FM 31-70

DEPARTMENT OF THE ARMY FIELD MANUAL

BASIC COLD WEATHER MANUAL

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY
APRIL 1968

FIELD MANUAL
No. 31-70

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *12 April 1968*

BASIC COLD WEATHER MANUAL

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*This manual supersedes FM 31-70, 24 February 1959, including all changes.

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CHANGE
No. 1

HEADQUARTERS
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BASIC COLD WEATHER MANUAL

FM 31-70, 12 April 1968, is changed as follows:

Page 53, paragraph 3-51 *b,* In line 16 "(LOW)" is changed to read "(LAW or Lubricant, Semi-Fluid, MIL--L--46000A(LSA))."

Page 165, paragraph D-2 *a.* In line 10 "(LOW)" is changed to read "(LAW or Lubricant, Semi-Fluid, MIL-L-46000A(LSA))."

Page 166, paragraph D-3a (2). In line 21 "LOW" is changed to read "LAW or Lubricant, Semi-Fluid, MIL-L-46000A(LSA)."

Page 166, paragraph D-3 *a* (3), In lines 3 & 4 "LOW" is changed to read "LAW or Lubricant, Semi-Fluid, MIL-L-46000A(LSA)."

Page 166, paragraph D-3 *b* (4). In line 7 "LOW" is changed to read "LAW or Lubricant, Semi-Fluid, MIL--L-46000A(LSA)."

Page 170, paragraph E–2 *a.* In line 14 "Cap, Cold Weather" is changed to read "Cap, Insulting, Helmet Liner-Helmet."

Page 171, paragraph E 2c. Entire page 171 is deleted and the following is added:

Weapon, Antipersonnel (Claymore)	3. 00
Pistol, Automatic, Cal. 45	2. 50
250 rounds, 7.62mm, Machinegun	22. 00
Bandoleer, w/7.62mm Ammunition (60 rds)	3. 61
Compass, Lensatic	. 30
Grenade Launcher, M79	6. 00
81mm Mortar, M29:	
Barrel	28. 00
Mount, M23A1	31. 00
Baseplate, M3	28. 50
3.5'' Rocket Launcher:	
Launcher	13. 00
Rockets	9. 00
Rifle, 90mm, M67:	
Rifle	35. 00
Ammo	9. 25
Stove, One Burner, Squad	L 30
Reel, DR8, w/WD1 Wire	13. 00
Radio, AN/PRC 6	7. 50
Radio, AN/PRC 25	24. 72

E-3. Type Load

The loads shown below are *type* loads which could be worn during moderately cold weather (approximately 15° F to –15° F). The term moderately cold is used only as a descriptive term. What is termed as moderately cold to one person, may be extremely cold to another. The windchill factor must also be considered, a moderate cold could change momentarily to extreme cold by the addition of high winds. Therefore, the commander should use the type loads for planning only and should adjust them accordingly to fit a given situation and temperature condition.

a. Fighting Load.

Clothing	*Weight*
Helmet, w/liner	3. 00
Undershirt, 50/50	0. 82
Drawers, 50/50	0. 89
Socks, Cushion Sole	0. 19
Suspenders	0. 25
Trousers, Cotton Nylon WR	2. 10
Shirt, Wool Nylon OG	1. 50
Coat, Cotton Nylon WR	3. 20
Liner, Coat, Nylon Quilted	0. 73
Cap, Insulating Helmet Liner-Helmet	0. 26
Hood, Winter	0. 96
Muffler, Wool	0. 38
Mitten Shells, Trigger Finger	0. 43
Mitten Inserts, Wool Nylon	0. 22
Overwhite Set	4. 00
Boots, Insulated, White	5. 50
Total clothing	24. 43
Equipment:	
Rifle, M14	9. 08
Grenade, M26 (2 ea)	1. 90
Magazine, w/7.62mm ammo (5 ea)	7. 85
Pouch, Ammo, 7.62mm, M14 (2 ea)	1. 46
Canteen, Cold Climatic	3. 85
Belt, M14, w/first aid packet & pouch	1. 01
Intrenching Tool, w/carrier	3. 96
Bayonet, w/scabbard	1. 07
Snowshoes, Magnesium	4. 60
Body Armor	8. 87
Protective Mask	2. 88
Total equipment	46. 53

Carried in pockets:	Weight
Chapstick	0. 10
Sun Glasses, w/case	0. 30
Box, Match, Waterproof	0. 15
Knife, Pocket	0. 40
Thong, Emergency	0. 12
Total	1. 07
Total Fighting Load	72. 03

b. Existence Load.

Rucksack, Nylon Duck, OG	3. 60
Following items are carried in or attached to the rucksack:	
Bag, Sleeping (Outer)	7. 06
Bag, Sleeping (Inner)	5. 41
Mattress, Pneumatic	3. 00
Case, Water Repellent	2. 25
Liner, Trousers, Nylon Quilted	0. 64
Socks, Cushion Sole (2 pr)	0. 38
Poncho, Nylon Twill	2. 00
1/3 Ration	2. 13
Toilet Articles	2. 00
Towel, Turkish	0. 64
Starter, Fire	0. 15
Mitten Inserts, Wool Nylon	0. 22
Total Existence Load	29. 48
Total of Fighting and Existence Load	101. 51

c. Supplemental Existance Load. The following are items of clothing not immediately needed by the individual during moderately cold weather. These items are normally carried in the duffle bag on unit transportation and should be available to the individual when needed:

Undershirt, 50/50
Drawers, 50/50
Socks, Cushion Sole (3 pr)
Trousers, Cotton Nylon, WR
Shirt, Wool Nylon, OG
Parka, Cotton Nylon
Liner, Parka, Nylon Quilted
Mitten Set, Arctic

Page 184, paragraph G-6a. In line 1 "(LOW)" is changed to read "(LAW or Lubricant, Semi-Fluid, MIL-L-46000A(LSA))."

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief Of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:
To be distributed in accordance with DA Form 12-11 requirements for Basic Cold Weather Manual.

CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

a. This manual is designed to prepare the individual soldier and small unit commander to conduct military operations for extended periods of time under the most severe and varying cold weather climatic conditions. The doctrine and techniques in the manual are applicable in any area that has cold weather and snow with their accompanying operational problems. Troops *properly trained* in this doctrine and these techniques will be able to fight; live; and move in any cold weather area of the world.

b. The provisions of SOLOG Agreement 23R, Arctic Doctrine are implemented in this manual.

c. The material contained herein emphasizes that cold, with its attendant problems affects military operations but does not prevent them. The proper use of authorized equipment and field expedients will, to a major degree, overcome any problems encountered as a result of the cold. It is the commander's responsibility to train his men so they can make the environment save military operations, *not hinder them.* The material presented herein is applicable, without modification to nuclear and nonnuclear warfare, employment of, and protection from, chemical, biological, and radiological agents, and internal defense and development operations.

d. Throughout this manual reference is made to the additional time required to conduct various tasks in cold weather operations. This requirement cannot be overemphasized and must be included in all planning. In addition to the increased amount of time consumed in actual movement, allowance must be made for other time consuming tasks that are not present in temperate zone operations. These include, among others, erecting and striking tents, performing maintenance, constructing roads, starting and warming engines, movement of supplies, and hundreds of other small tasks that must be performed while wearing bulky cold weather clothing.

e. Insofar as possible illustrations used in this manual reflect Standard A items of clothing and equipment. However, because of nonavailability of some items at time of publication, some illustrations show Standard B or C items of clothing (para 2-7).

f. Measurements in this manual to the extent practicable, reflect both the Metric and U.S. systems; however, in some cases figures will show only the U.S. system. For ease in transposition, meters have been converted to yards on a one for one basis. For more exact measurements use the conversions shown in appendix H.

g. Users of this manual are encouraged to submit recommendations to improve its clarity or accuracy, Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to Commanding General, United States Army, Alaska, APO Seattle 98749. Originators of proposed changes which would constitute a significant modification of approved Army doctrine may send an information copy, through command channels, to the Commanding General, United States Army Combat Developments Command, Fort Belvoir, Virginia 22060, to facilitate review and followup.

1-2. Relation to Other Manuals

This manual is prepared with the assumption that normal individual and basic unit

training have been completed. The manual should be used in conjunction with the basic field manuals of the arms and services as well as FM 31-71and FM 3l-72. Appropriate technical manuals contain detailed information beyond the treatment given in this manual on the operation and maintenance of equipment during cold weather operations. Appendix A contains a list of supplementary manuals and references.

CHAPTER 2

INDIVIDUAL CLOTHING AND EQUIPMENT

Section 1. GENERAL

2-1. Basis of Issue

a. As used in this manual, individual clothing and equipment are those items issued or sold to a soldier for his personal use, and include certain organizational equipment utilized by the individual. The basis of issue of cold weather clothing and equipment may be found in TA 50-901. Mandatory items of personal clothing are listed in AR 700–8400–1.

b. The U.S. Army, through continuous research and development, endeavors to maintain the best clothing and equipment in the world. When properly fitted and properly utilized this clothing will provide adequate protection from the elements and will enable trained, well disciplined troops to carry out year-round field operations under cold weather conditions, wherever they may be encountered.

c. To utilize fully the protection afforded by the present standard cold weather clothing and equipment, it is necessary to understand the principle involved and the correct function of each item. This chapter covers basic principles and provides general guidance on the purpose and use of cold weather clothing and equipment.

2-2. Commander's Responsibilities

a. Many factors will influence the commander's decision as to what items of clothing and equipment his troops should wear or carry. These include the weather, mission at hand, actual duties to be performed, overall physical condition of individuals and their degree of proficiency. If a movement is involved he must consider the distance to be traveled, the method of travel, and how the troops will be fed en route, if applicable. If the movement is on foot, he must bear in mind that under normal winter conditions, 65 to 70 pounds is the maximum weight a man can normally wear and carry and still be effective on reaching his destination.

b. The weight of individual clothing and equipment is covered in appendix E. Commanders should give particular attention to additional organizational equipment required for a given operation. Some of the more common items are also listed in appendix E. Since the individual soldier's combat load in cold weather operations exceeds that of a temperate climate load by more than 20 pounds, these organizational items (such as binoculars, compasses, radios and batteries, pioneer tools, crew served weapons, etc.) become major considerations and must be included at all levels of planning.

c. In addition to the individual combat load, another 45 to 55 pounds of clothing and equipment is required for the protection and comfort of each individual under conditions of *extreme cold.* Transportation must be provided for this additional load whenever possible.

d. The commander must take positive action to insure that a balance exists between what the individual is wearing and what he is required to carry in the way of equipment. He must also insure that troops dress as lightly as possible consistent with the weather in order to reduce the danger of excessive perspiring and subsequent chilling. The complete cold-wet or cold-dry uniform for the applicable environmental conditions must be readily available. A large proportion. of cold weather casualties results from too few clothes being available to individuals when a severe change in the weather occurs. Because of the differences in individual metabolism, commanders

must not be arbitrary in delineating strict uniform requirements, but must allow some personal choice of undergarments.

