraph 5.43.
Traversing

5.85 Traversing a slope may present some difficulties. To traverse a slope, kick the side of the snowshoe (edging) into the hillside engaging the crampon. Ensure that there is weight transfer and the crampon is engaged before stepping forward. Poles are to be used fully to provide balance and support on steep terrain.
5.86 When descending in snowshoes, route selection as well as heel traction is the key to an easy descent. The main points to remember are:

a. Keep knees slightly bent and weight over the heels to maintain grip and control.

b. Use poles to provide balance and support.

c. Take short strides.
CHAPTER 6

RATIONS FOR THE ALPINE ENVIRONMENT

SECTION 6-1. INTRODUCTION

6.1 Individuals participating in backcountry skiing AT activities require substantial amounts of energy to get through a day’s activity; this energy comes from food. Eating regularly throughout this type of AT activity will assist in maintaining a normal body core temperature that will avoid complications like hypothermia. It is important to provide a robust ration plan that provides regular meals and snacks so that participants are able to maintain the higher energy requirements of operating in an alpine environment. Rations are an integral part of an activity and the type of rations and how they are cooked can be an important part of developing the qualities required in the activity outcomes.

Types of Ration Options

6.2 There are a number of ration types that can be used for the conduct of the activity and they all have disadvantages and advantages. An activity can be rationed using any or a combination of the following combat ration pack (CRP) types:

   a. **Combat Ration One-man.** The combat ration one-man (known as CR1M) is designed for issue to individuals as the tactical situation dictates, or when no form of group feeding is practicable. This CRP is complete and provides food for one person for one day at an average energy value of approximately 18 000 kJ. The CR1M weighs approximately 1.9 kg.

   b. **Combat Ration Five-man.** The combat ration five-man (known as CR5M) is designed for feeding detachments of three to five persons and for group feeding where the use of fresh rations or a canned equivalent is not practicable. The CR5M, when not supplemented,
provides enough food for five people for one day at an average of approximately 16 800 kJ per day.

c. **Patrol Ration One-man.** The patrol ration one-man (known as PR1M) consists of similar nutritional characteristics to the CR1M, but with a slightly lower average energy value (approximately 17 700 kJ). However, retort pouches and canned products have been replaced by freeze-dried equivalents, which significantly reduce the weight of the ration. Cutlery and mess tins are not required for this type of ration pack. The PR1M is more expensive than the CR1M and is intended for use in situations where its lighter weight (approximately 1.0 kg versus 1.9 kg for the CR1M) is of considerable advantage to personnel who may be required to carry several days’ rations on their person.

d. **Allocated Rations.** Allocated rations (AR) are rations allocated by Army HQ to units to provide fresh rations for personnel participating in Army capability management system approved training activities. Units bid for an allocation in dollars. This money can be used to purchase rations needed for the activity from a supermarket. Other considerations are:

(1) AR are calculated at per person per day. GLs should consult their operations cell prior to the creation of the new financial year training and resource plans to ensure that sufficient funds will be allocated for each AT activity. Check the current rate per person allowance for rations per day; note that the rate may be different if rations are purchased in a metropolitan area or a regional location.

(2) When purchasing AR, it is important to note that packing items such as snap seal bags and plastic containers cannot be purchased with a Defence purchasing card.
Selected Rations from the Mess. Some units will not have access to combat rations or AR and may have to draw rations from the mess. Early consultation with the mess manager is needed to ensure that the types of rations required for the activity are available.

Adventure Training Supplement. The AT Supplement is for unit personnel undergoing authorised unit adventure training. The CO/OC must authorise the AT activity and is required to forecast for the additional supplement using AR. The AT Supplement consists of a muesli or chocolate bar (70 g) plus sports drink powder (60 g).

Details on rationing are provided in the Australian Defence Force Ration Scales and Scales of Issue, Edition 7.

Considerations

When planning rations for a backcountry skiing AT activity, there are many factors to consider, as follows:

a. length of activity
b. purchase, forecasting and lead time
c. unit entitlement or allocation
d. weight of rations
e. fuel requirements
f. if purchasing, ratios of carbohydrates, protein and fats
g. nutritional requirements
h. weight of rubbish.

Carbohydrates provide 4 calories per gram, fat provides 9 calories per gram, and protein provides 4 calories per gram. At first glance, it would seem that foods high in fat would be the best choice based on calories to gram, but this calculation does not take into consideration other important factors that may influence rationing for the activity. Variables such as altitude and the activity level of the individual are all-important when considering which food type to load-up on.
Fats

6.6 The advantages and disadvantages of fats are as follows:
   a. Advantages. Fats contain the highest calorie per gram ratio, which is great fuel for keeping the body warm, and calming the system for sound sleep; it is also a long-term energy source.
   b. Disadvantages. Fats are more difficult for the body to break down than the other food types, and yield only half the power produced from glycogen when compared to carbohydrates. Individuals should limit fats to about 20 per cent of their total calorie intake.

Carbohydrates

6.7 The advantages and disadvantages of carbohydrates are as follows:
   a. Advantages. Carbohydrates are easy for the body to break down, and are an excellent source for quick energy and fast gastric emptying. Carbohydrates get into the blood stream fast.
   b. Disadvantages. Carbohydrates burn very quickly, and as such, must be constantly consumed to be replenished in the body.

6.8 Carbohydrates should make up the majority of calorie intake. There is some evidence that suggests protein should be combined with carbohydrates in the meal in order to slow down the digestion of the carbohydrates, which may result in longer lasting energy. Getting enough carbohydrates is critical to the endurance athlete. For endurance activities the body requires a higher intake of carbohydrate than is normally required. If there is a shortfall of carbohydrates for energy, the body will utilise the stored carbohydrate (glycogen) in muscles, resulting in muscle fatigue and physical exhaustion.
Proteins

6.9 The advantages and disadvantage of proteins are as follows:

a. **Advantages.** Protein intake is vital for recovery after a difficult day of skiing. Proteins are best for increasing strength, and for rebuilding damaged tissue. Proteins are a major component of the immune system, and are used to make enzymes, which facilitate every reaction in the body.

b. **Disadvantages.** Proteins are slow to break down thus taking time to get into the blood stream.

6.10 Individuals should try to get at least 90 g of protein per day.

6.11 A high altitude climber needs 1.4 g of protein per kilogram of body weight. If they do not get this amount of protein, the body begins breaking down muscle tissue.

6.12 Knowing all this, it is better for the mountain climber to break down fat for a longer lasting source of energy. But this requires a good source of carbohydrates. Successful fatty acid breakdown requires the continual background support of the glycogen and blood glucose provided by carbohydrates. Therefore, when glycogen is exhausted and blood glucose levels dip, fat metabolism slows down.

Calorie/Kilojoule Requirement

6.13 A participant on a backcountry skiing activity carrying 20 kg for 6 hours over uneven terrain, digging snow shelters and other such activities could require between 5000 to 7000 calories (21 000 to 29 400 kJ) per day. When providing rations, consideration should be given to all of these factors, ensuring that the energy provides adequate energy for participants to undertake a day’s activity.

Combat and Patrol Rations

6.14 Combat and patrol ration packs do not provide enough energy value for a participant in an extended backcountry skiing AT activity. Therefore, consideration should be given to supplementing CRPs with the AT Supplement. A standard CRP
will probably be enough on a short backcountry skiing AT activity, but participants will lose weight. The approximate energy values for each CRP are as follows:

a. CR1M – 18 000 kJ (1.9 kg)
b. PR1M – 17 700 kJ (1.0 kg)
c. CR5M – 16 800 to 15 000 kJ
d. Individual meal ration (dehydrated) – 4500 kJ.

Purchased Rations

6.15 A number of units will not be able to get access to combat or patrol rations for the conduct of AT. Therefore, purchasing rations using AR will be an option that can be used to conduct the activity. Using AR will provide flexibility in choosing a menu that can support the development of individual or group qualities. The meals chosen can be quick and easy meals, or meals that need to be prepared as a group. More importantly, with judicious shopping, rations can be selected that are lightweight and easy to prepare. A suggested five-day menu plan is provided in Annex A.

Breakfast

6.16 Breakfast should be high in carbohydrates so that blood does not have to be diverted to the stomach for digestion thus taking away vital strength from the leg and arm muscles that are needed for AT backcountry skiing activities. Suggested options for breakfast are:

a. instant porridge with protein powder, powdered milk, sugar, or sweetened condensed milk
b. muesli with dried fruit (the fruit will help with regularity)
c. energy bars/cereals, plenty of water (if participants become thirsty, they are already dehydrated)
d. hot cocoa/chocolate (if there is time, cocoa can be a great starter, but be aware that more water will be needed because cocoa contains caffeine, which is a diuretic).
Snacks

6.17 Individuals should have a variety of snacks available that can be accessed throughout the day to help maintain energy. Examples of snacks are:
   a. chocolates
   b. nuts
   c. dried fruit
   d. muesli bars
   e. trail mix.

Lunch

6.18 Lunch can either be a hot or cold option. The choices of what individuals will have for lunch should take into consideration the type of weather to be faced, and which food option best suits the activity objectives. Some options are:
   a. cold options:
      (1) mountain bread
      (2) crackers
      (3) salami
      (4) tuna
      (5) cheese
      (6) spreads
      (7) muesli bars
   b. hot options:
      (1) noodles
      (2) soups
      (3) hot drinks.
Dinner

6.19 Dinner is the time to make heavy use of the other food types, namely fats and proteins, in order for the body to replenish fats for fuel and retain warmth during the night. Fats also provide slow-burning energy for the next day. Proteins are needed during this time for rebuilding the muscles and tissues that were exhausted during a long day of hiking and climbing. Suggested options for dinner are:

a. freeze-dried dinners with plenty of added olive oil
b. seeds and/or nuts
c. protein bars
d. instant soups (for super lightweight meals, just add hot water)
e. quesadilla with lots of cheese (taste great in the mountains)
f. sweet biscuits, chocolate bars, freeze-dried desserts, etcetera
g. vitamin C for repair and control of free radicals that are produced during periods of heavy exercise
h. tuna sachets, legumes, cheese, rice and pasta
i. pizza.

Water

6.20 It is also important to know that the body can only make use of so much water at any given point in time. For example, when the body is at rest (say while relaxing at home), it can only make use of approximately 250 mL of water per hour (for the average person). In the mountains (due to the dry air from higher altitude), this amount increases. The pace chosen also has an effect on water demands. A participant in action will be able to take in and utilise two, three, or more cups of water per hour; however, water intake should be done at a steady pace. It is far better to drink small quantities often, rather than to gulp down a litre of water (or more) while sitting in camp.
6.21 Once the body becomes dehydrated, it is very difficult to become rehydrated in a short period of time. Many wilderness travellers reason in their minds that they will be able to make up for lost time by drinking a large amount of water during an extended break. However, the body will not be able to assimilate a larger amount of water efficiently all at once, and cause increased urination that will eliminate most of the fluid before the body can make use of it. The bottom line on water intake is to ensure that enough water is consumed in a timely manner. As the old saying goes: ‘If you are thirsty, you are already dehydrated’. Advice for water consumption is as follows:

a. Use wide-mouthed water-bottles and carry 1 to 2 L, as this amount of water:
   (1) is enough to drink during the day
   (2) allows enough at the end of the day to start melting snow when more water is required.

b. Make water from snow:
   (1) using the stove, which requires fuel
   (2) using a water bladder, which requires sunny weather
   (3) on the run by topping up a water bottle with snow; the water in the bottle will melt the snow
   (4) using white/clean snow; avoid using yellow/dirty snow.

c. Use creek/river water and boil or sterilise.

Fuel Requirements for Alpine Cooking

6.22 An AT activity requires fuel usage planning, at a rate of 200 mL per person/day. The fuel to be used is methylated spirits.

6.23 The group should also carry a spare litre of fuel.
Annex:

A. Suggested Five-day Menu Plan
## SUGGESTED FIVE-DAY MENU PLAN

<table>
<thead>
<tr>
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<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
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</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td>Mess/home</td>
<td>Oatmeal breakfast pouch</td>
<td>Cereal</td>
<td>Porridge</td>
<td>Muesli</td>
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<td></td>
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<td>Powdered milk</td>
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<tr>
<td><strong>Lunch</strong></td>
<td>Wraps</td>
<td>Tuna pouch</td>
<td>Nuts/dried noodle mix</td>
<td>Wraps</td>
<td>Nuts/dried noodle mix</td>
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<td></td>
<td>Salami</td>
<td>Biscuits</td>
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<td>Cheese</td>
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<tr>
<td><strong>Dinner</strong></td>
<td>Sausages</td>
<td>Pasta Bake</td>
<td>Dehydrated meal or tuna curry with instant rice</td>
<td>Pizza</td>
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<tr>
<td></td>
<td>Powdered potatoes</td>
<td>Ingredients:</td>
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<td></td>
<td>Dehydrated peas/carrots</td>
<td>Pasta</td>
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<td>Wrap (small)</td>
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<td>Tomato relish</td>
<td>Tomato sauce pouch (small)</td>
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<td>Tomato paste</td>
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<td>Capsicum (sliced)</td>
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<td>Cheese</td>
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<td>Onion (sliced)</td>
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<td>(Other toppings as required)</td>
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<td>Italian herbs</td>
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<td>Method:</td>
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<td>Salami</td>
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<td>Place tomato sauce then cheese onto wrap. Add toppings as required; place pizza in fry pan and cook on slow heat on the Trangia stove; place tin foil over top of pizza to hold in heat</td>
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<td>Cheese</td>
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<td>Boil pasta then fry up all other ingredients, mix in together with pasta and add sauce and herbs</td>
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<tr>
<td>Other Items</td>
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<td>Beef jerky x 50 g</td>
<td>Soup dehydrated pouch x 1</td>
<td>Powdered milk x 50 g</td>
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<td>Beef jerky x 50 g</td>
<td>Beef jerky x 50 g</td>
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<td>Beef jerky x 50 g</td>
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</tbody>
</table>
CHAPTER 7

ALPINE SURVIVAL AND SNOWCRAFT

SECTION 7-1. INTRODUCTION

7.1 The main requirements for survival in an alpine area are heat, shelter, food and clothing. Of these, shelter is particularly important because it is difficult to provide heat or food until satisfactory protection from the elements has been established.

7.2 Options for shelter in the alpine environment can range from use of mountain huts, snow camping in tents, improvised shelters or deliberate snow shelters. The GL may use any of these options in a deliberate manner in order to enhance the development of qualities in their AT activity. In response to an emergency situation, any of these shelter options may be used.

7.3 This chapter describes options for shelter in the alpine environment. The GL is limited only by the conditions, equipment and their creativity.

SECTION 7-2. MOUNTAIN HUTS

7.4 There are advantages and disadvantages for siting a camp near mountain huts or shelters. Huts and shelters provide a welcome break from adverse conditions. These types of shelters provide somewhere to prepare meals in a group environment, dry out equipment, and socialise in bad weather.

7.5 Huts and shelters will also provide some security against tent failures, ferocious weather or accidents. However, huts and shelters attract crowds resulting in pollution and a shortage of firewood. Defence groups are not to use huts or shelters as the primary choice for accommodation. A group should always be prepared to be fully self-sufficient and not rely on the use of a hut or a shelter. Mountain huts vary widely in design (see Figure 7–1).
SECTION 7-3. SNOW CAMPING

Camp Site Selection

7.6 The ability to correctly site a camp in an alpine environment is a critical skill. There are many factors to consider when selecting a camp site in this type of environment. It is imperative that these factors are well understood by all participants in the activity. The GL should remember that the group is operating in a hazardous environment, so careful consideration should be given to the suitability of a camp site.

7.7 The ideal site is often hard to find, so the GL will have to decide on a balance of factors and identify which of these factors optimises the safety of the party. The factors that need to be considered when selecting a site are:

a. Exposure to Wind. Wind direction and strength should always be taken into account when siting a camp and/or determining whether additional measures such as wind breaks should be built.
b. *Direction of Sunlight.* Early morning sun makes breaking a camp more pleasant and certainly facilitates morning activities and movement. When choosing a suitable camp site, the aspect of the sun and light need to be considered as evening sun may be preferred over morning sun to ensure that the maximum benefit of light throughout the day is obtained.

c. *Avalanche-prone Slopes.* Avalanches in Australia are infrequent on a large scale; however, they do occur. When choosing a camp site, the GL is to avoid camping directly underneath or on very steep slopes or below cornices that may be prone to avalanche.

d. *Water Sources.* Access to water is important, especially when operating in an alpine environment, as melting snow for water requires the use of stove fuel and time. Except in the heaviest of snowfalls, water may be accessible from rivers, creeks, and streams. The camp should be sited no closer than 100 m to a water source. The GL must be aware of camping downstream of any huts as water pollution is becoming very common.

e. *Environmental Impact.* The GL should choose a site away from busy trails and if possible away from summer walking tracks. The view from the summit may be great but consider the impact of an abandoned camp site on the next group. GLs are to confirm restrictions with the relevant land manager.

f. *Sanitation Requirements.* The requirements for sanitation are necessary, regardless of whether the site selected is to be used in the short or the long term. The GL must remember to site this area taking into account all genders, and minimising the environmental impact. Group members are to be educated to not defecate or urinate upstream from an obvious water collection point or within close proximity to any stream. All human faeces must be carried out of the alpine area and disposed of correctly using the preferred portable waste collection system (see paragraph 7.22 and paragraph 7.23).
Tent Site Selection

7.8 When selecting a suitable tent site, the main consideration should be protection from the wind. Groves of snow gums should be used as a wind break (after checking snow build up in branches) or areas where there is a collection of large boulders or a rocky outcrop. As well as the immediate area, surrounding hills and spurs should be considered for wind protection as they protect an entire location. The prevailing and forecast weather conditions should be checked when determining the camp site because the tent has to be suitably protected or oriented for the current and anticipated wind direction.

Use of Local Vegetation

7.9 It is not advisable to camp directly underneath trees or branches. Falling snow may accumulate on branches and fall off in clumps, or break branches causing them to fall, damaging a tent or injuring the occupants. An example of snow accumulation is shown in Figure 7–2.