2-3. Cold Weather Conditions

The use of cold weather clothing is affected by two types of weather conditions: wet and dry. These conditions are amplified by humidity coupled with temperature and wind velocity; high humidity (wet conditions), low humidity (dry conditions).

a. Wet Conditions. Cold-wet conditions occur when temperatures are near freezing and variations in day and night temperatures cause alternate freezing and thawing. This freezing and thawing is often accompanied by rain and wet snow, causing the ground to become muddy and slushy. During these periods troops should wear clothing which consists of a water-repellent, wind-resistant outer layer and inner layers with sufficient insulation to provide ample protection in moderately cold weather (above 14°F.).

b. Dry Conditions. Cold-dry conditions occur when average temperatures are lower than 14°F. The ground is usually frozen and snow is usually dry, in the form of fine crystals. Strong winds cause low temperatures to seem colder and increase the need for protection of the entire body (windchill) (fig. F-1). During these periods, troops should have available additional insulating layers of clothing. This is particularly true when entering static situations form a period of strenuous exercise.

Section II. CLOTHING

2-4. Purpose of Clothing

a. Protection of Body Against Climatic Factors.

(1) If the body is to operate efficiently, it must maintain a normal temperature. The body attempts to adjust itself to the variable external conditions it encounters. These attempts are evidenced by the need for more food to produce additional heat during colder weather, by perspiration to increase removal of heat during hot weather, and by the gradual darkening of the skin as protection against extended exposure to the rays of the sun.

(2) Proper clothing, correctly worn, will assist the body in its adjustment to extreme climatic conditions. The clothing does this by holding in the body heat, thereby insulating the body against the cold outside air. The problem of protection becomes acute when freezing temperatures are involved. To understand this problem requires a knowledge of the methods by which the body resists the effects of climatic changes.

b. Balancing Heat Production and Heat Loss. The body loses heat at variable rates. This heat may flow from the body at a rate equal to or greater than the rate at which it is produced. When heat loss exceeds heat production, the body uses up the heat stored in its tissues, causing a rapid drop in body temperature. Excessive heat loss can result in shivering. Shivering uses body energy to produce heat which at least partially offsets the heat loss and slows the rate at which the body temperature will drop. Shivering is an important warning to start action to rewarm, either by adding more clothing, by exercising, by eating some food, or by entering a warm shelter, or by any combination of these actions. In freezing temperatures it is as important to remove and adjust clothing to prevent excessive overheating as it is to add clothing to prevent heat loss.

2-5. Principles of Clothing Design

Certain principles are involved in the design of adequate cold weather clothing to control the loss of heat from the body, to facilitate proper ventilation, and to protect the body.

a. Insulation. Any material that resists the transmittance of heat is known as an insulating material. Dry air is an excellent insulator. Woolen cloth contains thousands of tiny pockets within its fibers. These air pockets trap the air warmed by the body and hold it close to the skin. The principle of trapping air within the fibers or layers of clothing provides the most efficient method of insulating the body against

heat loss. Fur provides warmth in the same way; warm, still air is trapped in the hair and is kept close to the body.

b. Layer Principle.

(1) Several layers of medium-weight clothing provide more warmth than one heavy garment, even if the single heavy garment is as thick as the combined layers. The effect results from the several thick layers of air which are trapped between the layers of clothing, rather than one or two layers of large volume. These layers, as well as the minute air pockets within the fibers, are warmed by the body heat.

(2) The layers of clothing are of different design. The winter underwear is most porous and has many air pockets. These air pockets trap and hold the air warmed by the body. To keep the cold outside air from reaching the still inside air that has been warmed by the body, the outer garments are made of windproof, water-repellent fabric.

(3) The layer principle allows maximum freedom of action and permits rapid adjustment of clothing through a wide range of temperatures and activities. The addition or removal of layers of clothing allows the body to maintain proper body heat balance.

c. ***Ventilation.*** Perspiration fills the airspaces of the clothing with moisture laden air and reduces their insulating qualities. As perspiration evaporates, it cools the body just as water evaporating from a wet canteen cover cools the water in the canteen. To combat these effects, cold weather clothing is designed so that the neck, waist, hip, sleeve, and ankle fastenings can be opened or closed to provide ventilation. To control the amount of circulation, the body should be regarded as a house and the openings in the clothing as windows of the house. Cool air enters next to the body through the openings in the clothing just as cool air comes into a house when the windows are open. If the windows are opened at opposite ends of a room, cross-draft ventilation results. In the same way, if clothing is opened at the waist and neck, there is a circulation of fresh air. If this gives too much ventilation, only the neck of the garment should be opened to allow warm air to escape without permitting complete circulation.

2-6. Winter Use of Clothing

a. Basic Principles of Keeping Warm.

(1) Keep clothing Clean.
(2)Avoid Overheating.
(3)Wear Clothing Loose and in layers.
(4) Keep clothing Dry
(5) Remember C-O-L-D to keep warm in winter.

b. Application of Basic Principles.

(1) Keep clothing clean. This is always true from a standpoint of sanitation and comfort: in winter, in addition to these considerations, it is necessary for maximum warmth. If clothes are matted with dirt and grease, much of their insulation property is destroyed; the air pockets in the clothes are crushed or filled up and the heat can escape from the body more readily. Underwear requires the closest attention because it will become soiled sooner. If available, light cotton underwear may be worn beneath winter underwear to absorb body oils and lengthen the time interval between necessary washings of these more difficult to clean and dry garments. Winter underwear (Army issue is a 50/50 cotton/wool blend) and cushion sole socks (Army issue socks are 50 percent wool, 30 percent nylon, 20 percent cotton) should be washed in lukewarm water, if available. Hot water should not be used because it is injurious to the wool fibers and causes shrinkage. Synthetic detergents are more soluble than soap in cool water and also prevent hard-water scum, and are therefore recommended, if available. When outer clothing gets dirty it should be washed with soap and water. All the soap or detergent must be rinsed out of the clothes, since any left in the clothing will lessen the water-shedding quality of the clothing. In addition to destroying much of the nor-

mal insulation, grease will make the clothing more flammable. All outer garments of the Cold Weather Clothing System are washable and have laundry instruction labels attached. If washing is not possible for clothing that would normally be washed with soap and water, dry rubbing and airing will rid them of some dirt and accumulated body oils.

(2) Avoid overheating. In cold climates, overheating should be avoided whenever possible. Overheating causes perspiration which in turn, causes clothing to become damp. This dampness will lessen the insulating quality of the clothing. In addition, as the perspiration evaporates it will cool the body even more. When indoors, a minimum of clothing should be worn and the shelter should not be overheated. Outdoors, if the temperature rises suddenly or if hard work is being performed, clothing should be adjusted accordingly. This can be done by ventilating (by partially opening parka or jacket) or by removing an inner layer of clothing, or by removing heavy mittens or by throwing back parka hood or changing to lighter head cover. The head and hands, being richly supplied with blood, act as efficient heat dissipators when overheated. In cold temperature it is better to be slightly chilly than to be excessively warm. This promotes maximum effectiveness of the body heat production processes.

(3) *Wear clothing loose and in layers.* Clothing and footgear that are too tight restrict blood circulation and invite cold injury. Wearing of more socks than is correct for the type of footgear being worn might cause the boot to fit too tightly. Similarly, a field jacket which fits snugly over a wool shirt would be too tight when a liner is also worn under the jacket. If the outer garment fits tightly, putting additional layers under it will restrict circulation. Additionally, tight garments lessen the volume of trapped air layers and thereby reduce the insulation and ventilation available.

(4) Keep clothing dry.

(a) Under winter conditions, moisture will soak into clothing from two directions-inside and outside. Dry snow and frost that collect on the uniform will be melted by the heat radiated by the body.

(b) Outer clothing is water-repellent and will shed most of the water collected from melting snow and frost. The surest way to keep dry, however, is to prevent snow from collecting. Before entering heated shelters, snow should be brushed or shaken from uniforms; it should not be rubbed off, because this will work it into the fabric.

(c) In spite of all precautions, there will be times when getting wet cannot be prevented and the drying of clothing may become a major problem. On the march, damp mittens and socks may be hung on the pack. Occasionally in freezing temperatures, wind and sun will help dry this clothing. Damp socks or mittens may be placed, unfolded near the body, where the body heat will dry them. In bivouac, damp clothing may be hung inside the tent near the top, using drying lines or improvised drying racks. It may even by necessary to dry each item, piece by piece, by holding before an open fire. Clothing and footwear should not be dried to near a heat source. Leather articles, especially boots, must be dried slowly. If boots cannot be dried by any other method, it is recommended that they be placed between the sleeping bag and liner. Heat from the body will aid in drying the leather.

2-7. Components of Cold Weather Uniforms

The items of clothing below are Standard A as listed in SB 700-20. It should be borne in mind however that procurement may or may not have been started on some of the items

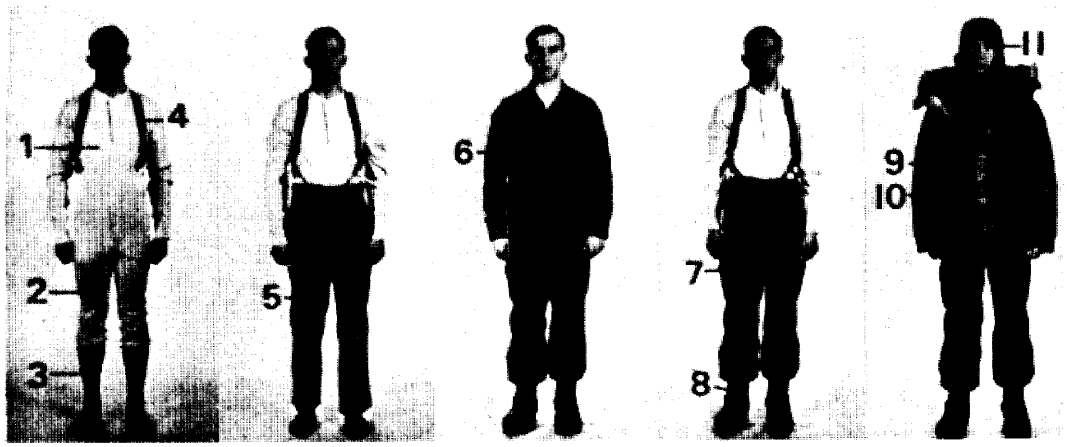


Figure 2–1. Basic components of cold-wet uniform.

and upon requisitioning some Standard B clothing may be issued. Although not shown as basic items of the cold weather uniforms, light cotton underwear may be worn under the winter underwear (para 2-6 *b* (l)).

a. Cold-Wet Uniform. The basic components of the cold-wet uniform are illustrated in figure 2-1 unless otherwise indicated.