Figure 7–2: Snow Accumulation in Trees
Slope Aspect

7.10 A level site is preferred for a camp site, although it is possible to excavate snow, if necessary, to create a level area. Excavated snow should be placed a minimum of 1 m off to the side of the tent site. It can be difficult to prevent the tent being buried during heavy snowfall if substantial excavations have been necessary (see Figure 7–3).

![Figure 7–3: Tents Sited on Slope Aspect](image)

Frost Hollows

7.11 Avoid camping in the bottom of a valley as the cold air drains to the bottom where it can be 10 °C colder than a few feet up the side of a slope.

Tent Site Preparation

7.12 When preparing a site to be suitable for pitching a tent, the base will need to be levelled out and the underlying snow stamped down and compressed. It is recommended that compressing the snow is to be carried out wearing skis, walking back and forth across the proposed site. Once this task is completed, the skis may be used to level the area.

7.13 A snow shovel can also be used to prepare the site and clear any larger amounts of snow, as well as used to dig cold pits. Participants should take their time to carry out this stage.
thoroughly as a poorly prepared site can be very uncomfortable and impossible to correct once the tent has been erected.

7.14 Once the tent has been erected and anchored, a cold pit needs to be dug at the vestibule end of the tent. This will allow space at one end for packs and the other for the cooking area. The cold pit will allow gas from cooking to settle at the bottom and allow fresh air for ventilation to flow through.

7.15 In very thin snow cover, it may be preferable to dig down to the ground surface ensuring that an insulating layer of snow is left on the ground. If a cold pit cannot be dug, ensure that there is enough ventilation, especially if a blanket of snow surrounds the tent. Inadequate ventilation can cause a shortage of oxygen and the build-up of carbon monoxide while cooking, which will result in poisoning of the occupants (which is caused by the incomplete combustion of stove fuel).

**WARNING**

To avoid serious injury to or death of personnel, ensure that adequate ventilation of tents has been established before cooking. Inadequate ventilation can cause a shortage of oxygen and the build-up of carbon monoxide while cooking and will result in poisoning of the participants (which is caused by the incomplete combustion of stove fuel).

7.16 It is important to remember that tent materials are flammable. When using the stove, be extremely careful to control the size of the stove’s flame, and keep the stove in a location near the doorway or inside the vestibule, if the tent has one. It may be necessary to instruct groups to cook outside until they are deemed capable of using their stoves without incident, such as burning the tent down.
Anchoring Tents

7.17 The following items can be used to anchor a tent:
   a. Aluminium snow pegs are the best all-round pegs to use. Pegs should be used to secure guy ropes.
   b. Snow disks or plates are very effective but can be difficult to remove in icy conditions.
   c. Another method is to use makeshift pegs or anchor points, which are bags full of snow. It is important to ensure that any bags used are recovered to protect and maintain the pristine environment.

7.18 Dry powder snow may present difficulties when anchoring a tent. This type of snow will be difficult to compress in order to form a suitable base and will not provide purchase for the pegs. There are five possible ways to cope in this situation:
   a. persevere
   b. dig down to old snow
   c. water the snow in order to firm the snow
   d. use skis and poles as pegs, under supervision from the GL, or
   e. lay pegs horizontal with guy ropes attached and stamp them down.

7.19 It is not uncommon in Australia to camp on a thin cover of snow. For these conditions, it is very useful to have pegs that can be driven into the dirt.

Snow Walls

7.20 A snow wall may help as a wind break for the tent, but this wall should not be overdone. In the event of a heavy snowdrift, snow will tend to build up in the lee of the wall. Depending on the weather conditions, it may be better to build a wall about 1 m away from the tent on the windward side (see Figure 7–4).
Snow Kitchens

7.21 Winter camping often provides the camper with a large amount of snow, which can be used to make counters, tabletops and seats. When building with snow, members will need to pack down the snow with shovels, skis or boots, which makes the snow denser and harder making it suitable for constructing such items (see Figure 7–5).
Sanitation Arrangements

7.22 The preferred portable waste collection system is the waste alleviation and gelling bag, commonly known as a WAG bag. It turns solid and liquid waste into a hygienic, odourless and biodegradable substance that can be disposed of in landfill.

7.23 Another option is a 100 mm diameter PVC tube with a screw-on top, approximately 600 mm high, which is used for storing solid human waste; this tube is commonly known as a poo tube (see Figure 7–6). This device is waterproof and robust. Users should ensure that after use, the tube is disinfected, washed in hot soapy water and inspected for cracks. The waste from the poo tube will need to be disposed of appropriately (ie, taken to a sewage farm or a suitable camping/caravan area with an established dump point).
Breaking Camp

7.24 Depending on weather conditions, it may be necessary to pull down tents from the inside out. This will depend on the type of tents being used. Participants can pack up the inner of the tents first and leave the outer tent up, supported by the poles. This will ensure that the inner tent remains dry. When the party is ready to go, the outer tent and poles can be packed into garbage bags as they may be wet. The use of garbage bags will help to ensure that the other contents of the pack remain dry.

7.25 The GL is to check that the area is cleared of rubbish and that any construction that has been made is broken down and any holes dug are filled in.

Site Selection Summary

7.26 Good camp site selection may initially present a challenge, but will develop over time. As long as the general guidelines provided in this chapter are followed, also taking into account
GL experience and local knowledge, successfully siting a suitable camp is a skill that will become second nature.

SECTION 7-4. SNOW SHELTERS

7.27 The ability to build with snow is an advantage exclusive to snow camping. A snow shelter is warmer and quieter than a tent and can be small enough for one person or big enough to accommodate a large group. There are many different types of snow shelters and each has its advantages and disadvantages, depending on snow conditions and the time available to construct the shelter.

Snow Shelter Building Principles

7.28 There are two basic principles involved in building snow shelters. One is termed ‘work hardening’ of the snow and the other is termed ‘shape’. During work hardening, the snow is compressed via a mechanical action, making it denser and thus strengthening the bonds between the grains of snow. This allows the participants to dig in the snow without it collapsing and provides the ability to cut blocks. The amount of work hardening that needs to be done depends on the snow conditions.

7.29 In its natural state, snow settles. As the settling process continues, the snow develops stronger bonds and becomes denser. Wind further work hardens snow by blowing and compacting the snow. This is why snowdrifts tend to be so much harder than the snow around them.

7.30 A dome-shaped snow shelter provides the strongest shape and longest lasting construction. This shape allows water droplets to run down the walls and not on to the occupants and equipment thus keeping them dry. The next best option for a snow shelter shape is an arch-shaped shelter. The smallest and largest shelters will often have straight walls and an arched ceiling. The least effective snow shelters are those with ceilings that are either flat or shaped like an upside-down saucer. As the roof melts it will act like falling rain, and sagging of the roof
occurs rapidly. This shaped shelter is more likely to collapse when being dug out.

Construction Principles

7.31 There are construction principles that need to be considered, which include:

a. The sleeping area of any snow shelter needs to be higher than the entrance to the shelter. This will ensure that the inhabitants will sleep in a space of warm air trapped in the ceiling. The warmth generated by body heat and any cooking in the shelter will rise and be trapped. The lower area near the entrance is the cold pit.

b. The ceiling of any snow shelter should be arched and smooth to prevent dripping. A ceiling will ‘melt back’ with age and the internal dimensions of the shelter will increase.

c. At least one snow shovel should be kept inside a snow shelter in case the shelter collapses.

d. Some snow shelters are virtually airtight. A ventilation hole should always be placed in the roof. A ski pole hole is the best method to make the hole.

e. The ski pole should be left in place through the roof and be given a tap periodically to remove snow from the basket and allow air into the shelter.

f. The occupants must ensure that the area above the shelter is marked with crossed skis to stop anyone skiing over the top and collapsing the shelter.

g. The occupants should mark the entrance with skis or poles on either side of the entrance in case of a large snowfall during the night. This provides rescuers with a quick direction for access and rescue.

h. Any candles used must be continually monitored to safeguard against oxygen depletion.
SECTION 7-5. TYPES OF SNOW SHELTERS

Snow Dome

7.32 A snow dome is a shelter that can be built even when the snow pack is shallow (see Figure 7–7). The shallower the snow, the longer it takes to pile the snow up for the shelter so participants may have to transport snow to the site in low snow. The suggested method for building a snow dome is as follows:

a. Determine how much snow is available by probing with a ski or ski poles avoiding areas with any hidden rocks or tree stumps as they will take up space in the dome.

b. The size of the dome will depend on how many people are to be accommodated. The smaller the dome, the stronger it will be. As a guide, a circle measured with the diameter of a ski works well. Group members should ensure that the tallest person’s ski is used as the size of the ski dictates the size of the dome.

c. Once the size of the circle has been determined, the snow should be compressed by walking around the perimeter a number of times and stamping down the snow. This area will be the foundation of the walls. Another method to create a strong foundation for the walls is to use a shovel and place the snow into the centre of the circle.

d. Place all of the packs in the centre of the circle and cover them with a shelter individual. This will save time digging out a mass of snow as the packs form a space (ensure that any items that may be needed are removed).

e. Start piling snow in the middle of the circle and keep piling the snow until a dome shape rises from the foundation to about a height of 2 m. It is recommended members pack down the snow as they work by stamping it down.

f. Once the desired height has been reached, start using shovels to pack down the snow as the snow needs to
bond together. Group members can form a dome shape by smoothing out the snow.