(1) Undershirt Mans. 50 Cotton 50 Wool, Full Sleeve.

(2) Drawers Mens. 50 Cotton 50 Wool, Ankle Length.

(3) Socks Mens. Wool Cushion Sole, OG 408, Stretch Type.

(4) Suspenders Trousers. Scissors Back Type.

(5) Trousers Mens. Wool Serge, OG 108.

(6) Shirt Mans. Wool Nylon Flannel, OG 108.

(7) Trousers Mens. Cotton Nylon, Wind Resistant Sateen, 8.5 oz, OG 107.

(8) *Boot Insulated Cold Weather.* Mens Rubber Black (or Boot Combat: Mens Leather Black 8½" high with Overshoe: Rubber Man's High Cleated 5 Buckle).

(9) *Coat Man.* Cotton and Nylon Wind Resistant Sateen, 8.5 oz, OG 107, with integral hood.

(10) *Liner Coat Mens.* Nylon Quilted 6.2 oz, OG 106.

(11) Cap *Insulating, Helmet Liner-Helmet.* Cotton Nylon Oxford, OG 107.

(12) Glove Shells. Leather Black with Glove Inserts; Wool and Nylon Knit, OG 208, or Mitten Shells; Trigger Finger Leather Palm and Thumb with Mitten Inserts; Wool and Nylon Knit, OG, Trigger Finger, or Mitten Set Arctic; Gauntlet Style Shell with Leather Palm (fig. 2-5).

(13) Hood Winter. Cotton and Nylon Oxford, OG 107, with drawcord and fur.

(14) Poncho. Coated Nylon Twill, OG 207 (not illustrated).

b. Cold-Dry Uniform. The basic components of the cold-dry uniform are illustrated in figure 2-2 unless otherwise indicated.

(1) Undershirt Mens. 50 Cotton 50 Wool, Full Sleeve.

(2) Drawers Mens. 50 Cotton 50 Wool, Ankle Length.

(3) Socks Mens. Wool Cushion Sole, OG 408, Stretch Type.

(4) Suspenders Trousers. Scissors Back Type.

(5) Shirt Mans. Wool Nylon Flannel, OG 108.

(6) Trousers Mens. Cotton Nylon, Wind Resistant Sateen, 8.5 oz, OG 107.

(7) Liner Trousers. Nylon Quilted, 6.2 oz, OG 106.

(8) *Boot Insulated Cold Weather.* Mens Rubber White, w/release valve.

(9) *Coat Man.* Cotton and Nylon Wind Resistant Sateen, 8.5 oz, OG 107.

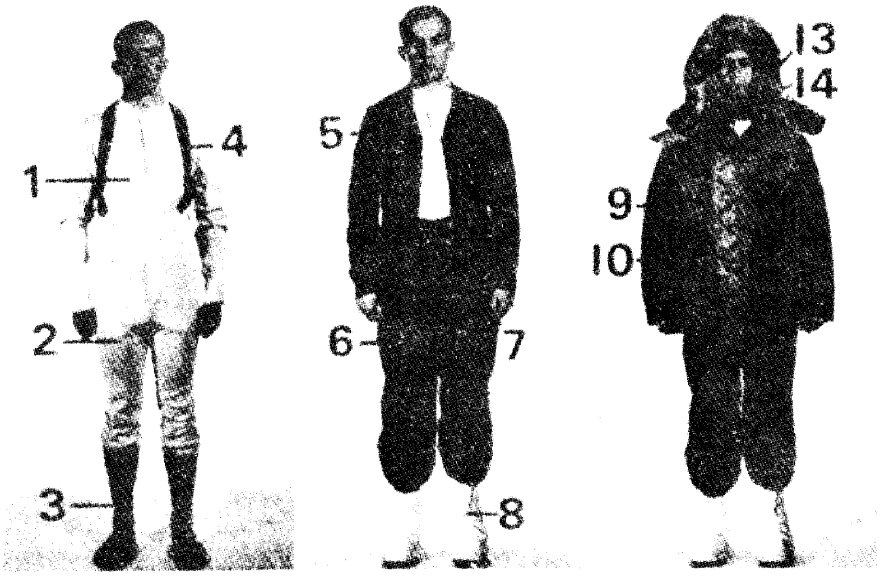


Figure 2-2. Basic components of cold-dry uniform.

(10) Liner Coat Mans. Nylon Quilted, 6.2 oz, OG 106.

(11) Parka Mans. Cotton and Nylon Oxford OG 107, w/o hood (not illustrated),

(12) Liner Parka Mans. Nylon Quilted, 6.2 oz, OG 106 (not illustrated).

(13) Cap, Insulating, Helmet Liner. Cotton Nylon Oxford, OG 107.

(14) Hood Winter. Cotton and Nylon Oxford, OG 107, w/drawcord and fur.

(15) Glove Shells. Leather Black with Glove Inserts; Wool and Nylon Knit, OG 108, or, Mitten Shells; Trigger Finger Leather Palm and Thumb with Mitten Inserts; Wool and Nylon Knit, OG, Trigger Finger, or, Mitten Set Arctic; Gauntlet Style Shell with Leather Palm (fig. 2-5).

(16) Poncho. Coated Nylon Twill, OG 207 (not illustrated).

(17) Gloves Cloth. Work Type (not illustrated).

2-8. Description and Wearing of the Uniform Components

a. Cold-Wet.

(1) *Inner layer.*

(a) Underwear. The underwear is loose fitting and is made of 50 percent cotton and 50 percent wool. It is constructed so that circulation and ventilation are not restricted.

(b) Suspenders. The scissors-type suspenders are worn over the undershirt. The drawers and all succeeding layers of trousers are supported by the suspenders. The use of suspenders allows the drawers and trousers to be worn loose at the waist so that neither circulation nor ventilation is restricted.

(2) Intermediate layer. The intermediate layer consists of the wool OG shirt and trousers which provide excellent insulation against the cold. The shirt is worn outside the trousers for better control of ventilation. The wool trousers and shirt are not designed to be worn as outer garments under field conditions since they lose their insulating qualities if they become wet or matted with dirt. When engaged in strenuous activity, care must be taken so that the wool material will not come in contact with the skin, thus causing possible irritation and discomfort.

(3) Outer layer.

(a) Coat. The coat ensemble is made up of a shell and a detachable liner.

Figure 2-3. Cap insulatng helmet and helmet liner.

The coat has a combination slide, snap and touch-and-close fastener front closure. The sleeves have adjustable cuffs with a hand shield extension. A lightweight hood is an integral part of the coat. When not being used the hood is secured under the collar and is concealed by a slide fastened enclosure. The detachable liner is made of quilted nylon and is extremely light and warm. The liner has a collar, open underarms, and buttonhole tabs for attachment to the coat.

(b) Trousers. The trousers are made of smooth, light, wind resistant sateen. They have extra closures and adjustments. to provide for ventilation and better fit.

(4) *Headgear.*

(a) Cap. The insulating helmet liner cap (fig. 2-3) is close fitting, visorless, and of helmet style. It has a combined one-piece earlap and neck protector, and utilizes an overlap touch-and-close fastener. The cap is designed to be worn under the steel helmet or under the winter hood. When worn as an outer headpiece, the lower flap portion of the cap may be folded up around the top with the touch-and-close fasteners crisscrossed in the front (fig. 2-3).

(b) Hoods. The winter hood (fig. 2-4) is a one-piece covering for the head, face, and neck. It utilizes touch-and-close fasteners and can be worn over the steel helmet. A malleable wire inside the fur ruff may be shaped as desired for visibility or greater protection of the head and face. Unit commanders must enforce "hood discipline," especially while men are on sentry duty or on patrols. The winter hood and the cold weather cap with flaps down will greatly reduce a man's hearing capabilities. When the temperature or wind does not require the use of heavier headgear, the cold weather cap and the lightweight hood should be worn. Hoods should be removed before the head starts to perspire. Breathing into the winter hood causes moisture and frost to accumulate and should be avoided as much as possible. Accumulated frost should be removed frequently.

(5) Handwear. See *c* below.

(6) Footwear. See *d* below.

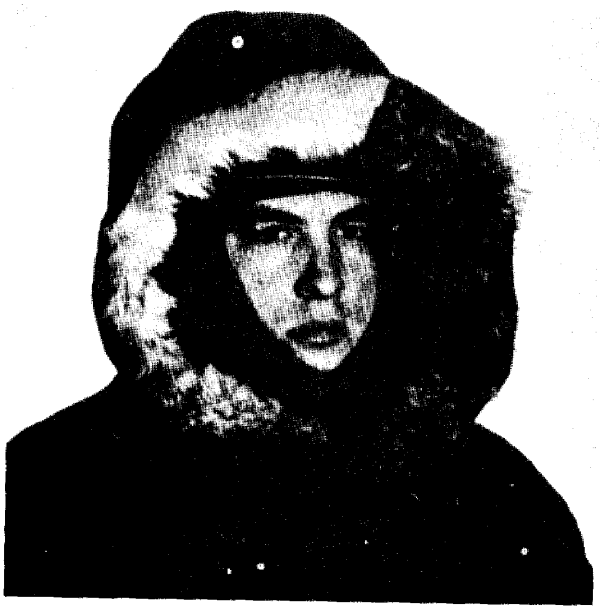


Figure 2–4. Winter hood.

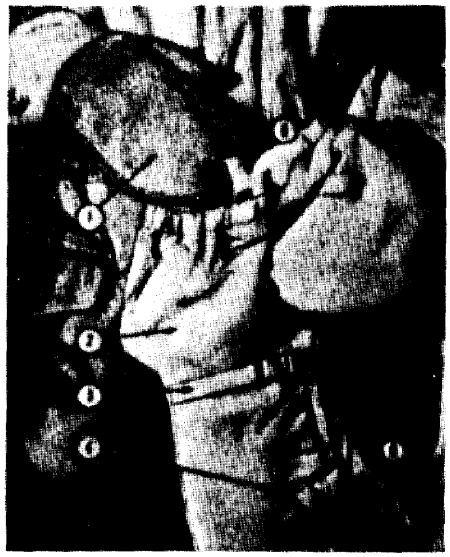
b. Cold-Dry.

(1) Inner Layer. Same as cold-wet.

(2) Intermediate Layer. The wool OG shirt is worn as the basic upper body garment. The wind resistant sateen trousers with the quilted nylon liner are worn as the basic lower body garment. In extreme cold weather, the coat with detachable liner, used as an outer layer in the cold-wet uniform, may be worn as an intermediate layer in cold-dry conditions.

1 Wool insert 2 Leather shell

Figure 2–5. Types of gloves and mittens.



Mitten insert 4 Trigger finger loop
Mitten shell 5 Trigger finger
Adjustable wrist strap 6 Cord loop

Figure 2–5—Continued.

Mitten insert 4 Snap fastener
Mitten shell 5 Cord loop
Adjustable gauntlet strap

(8) Outer Layer. Depending on temperature the outer garment may consist of the coat with detachable liner, the parka, with detachable liner, or both,

The parka is a three-quarter length, unlined coat with adjustable cuffs. It has a combination slide and snap fastener front fly closure, waist and hem drawcords and a split lower back. The parka has a detachable quilted nylon liner.

(4) Headgear. Same as cold-wet.

(5) Handwear. See *c* below.

(6) Footwear. See d below.

c. Handwear.

(1) *Gloves.*

(a) Standard black leather gloves are worn in mild weather or when work must be done that requires more freedom of finger movement than can be acquired with heavier handwear. In colder weather the same gloves are worn with wool inserts (fig. 2-5). Gloves may be worn with either the cold-wet or cold-dry uniforms when the weather is not cold enough to require the use of mittens.

(b) Personnel engaged in delicate finger operations, such as instrument adjustment may be issued lightweight cotton work gloves. These gloves allow for finger dexterity, have leather palms, and prevent the skin from sticking to cold metal. They will provide protection against cold for only a very short period.

(2) *Mittens.*

(a) The trigger finger mitten shells (fig. 2-5), are worn with wool trigger finger inserts during periods of moderate cold. The mittens may be worn with either the cold-wet or cold-dry uniform. Figure 2-5 shows the Standard B mitten. The Standard A item, although identical in outward appearance has had the trigger finger loop deleted and is lined on the inside upper surface with lightweight quilted nylon.

(b) During periods of extreme cold the arctic mitten set is worn (fig. 2-5). The mitten has a liner, a leather palm, a cheek warmer and a fastener on the back. A neck strap is attached to both mittens to prevent loss. The neck strap permits the mittens, when not required for warmth, to be conveniently carried snapped together behind the back. The arctic mitten set is carried whenever there is the possibility of the onset of severe cold weather, regardless of the mildness of the weather when setting out.

(3) Utilization.

(a) The general rules concerning the use of clothing apply also to handwear—keep it clean, avoid overheating, wear loose in layers, and keep it dry.

(b) The outer shells should always be worn with the minimum insulation necessary to provide protection, thus avoiding perspiration. Inserts should never be worn by themselves because they wear out quickly and provide little warmth alone. Trigger finger inserts are designed to fit either hand. Changing them to opposite hands frequently will insure even wear.

(c) Tight fitting sleeves should be avoided. They may cut down circulation and cause hands to become cold.

(d) When handling cold metals, the hands should be covered to prevent cold burns (immediate freezing of the flesh in contact with cold soaked metals).

(e) To keep hands warm when wearing mittens, the fingers should be curled (inside the mittens) against the palm of the hand, thumb underneath the fingers, or flexed inside the mitten whenever possible to increase the blood circulation. Hands may be exercised by swinging the arms in a vertical circle. Frostbitten hands can be warmed by placing them next to the skin under the armpits.

(f) An extra pair of mitten inserts should be carried.

d. Footwear.

(1) *General.* The feet are more vulnerable to cold than are other parts of the body. Cold attacks feet most often because they get wet easily (both externally and from perspiration) and because circulation is easily restricted. Footgear is therefore one of the most important parts of cold weather clothing.

(2) *Principles.*

(a) The rule of wearing clothing loose and in layers also applies to footgear. The layers are made up by the boot itself and by the socks. Socks are worn in graduated sizes. The instructions pertaining to fitting of footgear, as outlined in TM 10-228, must be carefully adhered to. If blood circulation is restricted, the feet will be cold. Socks, worn too tightly, might easily mean freezing of the feet. For the same reason: AVOID LACING FOOTGEAR TIGHTLY.

(b) Since the feet perspire more readily than any other part of the body, the rules about avoiding overheating and keeping dry are difficult to follow. Footgear is subjected to becoming wet more often than are other items of equipment. The insulated boots with release valve (white, cold-dry and black, cold-wet) are designed to contain perspiration within the interior of the boots. A change of dry socks should be carried at all times. Whenever the feet get wet, dry as soon as possible and put on a pair of dry socks. Also, the inside of the boots should be wiped as dry as possible.

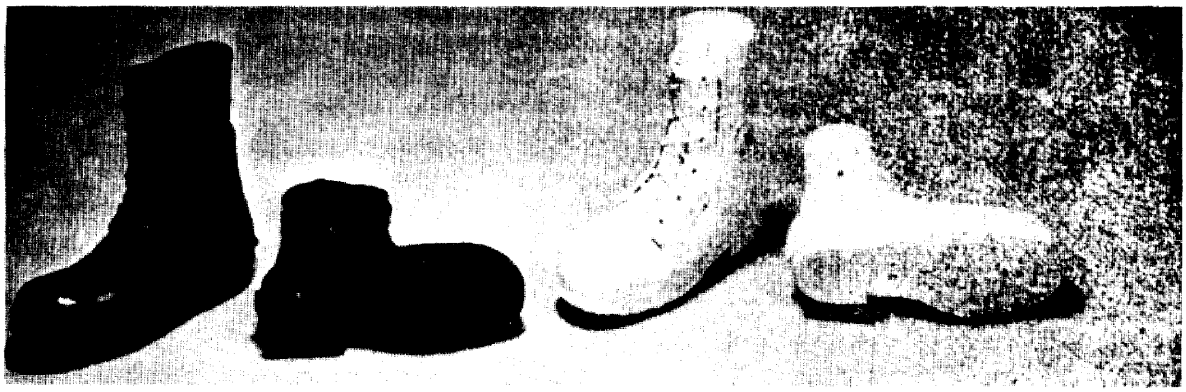
(c) Footgear should be kept clean. Socks should be changed when they become dirty. Socks and feet should be washed frequently. This washing will help keep feet and socks in good condition.

(d) The feet should be exercised. Stamping the feet, double-timings few steps back and forth, and flexing and wiggling toes inside the boots all require muscular action, produces heat, and will help keep the feet warm. The feet should be massaged when changing the socks.

(e) Boots are designed to permit attachment to individual oversnow equipment (skis and snowshoes). BINDINGS MUST BE ADJUSTED CAREFULLY. If they are too tight, the circulation of blood is restricted and feet will get cold. Improperly adjusted bindings may soon chafe feet or badly wear and tear the boot.

(3) *Types.*

(a) Boot, insulated, cold weather: mens, rubber, black. These boots (l, fig. 2-6) are particularly useful in snow, slush, mud, and water (cold-wet conditions), but are not adequate for prolonged wear in temperatures below –20° F. They are specifically designed for combat personnel who may not have the opportunity to frequently change to dry socks. Insulating material is hermetically sealed into the sides and bottoms of the boots. The insulation takes the place of removable innersoles and the secondary layer of socks worn in other types of cold weather boots. Perspiration from the feet and water spilling over the tops of the boots cannot reach the insulating material because it is sealed-in and always remains dry. Moisture from outside sources or from perspiration may make the socks damp; this dampness is not harmful to the feet, provided they receive proper care such as frequent drying and massaging. If socks are not changed and feet dried regularly (at least twice daily) the skin becomes softened and is more readily chaffed or blistered. These effects are occasionally mistaken for superficial frostbite. *Only one pair of cushion-sole socks* are worn with



1. Boot, insulated, black 2. Boot, insulated, white, w/release valve

Figure 2–6. Types of boots.

the boots. Additional socks should not be worn as the feet may become cramped, resulting in restricted blood circulation and cold feet.

(b) *Boot, insulated, cold weather: mens, rubber, white, w/release valve.* The insulated white boot (2, fig. 2–6) is designed for wear in cold-dry conditions and will protect the feet in temperatures as low as –60° F. The boots have a seamless inner and outer carcass, sealed insulation, and an outside air release valve used to compensate for air differentials. The white boots are worn over *one pair of cushion sole socks.* The air release valve provides airborne troops a means of equalizing external and internal air pressures when undergoing extreme changes in altitude. This valve must remain closed at all other times to prevent the possibility of introducing any amount of moisture into the insulation of the boot and rendering it permanently unserviceable.

2-9. Nose and Cheek Protectors and Masks

a. The Mask, Cold Weather may be issued for use during severe windchill conditions. The mask *must* be removed at intervals to check for frostbite.

b. A certain amount of protection can be gained by covering as much of the face as possible with a wool scarf. It may be adjusted from time to time, and should be rotated when the section opposite the mouth and nose becomes covered with frost. The frozen end should be left outside the coat or parka. The scarf, like the mask, *must* be removed at intervals to check for frostbite.