g. At this stage, the dome will need to bond for an hour or two. While waiting, group members should walk around the outside of the dome and place ski poles into the shelter, pushing them in about 45 to 60 cm (see Figure 7–7). These will be markers for the wall thickness when digging out later.

h. When it is time to start excavating the snow that has been piled up, locate a door site and dig down to a point that is level with the bottom of the dome. The smaller the entrance, the warmer the dome will be (see Figure 7–7).

i. Dig inwards and upwards towards the centre of the dome, ensuring that a sleeping bench is higher than the doorway. At this point, the packs should be found. The members then pull the packs out; the packs have created a space and have saved digging time.

j. The walls and roof of the snow dome need to be about 40 cm thick. If they are too thick or too thin, they will sag faster than if they are the optimum thickness. If the doorway is blocked, members will see blue ice in the walls or roof at about the 40 cm mark. This is a warning not to excavate more snow from that area. Group members should dig until they start hitting the poles or skis. The inside of a snow dome is illustrated in Figure 7–8.

k. When the dome reaches the desired size, ensure that the roof is arched, and it should be smoothed over with a gloved hand. The walls need to be straight, with a drain at the bottom leading towards the door.

l. A cooking area should be near the doorway but also ensure that there are plenty of ventilation holes.

m. Snow domes are more suited to Australian conditions compared to igloos, as the snow is generally not hard enough to construct an igloo.
Sink poles and skis in about 45 cm

Disassemble the probe poles and force them in

Start the door as low as possible

It is easier to stand and dig

Keep the door clear of snow

Fill in the standing area at the end with the final volume of snow

Figure 7–7: Snow Dome Ready for Excavation

Figure 7–8: Inside a Snow Dome
Snow Cave

7.33 A snow cave is similar to the snow dome, but there is no need to pile the snow as a cave is constructed when there is already 2 m of snow on the ground (see Figure 7–9). Group members should look for big snowdrifts and probe down into the area to check the depth of the snow. The suggested method for building a snow cave is as follows:

a. Determine how much snow is available by probing with a ski or ski poles and check the area for any hidden rocks or logs as they will take up space in the cave.

b. Start digging the doorway, in the same manner as for the snow dome (see paragraph 7.32), inwards and then upwards and construct the sleeping bench and cold pit as required.

c. The walls and roof need to be about 40 cm thick. If they are too thick or thin, they will sag faster than if they are the optimum thickness. If the doorway is blocked, members will see blue ice in the walls or roof at about the 40 cm mark. This is a warning not to excavate more snow from that area.

d. Once the snow cave reaches the desired size, ensure that the roof is arched and smoothed over with a gloved hand. The walls need to be straight, with a drain at the bottom leading towards the door.
Figure 7–9: Constructing a Snow Cave

- a. b. c. d.
- e.
- f. Blocks cut to fit over opening
- g. Rock

30º to 40º
Min 2.13 m Back
SECTION 7-6. EMERGENCY SNOW SHELTERS

7.34 The actions required by individuals separated from a group are detailed in Chapter 9. However, it is important for the separated individual, while awaiting to rejoin with the group, to improve their situation. As such, it may be necessary to erect a tent, if carried, or excavate a hasty trench to provide shelter from the wind. Depending on the location, this may be undertaken on flat ground or more preferably into a snow bank/drift (see Figure 7–10).

![Figure 7–10: Improvised Individual Shelter](image)

7.35 Chapter 2 details the equipment required to allow a group to survive extreme conditions overnight. If the group is forced to seek immediate shelter because of weather conditions, lack of daylight or other reasons, they are able to utilise their equipment for this purpose (see Figure 7–11), including options, such as:

a. erect tents carried by the group
b. seek shelter of nearby hut
c. construct improvised shelter using available equipment.
Figure 7–11: Improvised Shelter ‘Park Bench’ for Four Personnel
CHAPTER 8

INTERPRETING WEATHER CONDITIONS

SECTION 8-1. INTRODUCTION

8.1 Weather interpretation in the alpine environment is an important skill. Without this skill, an AT group faces possible danger. Therefore, this chapter should be read in conjunction with _LWP-G 7-6-1, Experiential Learning and Adventurous Training_. Other environmental information, weather conditions, terms and warnings can be found on the Bureau of Meteorology website¹.

The Australian Alpine Region

8.2 In Australia, the Great Dividing Range is a series of mountain ranges and tablelands that extend along the east coast, of which Mount Kosciuszko is the highest point with a maximum height of 2228 m. There are several peaks in excess of 1500 m, starting in Victoria and extending to northern New South Wales. Travelling from east to west across the range, the elevation abruptly increases away from the coastal plain, then west of the divide, it gradually descends onto the western plains. Consequently, winter snowfalls are experienced over the tableland regions or Australian alpine region.

8.3 On the western slopes, the rainfall gradually decreases, together with the frequency of winter snowfalls. Average maximum temperatures gradually increase as the height above sea level decreases.

Weather Terminology

8.4 The following terminology is relevant to weather conditions in an alpine environment:

- **Dew Point Temperature.** The dew point temperature is a measure of the moisture content of the air and is the

¹. http://www.bom.gov.au
temperature to which air must be cooled in order for dew to form.

b. *Dew*. Dew is formed from droplets of water deposited when air cools and the water vapour in it condenses.

c. *Frost Point*. The frost point is when the dew point falls below freezing.

d. *Wet-bulb Temperature*. The wet-bulb temperature is the temperature a parcel of air would have if it were cooled to saturation (100 per cent relative humidity).

e. *Dry-bulb Temperature*. The dry-bulb temperature is the temperature of air measured by a thermometer freely exposed to the air but shielded from radiation and moisture.

f. *Relative Humidity*. The relative humidity is the ratio of the actual amount of water vapour in the air to the amount it could hold when saturated, expressed as a percentage or the ratio of the actual.

g. *Thunderstorm*. A thunderstorm is one or more convective clouds in which electrical discharge can be seen as lightning and heard as thunder by a person on the Earth’s surface. A severe thunderstorm may produce:
   
   (1) hail at the ground with diameter of 2 cm or more
   (2) wind gusts at the ground of 90 km/h or more
   (3) very heavy rain likely to cause flash flooding.

h. *Snow Showers*. Snow showers occur for a short period, usually starting and ending suddenly. These showers typically fall from convective clouds.

i. *Blizzard*. A blizzard is a violent and very cold wind that is laden with snow, some part, at least, of which has been raised from snow covered ground.

j. *Change*. A change is signified by a transition between two air masses over a relatively short time period,
usually when a cooler air mass replaces a warmer air mass over an area. A change may or may not be accompanied by rain, and is characterised by a rapid change in wind direction usually from warm north to north-westerly to cooler south-east to south-westerly. A change differs from a sea breeze in that it is most often associated with the passage of a front or low pressure trough and affects a large area over a period of a day or more, as distinct from a sea breeze, which characteristically only affects areas up to around 60 km inland from the coast for a period of hours.

k. Windy. The term ‘windy’ is defined as a prolonged period of average wind speeds exceeding 40 km/h during the day.

l. Wind Speed. Wind speed descriptions are based on the Beaufort Wind Scale:

1. Calm – 0 km/h
2. Light winds – 19 km/h or less
3. Moderate winds – 20 to 29 km/h
4. Fresh winds – 30 to 39 km/h
5. Strong winds – 40 to 62 km/h
6. Gale – 63 to 87 km/h
7. Storm – 88 to 117 km/h.

SECTION 8-2. PLANNING

8.5 Backcountry skiing and alpine survival is greatly affected by adverse weather conditions, particularly high winds, storms, blizzards, whiteouts and extremely low temperatures. Weather conditions in mountainous or alpine regions can change quickly and without warning, placing ski parties in potentially dangerous situations. Therefore, at all times, when skiing outside a patrolled ski area, participants are to carry the
appropriate equipment and clothing to protect themselves from adverse weather.

8.6 Weather patterns should be systematically checked, as follows:
   a. Two days before the trip, the GL should check:
      (1) the overall weather patterns (the positions of highs, lows and fronts)
      (2) the projected weather for the next two days.
   b. One day before the trip, the GL should check:
      (1) the current weather to evaluate the accuracy of the previous day’s forecast
      (2) the overall weather pattern
      (3) the projected weather for the next two days
      (4) the possibility of strong winds, thunderstorms, blizzards.
   c. On the day of the trip, the GL should check:
      (1) the current weather forecast to evaluate the previous day’s forecast
      (2) the projected weather forecast for the duration of the trip.

8.7 During the trip, consider:
   a. if possible, carrying an internet-connected device in order to be able to obtain weather information when skiing outside of patrolled areas
   b. carrying a barometer in order to be able to check for approaching low pressure systems and fronts.

8.8 To obtain weather information, the best resources are:
   a. internet websites, including:
      (1) Bureau of Meteorology (www.bom.gov.au)
Freezing Level and Snow Level

8.9 The adiabatic lapse rate is the rate that air cools on ascent and warms on descent. The rate also varies depending on the moisture content of the air. There are three rates of adiabatic cooling described as follows:

a. the ambient atmosphere lapse rate, which is the rate that air cools as altitude increases
b. the dry adiabatic lapse rate of -10 °C per 1000 m rise
c. the saturated adiabatic lapse rate, about -6 °C per 1000 m rise.