2-10. Camouflage Clothing

a. Winter camouflage clothing (overwhites) consists of white trousers and lightweight parka with hood. White covers are also issued for the rucksacks.

b. Camouflage clothing provides a means of concealment and camouflage from the enemy —both from the ground and from the air- in winter conditions. Use of the white camouflage clothing is, however, dependent on the background; generally speaking, on vegetation and the amount of snow on the ground. The complete white suit (fig. 6-26) is worn when terrain is covered with snow. Mixed clothing (fig. 6-27)—white parka and dark trousers, or vice versa—is used against mottled back

grounds. The correct use of camouflage clothing is extremely important (para 6-22).

c. Overwhites may become frosty and icy after use. As with all clothing, the frost and ice must be removed to expedite drying. Soiled camouflage clothing will lose its effectiveness; therefore, care must be exercised when handling stoves, digging in ground, and performing similar tasks. Avoid scorching or burning the garments when drying or when lying down by an open fire. The clothing should be washed or changed frequently. When changing, clothing should be checked to insure that it fits over the basic garments without restricting movement.

2-11. Maintenance of Clothing and Equipment

a. Footgear.

(1) Boots. The leather in boots should be treated with approved agents. Normally, the insulated boot can be repaired with ordinary tire patching or air mattress patching material. If these items are not readily available, friction tape or even chewing gum may be used temporarily to plug up the hole and prevent moisture from damaging the insulation. If the damage cannot be repaired, the boots should be removed, airdried, and turned in for replacement as soon as possible. The inside of the boots should be washed at least once a month with a mild soap, and rinsed with warm water.

Caution: **Do not clean with abrasive materials. Also do not apply polish or paint to any part of the boot as it will result in deterioration of the rubber.**

(2) Socks. Socks should be washed daily, using lukewarm water to avoid excessive shrinkage. After washing, they should be wrung out and stretched to natural shape before drying. Holes in socks should be repaired as soon as possible, taking special precautions to avoid bunching or roughness of the mended area. It should be noted that proper repairs under field conditions are almost impossible and that blisters should be expected if field mended socks are worn.

b. Handgear. Holes should be mended promptly. Gloves or mittens should not be dried too near an open fire.

c. Headgear. Headgear should be washed as required to remove perspiration, dirt, and hair oils. When drying, normal care must be exercised to avoid scorching or burning.

SECTION III. EQUIPMENT

2-12. Sleeping Equipment

a. The complete sleeping bag for use in cold climates consists of three parts: a case, of water-repellent material; an inner bag (mountain type), of quilted tubular construction, filled with a mixture of down and feathers; and an outer bag (arctic bag), of the same material as the inner bag. In addition, an insulating air mattress and a waterproof bag into which the sleeping bags are packed are issued.

b. When temperatures are normally above 14° F., only one bag is used. It is placed in and laced to the cover. When temperatures are below 14° F., both bags are used. The inner bag is placed inside the outer bag and secured at the foot with the loops and tie straps provided and the cover laced over the outer bag.

c. When the bag is used, it is first fluffed up so that the down and feather insulation is evenly distributed in channels, thus preventing matting. Since cold penetrates from below, and the insulation inherent in the bag is compressed by the weight of the body, additional insulation is placed under the bag whenever possible. Added insulation can be obtained by placing ponchos, extra clothing, backboards, fiber ammunition or food containers, or boughs between the sleeping bag and the ground. The insertion of a waterproof cover, such as a poncho, between the sleeping bag and air mattress will prevent the mattress and bag from freezing together at very cold

temperatures. This is caused by condensation on the mattress due to the difference in temperatures between the lower side touching the ground and the upper side touching the relatively warm sleeping bag. Care must be taken to prevent puncturing the mattress or damaging sleeping bags. In general, the more insulation between the sleeping bag and the ground, the warmer the body.

d. If the tactical situation permits, individuals should avoid wearing too many clothes in the sleeping bag. When too many clothes are worn they tend to bunch up, especially at the shoulders, thereby restricting circulation and inducing cold. Too many clothes also increase the bulk and place tension upon the bag, thus decreasing the size of the insulating airspaces between layers and reducing the efficiency of the insulation. In addition, too many clothes may cause the soldier to perspire and result in excessive moisture accumulating in the bag, a condition which will likewise reduce the bag's insulating qualities.

e. The sleeping bag is equipped with a full length slide fastener which has a free running, nonlocking slider. In an emergency, the bag can be opened quickly by grasping both sides of the opening near the top of the slide fastener and pulling the fastener apart. As a safety precaution, bags should be tested at frequent intervals to insure that the slide fastener operates freely and will function properly.

f. The sleeping bag should be kept clean and dry. It should be opened wide and ventilated after use to dry out the moisture that accumulates from the body. Whenever possible, it should be sunned or aired in the open. The bag always should be laced in its water-repellent case and carried in the waterproof bag to prevent snow from getting on it. The warmth of the body could melt the snow during the night and cause extreme discomfort. Individuals should avoid breathing into the bag. If the face becomes too cold it should be covered with an item of clothing. Sleeping bags should be drycleaned at least twice a year. As a safety precaution, bags should be thoroughly aired prior to use to prevent possible asphyxiation from entrapped drycleaning solvent fumes.

2-13. Manpack Equipment

a. Rucksack-Nylon, OG 106 (fig. 2-7).

(1) The nylon rucksack consists of the following:

(a) A lightweight aluminum alloy frame to which all other components are attached.

(b) A lightweight aluminum alloy cargo support shelf provided as optional equipment for attachment to the frame when the frame is used as a packboard.

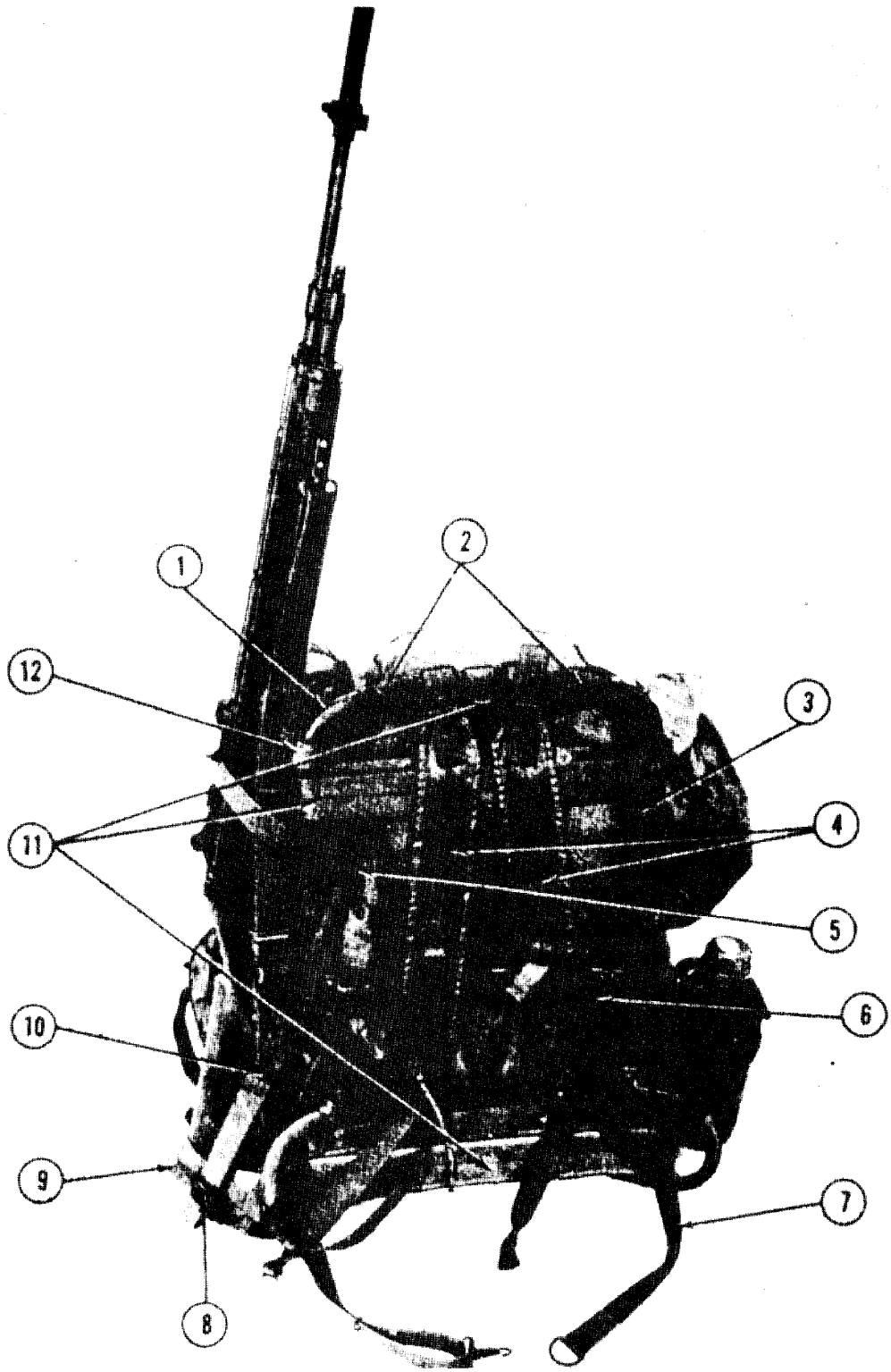
(c) A pouch fabricated from 4-ounce nylon fabric.

(d) Nylon left and right shoulder straps. The left shoulder strap has a quick-release device designed to facilitate rapid doffing of the rucksack. The right shoulder strap has a rapid adjustment buckle for lengthening the strap which allows the wearer to fire his rifle while in the prone position. The two straps are interchangeable to accommodate left-handed soldiers.

(e) A nylon webbing waist belt designed to prevent the rucksack from swinging to either side or bouncing during body movements.

(f) A rifle carrier consisting of a rifle butt pocket, constructed of nylon webbing, with a double hook and a rifle strap.

(2) The nylon rucksack is the normal pack equipment used for operations in northern areas and replaces the rucksack, with frame (Standard C). It should be noted that this item may be issued in lieu of the nylon rucksack. It should also be noted that the plywood packboard may be issued in lieu of the nylon rucksack. The soldier using the rucksack can carry extra clothing and rations in the nylon pouch and can also carry one sleeping bag (in waterproof bag). When the nylon pouch is removed and cargo support shelf attached, the rucksack may be used as a packboard for carrying loads weighing approximately 50 pounds (TC 10-8).