8.10 The following rough equation remains reasonably accurate up to the troposphere (elevation in metres, and temperature in degrees Celsius):

\[ \frac{\text{Elevation} + \frac{\text{Temperature} \times 304}{2}}{2} = \text{Freeze level} \]

8.11 When the freezing level has been estimated, the guidelines shown in Table 8–1 can be applied in order to estimate the snow level.
Table 8–1: Snow Prediction Chart

<table>
<thead>
<tr>
<th>If</th>
<th>And If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratus clouds or fog is present.</td>
<td>There is steady, widespread precipitation.</td>
<td>Expect to find the snow level at 300 m below the freezing level.</td>
</tr>
<tr>
<td>Cumulus clouds are present or a cold front is approaching.</td>
<td>There is locally heavy precipitation, varying from time to time or place to place.</td>
<td>Expect to find the snow level as much as 600 m below the freezing level. Snow will stick 300 m below the freezing level.</td>
</tr>
</tbody>
</table>

**Air Pressure**

**8.12** A very important factor in predicting weather is the air pressure. Barometric altimeters are common features in many GPS units and watches. Low pressure or dropping pressure normally indicates deteriorating weather, while high pressure usually provides more good weather or clearing of bad weather. Use an electronic barometric altimeter, barometer or altimeter at a static location to make basic wind strength predictions (see Table 8–2).
Table 8–2: Air Pressure and/or Altimeter Change over Three Hours

<table>
<thead>
<tr>
<th>Pressure Decrease</th>
<th>Altimeter Increase</th>
<th>Advised Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 to 1.2 millibars</td>
<td>6 to 12 m</td>
<td>None. Continue to monitor.</td>
</tr>
<tr>
<td>1.2 to 1.8 millibars</td>
<td>12 to 18 m</td>
<td>Clouds lowering hourly or thickening? If so, begin checking pressure changes hourly.</td>
</tr>
<tr>
<td>1.8 to 2.4 millibars</td>
<td>18 to 24 m</td>
<td>Winds ranging from 30 to 60 km/h are likely. Consider less exposed locations. Continue monitoring conditions.</td>
</tr>
<tr>
<td>More than 2.4 millibars</td>
<td>More than 24 m</td>
<td>Winds of 60 km/h or greater are likely. Immediate movement to protected area advised.</td>
</tr>
</tbody>
</table>

SECTION 8-4. WEATHER PATTERNS

Wind

8.13 The uneven heating of the air by the sun and rotation of the Earth causes wind. Much of the world’s weather depends on a system of winds that blow in a set direction. This pattern depends on the rotation of the Earth as well as the different amounts of energy from the sun (heat) that is experienced by different regions.
8.14 Wind can blow around fluffy powder snow easier than dense, heavy snow. How easily the snow blows is called ‘snow available for transport’ by avalanche professionals. This means that if a lot of snow is available for transport (fluffy powder snow) then not much wind speed is required to blow it around. Conversely, if no snow has fallen in several days and the existing snow is old and hard, then there is just not much to blow around. Even a storm with strong winds will not form many wind slabs.

8.15 Above hot surfaces, air expands (air molecules spread out), and moves to colder areas where it cools, becomes denser and sinks to the Earth’s surface. This forms a circulation of air from the poles along the surface of the Earth to the equator, where the air rises and moves towards the poles again.

8.16 There are winds that affect the mountain environments, they are described as follows:

a. Anabatic Winds. Anabatic winds are those that blow up mountain valleys to replace warm rising air; usually light winds. This type of wind occurs during the daylight hours (see Figure 8–1).

![Figure 8–1: Anabatic Wind](image-url)
b. **Katabatic Winds.** Katabatic winds are those that blow down mountain valley slopes and are caused by the cooling of air. These winds are occasionally strong winds and occur at night (see Figure 8–2).

![Figure 8–2: Katabatic Wind](image)

**8.17** The general wind patterns are defined by the atmospheric pressure distribution but, locally, the wind can be strongly affected by several factors:

a. the time of day (eg, sea breezes)

b. height above ground

c. the surrounding terrain.

**8.18** For this reason, participants should take care when interpreting any wind data.

**Local Influencing Patterns**

**8.19** The most prominent air patterns that influence the alpine region are a westerly stream. This westerly stream produces much of the winter precipitation in the alpine region. Air ascending on the western slopes will cool at the dry adiabatic lapse rate until saturated or at a greater rate due to evaporation cooling if rain is falling.
8.20 **Cold Pre-frontal North-westerly.** As a cold front approaches, the alpine region in general is affected by a cold north-west to west-north-westerly stream. This feature produces a short period of heavy snow. Experience has shown that the most likely wind for snow formation is the cold westerly, which includes south-west and north-west components. The snow producing mechanism in this situation is vertical motion produced by:

a. the front when it is close to the mountains
b. forced ascent of the air over the mountains.

8.21 **Strong Westerly.** Most of the major snowfalls over the higher parts of the alpine region (above about 1500 m) are from a strong and persistent westerly stream. In winter and spring, blizzard conditions often persist for several days above this level with this type of airflow. With such an air stream, the snow producing mechanism is vertical motion produced by forced ascent of air over the mountain ranges.

8.22 While the moisture content of this type of air stream is not high, snowfall rates can be quite substantial. This is because the strong, low-level wind speeds, normal to the mountain ranges, produce high vertical velocities as the air ascends over the barrier. This results in large vertical fluxes of water vapour. When this air stream persists for several days, snow falls continuously and produces a deep cover on the higher parts of the mountains.

8.23 **Cold, Southerly Air Streams.** A cold, southerly air stream is not a common factor in the alpine region. When cold, southerly or south-westerly air streams approach, they result in snow falls to low level areas but snow falls at higher levels are not usually heavy. There are several reasons for this:

a. The precipitation of water in these air streams is usually very low.

b. In a strong, westerly air stream, the airflow is normal to the main ridgeline and most of the air ascends over the barrier, but in a southerly air stream, the flow is almost
parallel to the main ridgeline, so much of the air can diverge around the barrier.

c. A deep southerly air stream rarely lasts for more than two days.

d. If the air stream is from the south-west, the air passes over the Victorian Highlands before reaching the Snowy Mountains area. Hence, much of the moisture in the air stream is precipitated before the air reaches New South Wales.

Orographic Lift

8.24 The desert areas cool the predominantly westerly air stream that moves across Australia in winter. When the air reaches the alpine area, it is forced upwards by the mountain ranges.

8.25 When an air mass is uplifted, precipitation occurs. This is because as air rises it becomes less dense, causing it to cool. The cooler the air mass, the less water is able to be maintained in a gaseous vapour form. The excess water either condenses to form water droplets (rain) or frozen particles (snow) (see Figure 8–3).

8.26 As moisture rises, it cools. At lower levels it may fall as rain. When the moisture reaches a certain level, it is dropped as snow. This occurs near the freezing level of the mountain. In Australia, the average freezing level during winter is about 1700 m.
Figure 8–3: Orographic Lifting
CHAPTER 9

EMERGENCY MANAGEMENT

SECTION 9-1. INTRODUCTION

9.1 This chapter on emergency management should be read in conjunction with LWP-G 1-2-5, Army First Aid and LWP-G 7-6-1, Experiential Learning and Adventurous Training.

9.2 Providing first aid to casualties in remote areas is far more demanding than providing first aid in a suburban environment. First response to incidents in remote areas is primarily determined by the time required for assistance to arrive and may be adversely affected by:

a. the distance required to travel from the first aid post to the casualty
b. the type of terrain to be covered
c. the weather conditions
d. the size of the group and the GL’s level of experience
e. the rescue and evacuation facilities available in the area.

9.3 A group conducting AT within the alpine environment has a very limited capability for evacuating casualties. Even casualties who have sustained lower limb injuries that would normally be classed as Priority 3 (minor injury), yet who are unable to walk or ski, may require a larger scale of response for evacuation (as shown in Figure 9–1).
SECTION 9-2. COMMON EMERGENCIES

9.4 Common emergencies and typical responses associated with backcountry skiing and alpine survival activities are described as follows:

a. Individual(s) Becoming Separated from the Group. A combination of poor visibility, inability to keep up, lack of teamwork and/or group management may contribute to a situation where an individual(s) becomes separated from their group. During the activity safety brief, all participants must be given instructions, or actions on,
relating to a member becoming separated from the main group, as follows:

1. The individual who realises they have become separated from the main group is to stop moving immediately.

2. They are to improve their own situation by gaining protection from the elements: using terrain and foliage to gain relief from the wind; by wearing extra clothing; and through to digging an emergency shelter (see Chapter 7).

3. They are to stay on or close to the line of march or track so that the main group can readily collect them during the group’s initial search. If the separated member moves off this line of march or track then they are to place a set of crossed skis at this point of departure as an indicator to the main group that they are nearby. This action prevents the search party from bypassing the separated member.

4. They are to begin signalling the international distress signal using the system of whistle blasts (i.e., six long whistle blasts over a minute, pause a minute to listen for a reply, then repeat the cycle). The reply is three long whistle blasts over a minute by the searching party, again pausing for a minute to listen and thereby enabling the searching party to establish the location of the separated member.