1 Top horizontal bar
2 Cargo straps
3 Frame
4 Shoulder straps
5 Rifle strap bracket
6 Combat pack
7 Waist strap
8 Rifle strap buckle
9 Rifle butt pocket
10 Rifle strap
11 Back straps
12 Rifle strap loop end

Figure 2-7. Rucksack nylon OG 106.

b. Suspenders and Belt, Individual Equipment. The suspenders and belt of the M-56 standard load-carrying equipment is worn beneath the nylon rucksack to carry ammunition pouches, first aid or compass case, and the entrenching tool. The suspenders and belt should be adjusted to fit loosely over the cold weather clothing, to allow for proper ventilation. The suspender belt combination is designed so that the belt can be worn unbuckled while on the march, if additional ventilation is required.

2-14. Miscellaneous Equipment

a. Sunglasses, Sunglasses always should be worn on bright days when the ground is covered with snow. They are designed to protect the eyes against sunglare and blowing snow. If not used, snow blindness may result. They should be used when the sun is shining through fog or clouds, A bright, cloudy day is deceptive and can be as dangerous to the eyes as a day of brilliant sunshine. The sunglasses should be worn to shade the eyes from the rays of the sun that are reflected by the snow. Snow blindness is similar to sunburn, in that a deep burn may be received before discomfort is felt. To prevent snow blindness, sunglasses must be used from the start of exposure. Waiting for the appearance of discomfort is too late. The risk of snow blindness is increased at high mountain altitudes because the clear air allows more of the burning rays of sunlight to penetrate the atmosphere. When not being used, they should be carried in the protective case to avoid scratching or breaking the lens. If sunglasses are lost or broken, a substitute can be improvised by cutting thin, 3 cm (l") long slits through a scrap of wood or cardboard approximately 15 cm (6") long and 3 cm (1") wide. The improvised sunglasses (fig. 2-8) can be held on the face with strips of cloth if a cord is not available.

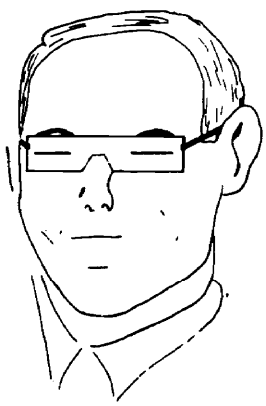


Figure 2–8. Improvised sunglasses.

b. Canteens.

(1) *Canteen, water; cold climatic* (fig. 2-9), This canteen is a vacuum-insulated canteen of one quart capacity with an unpainted dull finish steel exterior. The inner and outer stainless steel vessels are welded together at the top of the neck. A nonmetallic mouthpiece at the neck prevents lips from freezing to the metal neck. A plastic cap seals and protects the mouthpiece. A nesting type metal cup with a capacity of one pint is provided for eating and drinking beverages. The canteen with cup is carried in a canvas cover which fastens to field equipment in a manner similar to the conventional canteens. Care must be taken to insure that the mouthpiece or cap are not lost. A sharp blow to the canteen may result in denting or rupture with consequent loss of insulating capabilities.

(2) Conventional metal and plastic canteens. Conventional canteens are carried in a fabric carrier; however, this will not keep the liquid in the canteen from freezing in extreme cold. When possible, the canteen should be carried in one of the pockets or wrapped in any woolen garment and packed in the rucksack. If available, warm or hot water should be placed in the canteen before starting an operation. During extreme cold the canteen should never be filled over two-thirds full. This will allow room for expansion if ice should form, and will prevent the canteen from rupturing. Insure that the gaskets are in the cap at all times. This is an important precaution and will prevent the liquid from leaking out and dampening the clothing in the ruck-

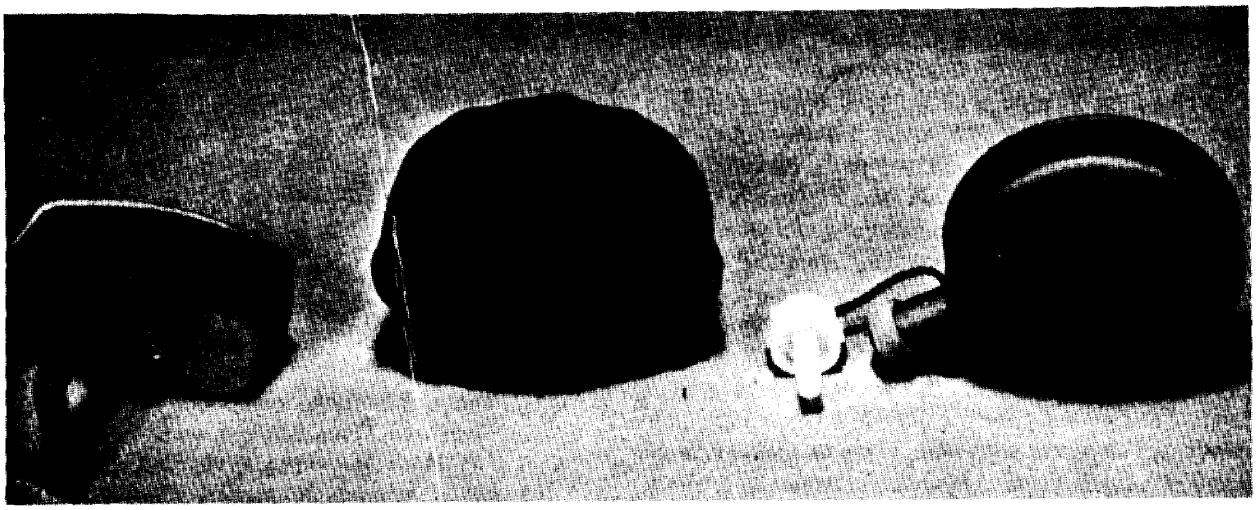


Figure 2-9. Canteen, water; cold climatic.

sack. Conventional thermos bottles will keep liquids hot, or at least unfrozen for approximately 24 hours, depending on temperatures. If canteens or thermos bottles freeze, they should be thawed out carefully to prevent bursting. The top should be opened and the contents allowed to melt slowly.

c. Pocket Equipment. There are several small items that should be carried in the pockets so they will be readily available for use. Having these items when they are needed will contribute to the well-being of individuals and help prevent injuries. A good sharp pocketknife is an essential item. It is useful for cutting branches, in shelter construction, in repairing ski bindings, and numerous other tasks. Waterproof matches should be carried and kept in the watertight matchbox and used only in an emergency. They should never be used when ordinary matches and lighters will function. Sunburn preventive cream will protect the skin from bright, direct sunshine, from sunrays reflected by the snow, and from strong winds. The chapstick will prevent lips from chapping or breaking due to cold weather or strong winds. The chapstick should be protected from freezing. The emergency thong has numerous uses, such as lashing packs, replacing broken bootlaces, and repairing ski and snowshoe bindings.

d. Emergency Kit. It is recommended that all personnel carry an emergency kit for use in individual survival. With this kit, an individual can survive off the land by trapping and fishing and can procure the minimum amount of food necessary to maintain his strength for a short period of time.

(1) 1 each emergency thong.
(2) 1 each sharp pocketknife.
(3) Single-edge razor blades.
(4) Waterproof matches.
(5) Safety pins.
(6) Fishing line.
(7) Fire starters.
(8) Salt tablets.
(9) High protein candy bars.
(10) Bouillon cubes.

2-15. Steel Helmet

The steel helmet may be worn during warm periods in cold areas in the same manner as in moderate climates. During cold periods it is normally worn over the Cap, Insulating Helmet Liner-Helmet. The helmet may also be worn under the winter hood.

2-16. Protective Mask

a. The Mask, Protective, Field, M17 is the Army standard protective mask. Information on this mask can be found in TM 3-4240-202-15. TM 3-4240-202-15, describes the winterization measures for the M17 Mask. In addition to the wearing of tinted antiglare

outserts for the plastic lenses, this kit provides for winterization inlet and nosecup valves together with an ice prefilter. This allows the standard mask to be worn at temperatures down to –50° F. with the M6A2 hood.

b. The protective mask may be worn in moderately cold weather in the same manner as in moderate climates. When the mask is used in extreme cold, the rubber facepiece should be warm enough to make it pliable when it is adjusted to the wearer's face. One method of keeping the mask warm is to carry it inside the outer garments and next to the body. It is also recommended that the mask be kept inside the sleeping bag during the night. On removing the mask, any moisture on the face should be wiped off immediately to prevent frostbite. After drying the face, the facepiece of the mask should be thoroughly dried to prevent freezing of moisture inside the mask. The rubber cover of the outlet valve should also be raised and the valve, surrounding area, and the inside of the cover wiped dry to prevent the outlet valve from icing.

c. If it becomes necessary to wear the mask for protection against chemical agents during extreme cold weather, troops must be advised that the facepiece of the protective mask will not protect the face from the cold and that, in fact, the opposite is true. The danger of frostbite increases when the mask is worn.

d. The three automatic atropine injections of 2 mg each, carried as accessories during moderate temperature conditions, are carried in a pocket of the protective mask carrier. In cold weather (40° F. and below), the injectors will be removed from the carrier and placed in the inside of the right-hand pocket of the OG shirt, where body temperature will prevent freezing.

2-17. Body Armor

Standard issue body armor may be worn with either of the cold weather uniforms. When worn with the cold-wet uniform it is worn over the OG shirt and under the coat and liner. When worn with the cold-dry uniform it is worn over the OG shirt and under the coat and liner or the parka and liner. Although the body armor is worn primarily for protection against shell and mortar fragments, it may provide additional environmental protection for the user; however, because of the weight, armor should be worn only for its primary purpose and not for additional warmth.

CHAPTER 3

SMALL UNIT LIVING

Section 1. GENERAL

3-1. Characteristics of Operations in Cold Weather

Unlimited space and a sparse, widely scattered population are dominant features of most of the colder regions of the world. Such conditions permit unrestricted maneuver for troops properly trained and equipped for cold weather operations. Warfare under such circumstances is characterized by, widely dispersed forces operating at great distances from other units or their parent organization. Units must be highly mobile and have the ability to sustain themselves while carrying out independent operations over extended periods of time.

3-2. Composition of Units

a. Small units (squad, gun crew, tank crew, wire team, etc.) form the basic working group for cold weather operations. Under normal operating conditions they will work together, cook and eat together, and share the same tent or other shelter. These small units should be formed at the beginning of training and, if possible, kept intact. The standard to be achieved is a unit which can make or break camp quickly, efficiently, and silently under all conditions; one in which each man knows the tasks to be completed and does them without having to be told.

b. Small units operating in cold weather must be thoroughly familiar with the special equipment required and the techniques involved in living away from their parent organization for extended periods of time. Equipment, and the techniques of using it, are discussed in this chapter.