5. They are to increase their personal visibility by utilising non-essential equipment.

6. The GL, on realising that there is a separated individual from the group, is to confirm information by conducting a head count, verifying the last point the separated member was seen by other group members, and by conducting an initial search by guiding the group back towards the verified last-seen location.
b. **Group Becoming Lost.** A combination of deteriorating visibility, poor route/navigation planning, unreliable GPS operating conditions or technical ability of the GL can contribute to a group becoming lost. During the activity safety brief, all participants must be given instructions, or actions on, relating to a group becoming lost, as follows:

1. Stop and consolidate the group; consider the situation calmly.
2. The GL is to check all recorded bearings and distances and recalculate the position. The GL may do this by themselves or with the assistance of other members of the group.
3. The GL is to gain positive information using all available resources in order to make a decision on best course of action.
4. If conditions are safe, the group is to backtrack to the last known point in order to re-establish the correct course and continue.
5. If the situation is considered unsafe, the members of the group are to establish camp or emergency shelter until conditions improve.

**SECTION 9-3. SEARCH OPERATIONS**

9.5 **Organised Search Operations.** The search techniques described in *LWP-CA (DMTD CBT) 3-3-8, Patrolling* are to be used in combination with standard fire team/section formations. These techniques can be readily adopted as a basis for organised search operations.

9.6 If an immediate search fails to find a separated member, the GL must consider the following options given the available time, number of personnel and ground:

a. **Fan Method Search.** This method is effective for searching in dense wooded areas. A search team is dispatched at compass bearing intervals from a central
location. These intervals are dependent on the terrain and distance. Therefore intervals may be anywhere from 200 mils through to cardinal points of the compass.

b. **Ridge/Stream Method Search.** In this method, a search team may work their way up and down banks of streams, ridges and spur lines. A ridge/stream method search may be chosen to include areas or locations of high probability such as pole lines, track intersections and huts.

c. **Baseline (or Box) Method Search.** When using this method, a linear feature may be utilised as a coordination line or baseline to enable search teams to move a prescribed distance, turn 1600 mils to the left or right and move another prescribed distance and return to the central location. As additional groups become available, they can be readily incorporated into this plan.

d. **Coordination.** There should be coordination of the search response with other groups with the OIC.

e. **External Sources.** Support may be available from external SAR agencies.

9.7 The time frame for survival in an alpine environment is critical, necessitating immediate action in order to reduce the likely risk of hypothermia to separated individuals. Therefore, when assessing a plan of action, the OIC or GL may consider requesting external SAR resources early (see paragraph 9.10).

9.8 **Behavioural Characteristics in Alpine Extreme Cold.** In an alpine environment, a person who is lost and exposed to extreme cold over time may develop hypothermia. The GL should be aware that in such circumstances, a lost person’s cognitive ability may be adversely affected. They may exhibit any or all of the following poor decision-making behaviours\(^1\):

a. fail to make shelter

---

b. discard equipment
c. disrobe, removing essential clothing
d. fail to respond to searchers
e. follow the path of least resistance.

SECTION 9-4. RESCUE

9.9 Constructing a Plan of Action. When considering a plan of action, the GL should ask themselves the following questions before embarking on the rescue mission:

a. What is the weather forecast? If the weather is deteriorating, it is essential that adequate shelter is found or that the casualty is evacuated.
b. Which is the easiest escape route to use in order to get to assistance?
c. What shelter is available in situ?
d. How much daylight is left?
e. Is there time to get to assistance before dark?
f. Is it safe to evacuate in darkness?
g. Is it possible to send two people for help or is it possible to rely on being seen by a passer-by?
h. How is the health/fitness/experience of the members of the group?
i. Are any members suffering fatigue, mild exposure or shock?
j. Will the casualty and/or the group be strong enough to help themselves or will they require assistance from another group?
k. Is the nature of the injury or injuries such that expert help is required quickly?
9.10 Requesting Assistance. If assistance is required, the GL should not delay in making the decision to call or go for help. Ideally the first means of contact if possible is by mobile phone or satellite phone. The following actions are recommended when requesting assistance:

a. Dial '000' and establish contact with emergency services by mobile phone or satellite phone. Inform the emergency services operator of the situation, location and status of the casualty.

b. Consider informing other local authorities in order to expedite a response. The local authorities (eg, local police, SES\(^2\) or ski patrol) are likely to effect or coordinate the rescue.

9.11 Mobile Phone and Satellite Phone Reception. Often mobile phone signals can be obtained by moving to a different or higher location and different phone models/brands may work better than others. Look for phones that have been approved for use in regional/rural locations or carry a satellite phone. It is strongly recommended that a spare battery or charger is carried for mobile phones. It is recommended that the battery in a satellite phone is removed when carrying as some models have a tendency to turn on when stored in a pack. It is also recommended that a spare battery for a satellite phone is carried and that the phone has been tested. Ensure that personnel have been briefed on phone PIN, in particular how to use a satellite phone.

9.12 Personal Location Beacon. If there is no mobile phone reception and/or there is a risk of grave or imminent danger that equates to facing a life-threatening situation, then a distress beacon should be activated. Activating a distress beacon is a

\(^2\) State Emergency Service.
personal decision that is different for everybody, and influenced by different circumstances:

a. The decision to deploy a PLB should be made only if an individual or group is in grave or imminent danger and/or all other communication methods have been exhausted.

b. When deploying a PLB, it will deliver best performance where there is a clear view of the sky. If situated in a narrow valley or ravine, the chances of rescue authorities of detecting the PLB signal can be greatly increased by placing it on higher ground. Deploy the beacon in an upright position with the wire antenna vertical and well clear of any surrounding obstructions such as trees or rocks. If adverse weather conditions exist, use any available props around the base of the beacon to ensure that it will not topple over. Where on-person operation is unavoidable, choose an elevated position that also achieves good local clearance around the vertical wire antenna.

c. Once the beacon has been activated, leave it switched on. A continuous signal is needed for rescue authorities to determine the correct location for rescue.

d. Rescue personnel will advise when to turn off the PLB.

e. If a PLB is accidently activated, immediately switch off the device and contact the Australian Maritime Safety Authority immediately to inform them that a rescue is not required.

f. A deployed PLB will need to have its battery replaced in accordance with the manufacturer’s instructions and by an authorised provider. The PLB should not be used until this has been completed.

9.13 Splitting the Group. There may be a need to send personnel to seek assistance; however, this decision should be carefully considered. Ultimately by splitting the group, the GL must be satisfied that choosing this course of action is based on sound decision-making, and not based on luck, as historically many
incidents have resulted in loss of life. The two (or more) fittest and most competent members available in the group, excluding the first aider, are to carry a written message for assistance and should be given concise instructions. The GL must be satisfied that the selected personnel:

a. have knowledge of the best and safest route out
b. are confident to navigate
c. know how to contact emergency services or where to find them
d. have the appropriate equipment to survive.

9.14 Contents of the Message. To assist rescue services, include the following minimum guidelines for the contents of the message for assistance:

a. a six- or eight-figure grid reference or a description of geographical physical features to allow identification of the location of the casualty. This information should be enhanced with map series and edition and/or grid-zone designator information
b. a description of the area
c. the names of tracks/huts nearby
d. details of the casualty’s injuries and their history
e. details of the treatment already given
f. the time of incident
g. the casualty’s details
h. the number of individuals in the party and their experience levels
i. the equipment carried
j. the method of communications/signalling that the group is using
k. the leader’s intentions.
SECTION 9-5. COLD WEATHER INJURIES

Hypothermia

9.15 For identifying signs, symptoms and treatment of hypothermia refer to LWP-G 1-2-5, Army First Aid. For the prevention and management of hypothermia applicable in the AT context there are, however, important considerations for GLs:

a. group management
b. identifying signs early
c. in addition to the first aid treatment for a specific injury, it is important to also guard against heat loss, which is enabled by treating the casualty for hypothermia at the same time
d. food equals fuel, which equals heat (never skip meals)
e. one person suffering hypothermia is quickly followed by more in the group
f. field management applicable to AT.

9.16 Every year many healthy, uninjured and often young people lose their lives in alpine regions through ignorance of simple facts and a failure to observe common sense rules. Individuals who find themselves on mountains or hills with inadequate clothing in cold, wet conditions may die from exposure. Exposure is a loose term that fails to give the precise pathological cause of death; rather, it is simply the circumstances by which death occurred. The real cause is hypothermia.

9.17 Definition of Exposure. Exposure occurs when the body is subjected to conditions that cause severe chilling of the body surface, which then results in hypothermia.

9.18 Definition of Hypothermia. Hypothermia is the term given to an abnormally low body core temperature. The body core consists of the brain, heart, lungs and other major organs. Following the need for an adequate supply of oxygen, a normal body temperature is the second most important basic
requirement of the human body. In order to ensure the continued functioning of these important organs, the body initiates physiological reflexes in an effort to maintain a normal temperature.

9.19 Under normal circumstances the body, with the aid of suitable clothing, can tolerate temperatures down to -40 °C without any adverse effects. There are, however, three factors that affect the body’s tolerance to cold:

a. the length of time the individual is exposed to a low temperature

b. the amount of air movement over the body

c. the amount of water/moisture on the person (are they wet or dry).