Section II. TENTAGE AND OTHER EQUIPMENT

3-3. General

A considerable quantity of various types of special equipment is required to maintain small units in cold weather. Permanent shelters are usually scarce in northern areas of operations and heated shelters are required. Special tools are necessary for establishing bivouacs, breaking trails, and constructing temporary winter roads and battle positions.

3-4. Need for Shelter

a. In order to conduct successful military operations in cold weather and maintain a high level of combat efficiency and morale, heated shelter must be provided for all troops. An individual's ability to continue to work, live, move, and fight under extreme climatic conditions depends upon adequate shelter. Tents and stoves, therefore, become a vital part of cold weather equipment.

b. In cold weather, tents should be placed as close as practicable to the scene of activity, whether the activity be combat or administrative. By so placing the tents, rotation of men for warmup is possible and maximum continuity of effort can be maintained.

c. Tents vary in size and shape, depending on their purpose. Small units such as a rifle squad, artillery section, or similar type unit are normally equipped with one 10-man arctic tent. During combat, fewer tents will be needed, as part of the personnel are always on guard detail, occupying positions, or performing similar missions. It may become necessary

for the unit, temporarily, to use only one-half or one-fourth of its tentage; i.e., one 10-man tent per platoon, with the men sleeping on a rotation basis. Reduced numbers of tents and stoves will decrease the requirement for logistical support, such as fuel and transportation.

d. Elements smaller than the rifle squad (tank and SP artillery crews), which require less shelter space, are normally equipped with the 5-man tent (FM 31-71).

e. Normally, small reconnaissance patrols are not equipped with tents, as tents tend to hamper the mobility and speed of the patrol. Strong combat patrols and long-range reconnaissance patrols may be equipped with tents and stoves if sufficient transportation is available to move the extra weight. When speed is of the essence, patrols will improvise shelters built from local materials at hand. For semipermanent base camps, portable type frame shelters may be erected for increased comfort of the troops.

3-5 Description of Tentage

a. General. Tentage issued for use in cold weather is designed on the same layer principle as cold weather clothing. It is, however, made of only two layers. The outside layer is made of strong, tightly woven fabric. It is water repellent and impervious to rain and snow. The inner layer is much lighter in weight than the outer layer. The liner is fastened by toggles to the tent and provides an airspace the same as in clothing. It is designed to provide insulation against the cold. It also prevents frost from forming on the inside of the tent. Heat is provided by stoves (normally the M-1950 Yukon stove).

b. Tent, Artic, 10-Man (fig. 3-1). The six-sided, pyramidal tent, supported by a telescopic pole, normally accommodates ten men and their individual clothing and equipment. It will accommodate additional men by leaving individual packs and equipment outside the tent overnight and by lowering the telescopic pole to spread the sidewalls to cover more ground surface. It may also function as a command post, aid station, or as a small storage tent. The tent has two doors; this permits tents to be joined together, with access from one to the other, when additional space is required. A snow cloth is attached to the bottom of the sidewalls for sealing the tent to the ground. This is accomplished by piling and packing snow on the snow cloth. If the tent is used in terrain where there is no snow, sod or other materials may be used to seal the bottom of the tent. Flexible plastic screen doors are provided and may be attached front and rear of the tent for protection against insects. The tent is ventilated by four built-in ventilators on opposite sides and near the peak of the tent. Four lines are provided for drying clothing and equipment. Total weight, to include the pins and tent pole, is 76 pounds. The tent is heated by an M1950 Yukon stove.

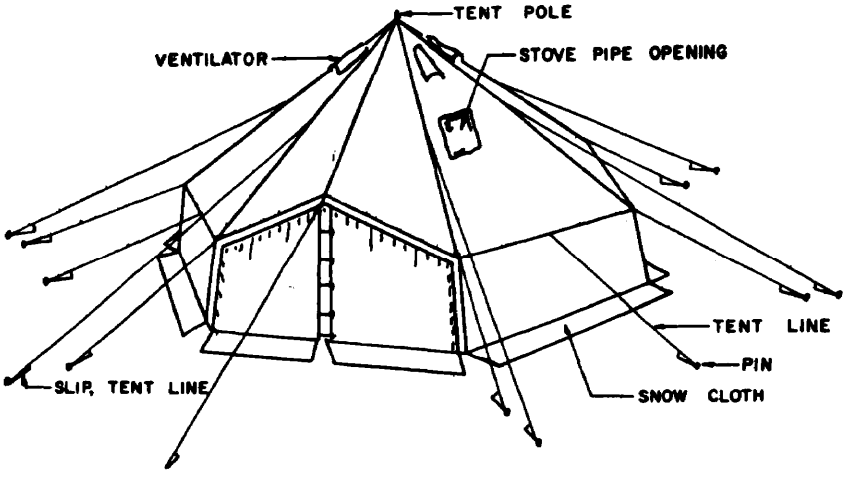


Figure 3–1. Tent, arctic, 10-man.

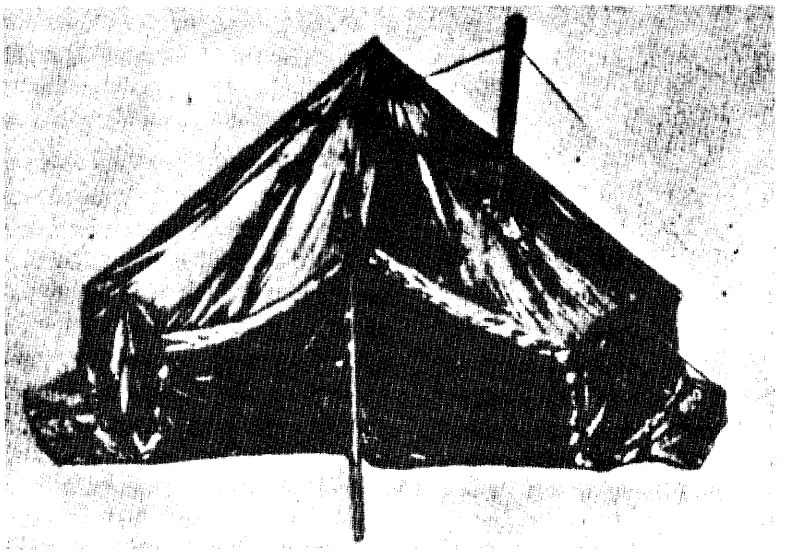


Figure 3–2. Tent, hexagonal, lightweight.

c. Tent, Hexagonal, Lightweight (fig. 3-2). This tent is also six-sided, pyramidal, and supported by a telescopic tent pole. It is designed to accommodate four to five men and their individual clothing and equipment. Under emergency conditions one tent may provide shelter for a rifle squad or other similar unit when rucksacks are placed outside the tent. The tent has one door; ventilation is provided by two built-in ventilators located on opposite sides and near the peak of the tent. Three lines are provided for drying clothing and equipment. Total weight of the tent, including the pins and center poles, is 48 pounds. The tent is heated by an M1950 Yukon stove.

d. Tent, Frame-Type, Sectional (Jamesway). This 16 by 16 frame-type tent (fig. 3-3) is a lightweight unit that offers protection for one squad. It has wooden floor units, a frame, a rounded roof, and comfortable head clearances along the centerline of the shelter. The roof and ends of the tent are fabricated from insulated, coated, fabric blankets. The structure is fastened to the ground with tent pins or snow with improvised devices. An optional vestibule may be erected at one or both ends. Additional floor sections may be added to each other lengthwise for creating larger buildings. Extra end sections may be installed along any rib as interior partitions. It weighs approximately 2,250 pounds and is heated by one tent stove M1941. The heavier weight of this tent restricts its normal use to permanent or semipermanent base camps. It could be used for forward elements under stabilized conditions.

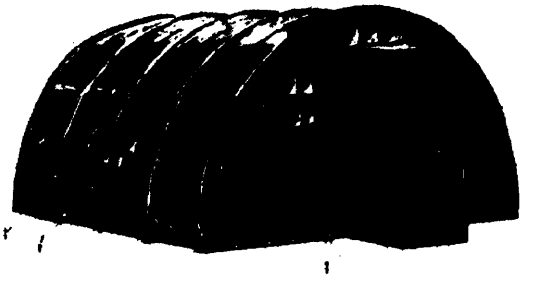


Figure 3–3. Tent, frame type, sectional.

e. Tent, General purpose, Small (fig. 3-4). This tent is a six-sided pyramidal tent fabricated of cotton duck cloth. A liner is available to insulate the tent furing cold weather. The tent is equipped with slide fastener doors, screened doors, screened ventilators, and stovepipe opening. It has a front and rear entrance, each with a lacing flap arrangement to permit attachment of the vestibule or erection of tents in tandem. The tent is supported by eight ad-

Figure 3–4. Tent, general purpose, small.

justable aluminum poles around the eave line and a standard telescopic magnesium pole at the peak. The tent is used for command posts, fire direction centers, battalion aid stations, or for any general purpose use. Although similar in appearance to the Tent, Arctic, 10-man, the tent has an eave height of 152.40 cm (60") compared to 91.44 cm (36") for the 10-man tent. The complete tent, with liner, pins and poles weighs 186 pounds.

3-6. Pitching and Striking Cold Weather Tents

a. With proper training, small troop units will be able to pitch tents in 15 to 30 minutes. Additional time will be required to complete the camouflage of the tent. Pitching and striking of the tents are performed in a routine drill manner in accordance with instructions contained in FM 20-15.

b. The following must be considered when pitching or striking the tents in snow or on frozen ground:

(1) Whenever possible snow should be cleared to the ground surface to obtain a lower silhouette and gain advantage of ground temperatures which are generally warmer than air temperatures. Coniferous boughs or similar material should then be placed on the ground for insulation and comfort. When it is impractical to remove snow to ground level, an adequate tent site may be made by packing the snow with skis or snowshoes until a firm base is provided for pitching. In this case, the tent pole is placed on a log or other suitable support to keep the pole from sinking into the snow. Support is also needed for the stove under similar conditions.