Causes of Hypothermia

9.20 Hypothermia is caused by heat loss from the body (see Figure 9–2). Heat loss occurs in the following ways:

a. Radiation. Radiation is the direct heat loss from the body to its surroundings. If the surroundings are colder than the body, the net result is heat loss. An unclothed person loses about 60 per cent of their total body heat by radiation. Specifically, heat is lost in the form of infra-red radiation.

b. Conduction. Conduction is the direct transfer of heat from one object to a colder object, for example:

(1) Conduction most commonly occurs when an individual sits or rests directly on a cold object, such as snow, the ground, or a rock. Without an insulating layer between the person and the object (such as a foam mat), a person quickly begins to lose heat. This is why it is important not to sit or sleep directly on cold ground or snow without a mat or a pack acting as insulation.

(2) Water conducts heat away from the body 25 times faster than air.
c. **Convection.** Convection is heat loss to the atmosphere or liquid such as water in the following manner:

(1) Water or air that is in contact with the body absorbs heat from the body until the body and air or water is the same temperature. However, if the air or water is continuously moving over the body, the temperatures can never equalise, and the body continues to lose heat.

(2) Convection is most commonly encountered through the wind chill effect. Whether walking or skiing, wind must be taken into account to determine the effective temperature experienced by the unprotected body. The movement of wind or air over the body will cause heat loss through convection. The amount of air movement will affect the maximum tolerable temperature. For example, the body will lose as much heat in an environment of 5 °C with a 20 km/h wind as it would in still air at about -35 °C. Table 9–1 shows body heat loss in relation to the strength of the wind movement.

d. **Evaporation.** Heat loss from evaporation occurs when water (sweat) on the surface of the skin is turned into water vapor. For this process to occur, energy in the form of heat is required. This heat comes from the body. This is the primary method the body uses to cool itself down and is the reason that people sweat when they practice physical exertion. One litre of sweat, which a person can easily produce in an hour of hard physical training, will take about 600 calories of heat away from the body when it evaporates.

e. **Respiration.** When a person inhales, the air they breathe is warmed by the body and saturated with water vapor. When they exhale, that heat is lost. That is why their breath can be seen in cold air. Respiration is really a combination of convection (heat being transferred to
moving air by the lungs) and evaporation with both processes occurring inside the body.

![Figure 9–2: Ways the Body Loses Heat](image)

### Table 9–1: Wind Chill Chart

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*LWP-G 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018*
9.21 Exhaustion. While it is possible to survive extreme weather conditions without suffering hypothermia, individuals who are suffering from exhaustion in such conditions are susceptible to the effects of exposure.

9.22 An exhausted body cannot tolerate even a mild cooling of the environmental temperature and it does not make the necessary physiological adjustments to maintain normal body temperature. In a cold or wet environment, once the body becomes exhausted, collapse may occur and is rapidly followed by unconsciousness due to hypothermia. Death can occur within an hour or two.

9.23 Prevention. Once the individual has collapsed, treatment is extremely difficult, so every effort must be made in order to prevent this stage being reached. The factors in the prevention of hypothermia that should be considered by all leaders before departing on any tour are as follows:

a. knowledge of the signs and symptoms of hypothermia
b. ensuring that all group members have adequate and appropriate protective clothing
c. being aware of meteorological advice for that area
d. contingency planning
e. the fitness levels of group members and the loads to be carried
f. leadership skills (such as teaching, listening and encouraging teamwork).
9.24 It is important for the leader to ensure that the work rate of the entire party is within the capability of the weakest group member. It is very easy for a fit leader to exhaust one or more members of the party without exerting themselves. This is particularly likely to occur if the group’s pace is increased in order to escape a sudden deterioration in weather.

9.25 The increased pace may exhaust some group members thereby increasing the chance of hypothermia in those individuals. In this situation, rather than potentially exhaust an individual in an attempt to make a predetermined rendezvous, it is better to stop and shelter and, if necessary, to spend the night on the hill. In adverse conditions, it is the tiring members of the party who are more susceptible to the cold and who are in need of more careful scrutiny for the early signs of hypothermia.

9.26 If possible, individuals should avoid sweating by either venting or removing items of clothing. This will reduce the insulation that the clothing provides. It is worth remembering an old mountaineering adage: ‘The best way to stay warm on a mountain is to always stay slightly cold’. When the exercise rate and body heat production is reduced additional clothing should be put on, which will assist to maintain an even body temperature.

9.27 Signs and Symptoms of Hypothermia. A hypothermia casualty may be recognised by the presence of all or some of the following factors:

a. loss of interest in the activity or lagging behind other group members
b. stumbling and falling with a reluctance to carry on
c. having extremely pale, cold skin
d. exhibiting unreasonable behaviour or extreme mental apathy
e. shivering in the early stages (shivering is usually absent in the later stages as the casualty is generally too exhausted to shiver)
9.28 **Classification.** Hypothermia can be classified into the following three categories:

a. **Mild Hypothermia.** This category can be treated in a field situation. The patient only needs to be protected from further heat loss.

b. **Moderate Hypothermia.** This category is an immediate medical emergency demanding intensive care.

c. **Severe Hypothermia.** If core body temperature is lower than 28 °C, the condition is life-threatening without immediate medical attention. Under this temperature, a person will be very cold to touch, unresponsive, rigid, not breathing, have no pulse, and their pupils will be fixed (they will not respond to light changes). They will appear to be dead, but they may not be.

9.29 It is important to note that moderate hypothermia leads to severe hypothermia if the symptoms are not recognised and the correct action is not taken. As checking the body core temperature in the field is difficult, GLs should always err on the side of caution with hypothermia and treat a patient suffering cold stress or mild hypothermia immediately before the condition worsens.

9.30 **Paradoxical Undressing.** Twenty to fifty per cent of hypothermia deaths are associated with paradoxical undressing. As the person becomes disoriented, confused, and combative, they may begin discarding their clothing, which, in turn, increases the rate of heat loss. This typically occurs during moderate and severe hypothermia. One explanation for the effect is a cold-induced malfunction of the hypothalamus; the hypothalamus is the part of the brain that regulates body temperature. Another explanation is that the muscles
contracting peripheral blood vessels become exhausted (known as a loss of vasomotor tone) and relax, which leads to a sudden surge of blood (and heat) to the extremities, causing the person to feel overheated.

9.31 Cold-related Stress. Cold-related stress is the first stage of mild hypothermia. It has the same signs and symptoms of mild hypothermia, and if treated immediately as for mild hypothermia, the patient will recover in 15 to 30 minutes. All personnel need to be able to recognise that they are displaying these symptoms and take appropriate action to avoid becoming a liability to the group. Personnel should be aware that 'it does not pay to be a hero' and it is important to take preventative action in order to avoid injury and/or illness.

9.32 Mild Hypothermia. Mild hypothermia occurs when the core temperature is above 32 °C. Patients of mild hypothermia need only to be protected from further cooling by the environment. If they are placed in a warm environment and provided with food and drink, they rewarm by themselves. Patients are often constantly wet due to the inability to properly dry clothing. The symptoms for mild hypothermia may be indicated by an individual:

a. complaining of feeling cold
b. shivering (bodily response attempting to produce heat)
c. showing a loss of interest in the activity and is only interested in getting warm
d. developing a negative attitude towards the group or the goal
e. developing problems with muscular coordination.

9.33 The first sign of the onset of mild hypothermia during an activity is the inability of an individual to keep up with the group. Fit, motivated people may push themselves through the mild hypothermic stage when in a group and may then be affected by moderate hypothermia.
9.34 **Moderate Hypothermia.** Moderate hypothermia occurs when the core temperature is 32 °C or below. The symptoms a person will show are as follows:

a. shivering has stopped
b. an altered mental state is displayed, such as by no longer trying to keep warm and may remove clothing or leave their jacket unzipped
c. coherent thought is affected (memory and decision-making)
d. incoherent speech
e. the skin feels cold, non-pliable and may be bluish
f. the pulse is weak and hard to feel
g. breathing is slow and shallow
h. the breath has an acetone odour.

9.35 **Severe Hypothermia.** As the temperature decreases, further physiological systems falter and heart rate, respiratory rate and blood pressure decrease. This results in an expected heart rate in the 30s at a temperature of 28 °C. Difficulty speaking, sluggish thinking, and amnesia start to appear; inability to use hands and stumbling are also usually present. Cellular metabolic processes shut down. Below 30 °C the exposed skin becomes blue and puffy, muscle coordination is very poor, and walking almost impossible, and the person exhibits incoherent or irrational behaviour. Pulse and respiration rates decrease significantly, but fast heart rates (ventricular tachycardia, atrial fibrillation) can also occur, although atrial fibrillation is not typically a concern in and of itself.
9.36 Treatment of Hypothermia. First aiders can assist spontaneous rewarming of the casualty and provide care to the team by carrying out the following actions:

a. Apply the basic life support principles of DRSABCD:
   (1) D = danger
   (2) R = response
   (3) S = send
   (4) A = airways
   (5) B = breathing
   (6) C = cardiopulmonary resuscitation
   (7) D = defibrillation.

b. Stop moving and when handling casualty treat very gently to avoid jolting or jarring. Do not massage or rub a casualty’s limbs, encourage exercise or attempt rapid rewarming.

c. If a casualty’s clothing is wet, gently replace wet clothing with dry clothing. Also add extra layers of clothing, ensuring that the head is adequately covered. Ensure that all other party members put on extra clothing.

d. Erect a tent or some other form of shelter and gently assist the patient into a sleeping bag (remember to place a sleeping mat between the sleeping bag and the ground). Place one or two extra companions with sleeping bags in the tent. The extra people in the confines of the tent will provide direct warmth to the patient and will help to raise the air temperature and humidity within the tent.

e. Provide warm sweetened drinks. Warm drinks offer little calorific value, but can make a person feel warmer and may provide comfort. Do not give alcohol or coffee.

f. Use water bottles filled with hot water and wrapped in clothing to place in the sleeping bag to assist warming. It
is vital that the heated water bottle is not placed directly on a person’s exposed skin and that these objects should not be too hot to hold in your hand. Apply warm objects to the head, neck and chest to prevent further heat loss. Do not apply warm objects to the armpits or groin as this can stop a casualty shivering by fooling the brain into thinking the body is warm and lead to further heat loss from the core.

9.37 Immersion Hypothermia. This results from a person’s immersion in cold water. A high rate of heat loss from the body combined with water being able to penetrate clothing rapidly

Continually monitor the casualty’s signs of life and also check the health condition of other party members.

Erect the remaining tents and instruct tent groups to prepare food as the group will have to remain at this site overnight. The casualty should be evacuated by trained rescue crew or for mild cases, remain inactive for at least 48 hours as a relapse is likely.

Monitor the rewarming process of the patient. Vasoconstriction will slowly give way to vasodilatation, producing a net decrease in core blood volume (hypovolaemia). This occurs because of the redistribution of blood to the periphery. It is important that fluids are given to the patient during the rewarming phase of patient management in order to ensure that this condition does not arise.

Place an unconscious casualty in the recovery position, continue to monitor. At no stage should an unconscious casualty be left unattended and the first aider should be ready to commence CPR if indicated. The casualty may be rewarmed slowly. Even casualties who appear to be dead must be presumed alive and treated as such until all treatment fails and/or a doctor certifies death.

If severe hypothermia has developed or is suspected then arrange for evacuation immediately. Add heat gradually and gently in order to prevent further cooling.

$LWP-G$ 7-6-3, Adventurous Training – Backcountry Skiing and Alpine Survival, 2018
and a large amount of heat being required to raise water temperature, result in the onset of hypothermia.

9.38 Short-term Cold Water Immersion. When the body is immersed in cold water, it can shock the heart and increase the heart rate. The shock can cause death. The ability to hold one’s breath is reduced and muscle dysfunction (muscles failing) will occur. Thus, sudden death can occur either immediately or within a matter of minutes after immersion.

9.39 Long-term Cold Water Immersion. The body’s core temperature begins to cool after 15 to 20 minutes in water. The length of time for survival depends on the following conditions:
   a. the temperature of the water
   b. the person’s size
   c. the clothing being worn.

9.40 Death from long-term immersion is due to hypothermia and/or drowning.

Dehydration

9.41 Dehydration occurs when too much water or salt is lost from the body, when respiring from an adverse working environment or from physical exertion. Dehydration is more common in dry, hot or dusty environments but can occur when backcountry or downhill skiing on a hot day. The sun heating the ice or snow, cause the temperature and humidity to rise.

9.42 Prevention. The following factors can aid in the prevention of dehydration:
   a. avoid consuming alcohol
   b. ensure that enough water is consumed (indicated by pale and plentiful urine)
   c. avoid moving in the heat of the day
   d. drink a minimum of 2 L of water per day or as is needed for the level of physical exertion being undertaken.
9.43 Signs and Symptoms. Early detection of the following early signs may avoid heat stroke:

a. fatigue, tiredness and weakness
b. headache and irritability
c. nausea
d. dizziness
e. a reduced urine output that is dark and strong smelling.

9.44 If these symptoms are not treated, they could lead to drowsiness, failure of the blood circulation, shock and death. Further signs that an individual is dehydrated include:

a. clumsiness
b. pale, dry skin with no elasticity
c. sunken eyes
d. a rapid, weak pulse.

9.45 Treatment of dehydration involves:

a. removing the patient from the heat and placing them in the shade if possible
b. removing any restrictive equipment or clothing that is preventing cooling
c. placing a cool compress on the neck or the back of head
d. administering water or electrolytes (only small sips)
e. keeping a note of the liquid intake versus urine output, and check the colour of the urine.

9.46 Water disinfection is important when in the field because contaminated water can lead to diarrhoea that in turn may lead to dehydration. The best way to sterilise water is to boil it. If the group is using purifying tablets, they may need to dilute the flavour by adding cordial. Remember to wait until the iodine has purified the water before adding these substances.
Frostbite

9.47 Description. Frostbite is a type of tissue damage caused by cold conditions. It occurs mainly in the extremities, such as the hands and feet, or in exposed parts such as the ears and nose. Actual freezing of the tissue may occur in extreme cases.

9.48 Superficial Frostbite. Superficial frostbite produces a feeling of cold or numbness, usually in the fingers and hands, feet and toes, or the nose and ears. At the onset of these early symptoms, treatment should be started immediately. Later symptoms of deep frostbite are coldness, complete lack of feeling, whiteness or blueness of the affected skin, and stiffness of the affected parts. Treatment of these symptoms should be immediate.

9.49 Prevention of Frostbite. Frostbite occurs frequently when people are tired, careless or incapacitated by injury or illness. Prevention is better than cure. Adequate clothing must be worn and high personal hygiene standards need to be maintained.

9.50 Treatment of Frostbite. Individuals suffering frostbite may also be suffering hypothermia and perhaps other injuries. Frostbite casualties should be examined for other injuries and proper treatment given. The treatment for frostbite should be as follows:

a. Apply the principles of DRSABCD.

b. Seek shelter, wrap the casualty in blankets and/or a sleeping bag and give them warm fluids by mouth.

c. Once inside, remove clothing from the frostbitten areas of skin.

d. Rewarm the frostbitten area as quickly as possible to salvage as much tissue and function as possible. Rewarming is most effectively accomplished by immersing the affected area in water heated from 37 to 39 °C. Do not allow the water to get too hot or too cold. Avoid premature termination of the rewarming process. Remember to treat pain associated with rewarming.
e. Prevent any part of the injury from coming into contact with the side of the container and keep the water circulating.

9.51 Treatment of Superficial Frostbite. This is the only frostbite that can be treated as previously described in paragraph 9.50. The affected area should be rewarmed by removing clothing and then rewarmed it against a warm part of the body. For example, place the affected hand into the opposite armpit. The feet can be rewarmed using another’s body heat. Cupped hands can cover the ears and nose.

9.52 Treatment of Deep Frostbite. The treatment for deep frostbite should not be commenced until adequate facilities are available. A person with a frostbitten foot can probably walk out on it. This would be the wisest course of action in order to reach a place where proper treatment can be started. Ideally, if possible, have SAR services extract the patient.

9.53 Frostbite Treatment ‘Don’ts’. To prevent further damage or injury to the casualty when treating frostbite:

a. do not rub the area briskly with snow or any other product, in an effort to generate heat
b. do not heat the affected part in hot water, or near an oven or fire
c. do not allow weight-bearing after rewarmed.

Immersion Foot (Trench Foot)

9.54 Immersion or trench foot develops following exposure to cold, wet conditions and typically occurs when a patient has to wear wet socks or boots. Initially the feet are cold and painless with a weak pulse present in the foot. This is followed by a developing hot sensation with a burning, shooting pain in the feet. In later stages, the skin is pale and may have a bluish appearance and a decreased pulse. Other signs and symptoms include blistering, swelling, redness, localised heat, bleeding and gangrene.
9.55 **Treatment.** The patient should be rewarmed by exposing them to warm air but not direct flame from a stove. The feet should be dried and clean, dry socks applied. The feet should be inspected daily for any further indication of trench foot.

**Snow Blindness**

9.56 When UV light reflects from the snow, ice or quartz rock, it can burn the retina of the eye causing temporary blindness. This condition is known as snow blindness and it should be avoided as it is a crippling injury that can keep a person tent-bound for days.

9.57 **Signs and Symptoms of Snow Blindness.** The signs and symptoms of snow blindness are that the eyes become red and watery, very painful, and they are unable to tolerate light.

9.58 **Treatment of Snow Blindness.** The treatment of snow blindness is as follows:

   a. rest the eyes for 24 hours by placing bandage pads firmly over the eyes
   b. apply a cold compress to help with pain relief
   c. avoid rubbing the eyes, as this may cause infection.

9.59 **Prevention of snow blindness can be aided by taking the following precautions:**

   a. wearing sunglasses or goggles with lenses that are meet a Category 3 to Category 4 standard at all times
   b. making sure that the sunglasses or goggles have a side shield and a neck cord to prevent loss
   c. if sunglasses or goggles are not available, cut slits or poke tiny eye holes into a piece of cardboard and tie with a string or tape.

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BIBLIOGRAPHY


*Australian Standard/New Zealand Standard 1067.1–2016: Eye and face protection – Sunglasses and fashion spectacles – Requirements*