(2) In open terrain, with a strong wind, it may become necessary to build a snow wall on the windward side of the tent to protect it from the wind. The snow wall also makes it easier to heat the tent and less likely that the tent will blow down. The tent is pitched with the entrance 45° down-

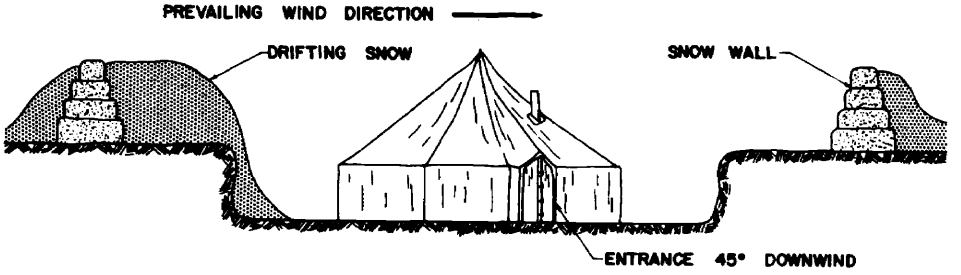
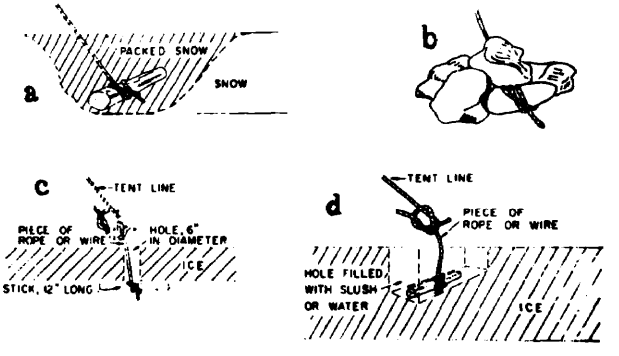


Figure 3–5. A tent dug in with snow wall windbreak.

wind (fig. 3-5). Variable winds may require construction of a windbreak at the entrance. High winds in certain cold areas necessitate anchoring the tent securely. When the tent is set up, the snow cloth should be flat on the ground outside the tent. Stones, logs, or other heavy objects should be placed on the snow cloth in addition to the snow to assist in anchoring the tent. If this is not done, the tent will be drafty and very difficult to keep warm.

(3) Tents may be pitched rapidly and anchored securely by attaching the tent lines to trees, branches, logs or stumps whenever possible. If these natural anchors are not available, suitable holes are dug into the snow for the purpose of using "deadmen." This is accomplished by digging a hole into the snow large enough to insert a pole or log approximately one meter (3') long with the tent line attached. The hole is then filled with snow, well packed, and in a short period of time the packed snow freezes and the tent will be securely anchored (a, fig. 3-6). Driving metal pins into frozen or rocky ground should be avoided when excessive force is required. On rocky ground, tent lines may be tied around heavy rocks and then weighted down with other stones (b, fig. 3-6).

(4) Tents are also occasionally pitched on ice. When the thickness of the ice is not excessive, a small hole is chopped through the ice. A short stick or pole with a piece of rope or wire tied in the middle of it is pushed through and then turned across the hole underneath the ice (c, fig. 3-6). If the ice is very thick a hole 30 to 60 cm (1' to 2') deep is cut in it, the "deadman" inserted and the hole filled with slush or water (d, fig, 3-6). When the slush or water is frozen, an excellent anchor point is provided. When the "deadman" is placed underneath or into the ice, a piece of rope or wire should be fastened to the rope or wire after the "deadman" is secure. This may prevent the tent line from being accidentally cut or damaged when being removed from the ice.



a. "Deadman" buried in packed snow
b. Tent line buried under stones
c. Lowering anchor through ice
d. "Deadman" placed in thick ice

Figure 3–6. Improvised methods of anchoring tents.

(5) When striking the tent in winter it normally will be covered with snow and ice which must be removed or the tent may double in weight. Snow and ice can be removed easily by shaking the tent or by beating it with a mitten or a stick. If the snow cloth is frozen to the ground, the snow and ice around it must be carefully removed by chopping or shoveling in order to avoid damage to the material. One method of accomplishing this is to ease the shovel between the cloth and the ground and gently pry the cloth away from the ice.

c. The vestibule attached to the basic frame-type tent (Jamesway) helps reduce heat loss when the door is frequently used. The main door of the tent opens inward, and thus cannot be blocked by drifting snow if the occupants are equipped with a shovel or improvised digging equipment. However, the vestibule door opens outward and can be blocked by drifting snow during a violent storm. A safe practice is to install the vestibule only at one end facing the prevailing wind and to use no vestibule on the more leeward end where drift will probably accumulate. Rapid exit in case of fire or other emergency is then assured. Where severe winds are expected the tent should be sited crosswise to the anticipated wind direction since the curved roof tolerates the wind load better than the flat ends, and buffeting is reduced. A vestibule should not be used on a tent intended for aid station use, since a standard litter cannot negotiate the right angle turn required in the short vestibule.

3-7. Ventilation

a. Tents are pitched to protect-occupants from the elements and to provide necessary warmth and comfort. When the bottom of the arctic tent is properly sealed and the doors are zipped shut, moisture will form on the inside of the tent and accumulate on clothing and equipment, thereby causing dampness and hoarfrost. In addition, carbon monoxide, carbon dioxide, and fumes from the stoves may soon accumulate to a dangerous degree. To offset these factors, the built-in ventilators near the peak of the tent must be kept open.

b. To improve ventilation, a draft channel may be constructed by forming a pipe with green logs (fig. 3-7). The channel is buried in the floor and has an opening under the stove. The draft of the stove draws fresh air from outside the tent into the channel.

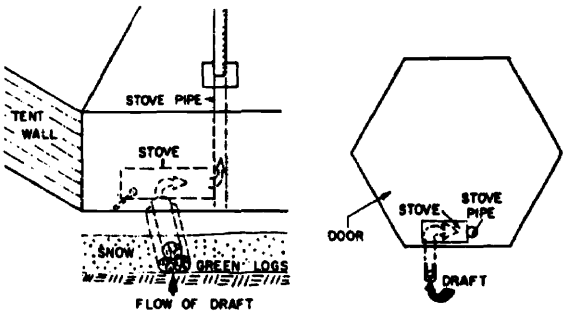
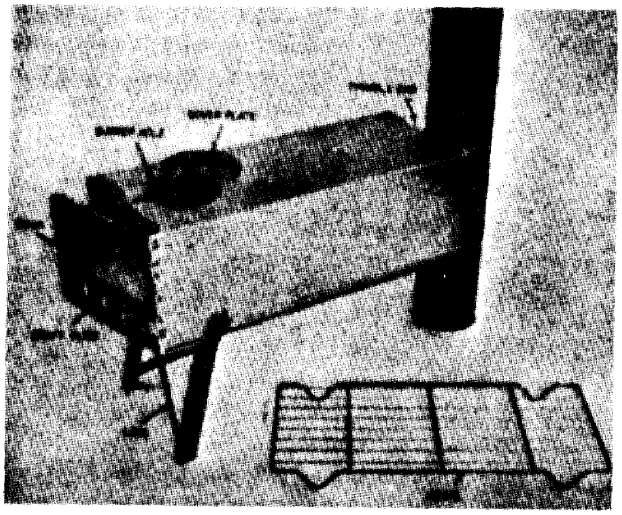


Figure 3–7. Draft channel for stove.

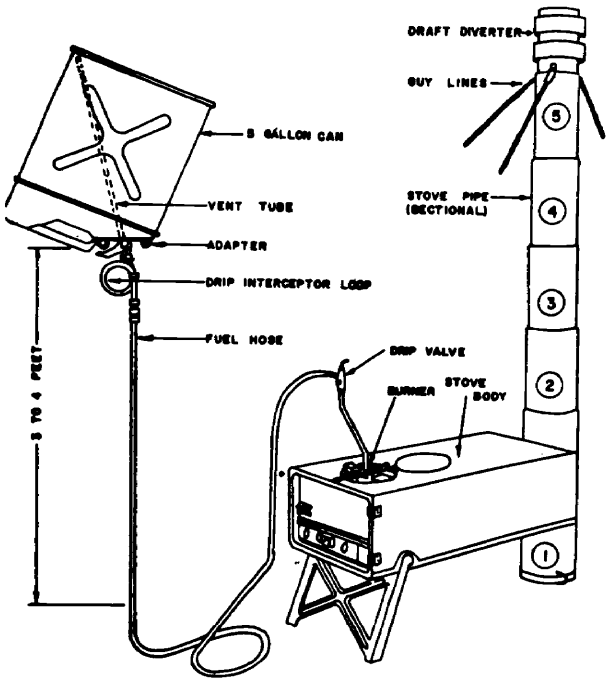
3-8. Heating Tents with Stove, Yukon, Ml950, 60,000 BTU

a. General. The Yukon stove (1, fig. 3-8) is used to heat the 10-man, 5-man, and GP Small tents. In addition to providing heat, the top surface of the stove and, to a small degree, the area beneath the stove, may be used to cook rations or heat water. The Yukon stove utilizes standard leaded motor fuel as its normal fuel, but may also be operated with white gasoline, kerosene, light fuel oil, naptha, or JP-4 fuel, without modification (2, fig. 3-8). During low temperatures the stove will burn five gallons of gasoline every 8 to 12 hours. When solid fuels (wood, coal, etc.) are used, the stove must be modified by removing the oil burner from the top of the stove, closing the opening where the burner was installed, and turning over the wire grate so that there is space below the grate for draft and ashes. A piece of plywood slightly larger than the base of the stove should be carried as part of the tent group equipment. The plywood is covered with aluminum foil and is used to provide a firm base for the stove and to prevent it from melting down into the snow.

b. Operating Procedures. The compact, lightly constructed, 33-pound Yukon stove permits all accessory parts to be packed within the stove body for convenient portability in a sled or on a packboard. A draft diverter is issued as a component part of the stove. It shields the top of the stovepipe from the wind and pre-



1 Body assembly



2 Installation setup

Figure 3–8. Stove, Yukon, M1950.

vents a backdraft from forcing smoke or gases into the stove and tent. Three, 4.5 meter (15') guylines tied to the draft diverter serve to anchor the stovepipe in strong winds. These guylines must be anchored to the tent or tent ropes, not to the ground or nearby trees. A simple method of erecting a tripod for the fuel can is to obtain three poles about 2 meters (6') in length; the poles are tied about two-thirds of the way up using wire from ration cases, string, rope, or emergency thong, and then spread out to form a tripod. The fuel can should be at least one meter (3') higher than the stove. The lowest part of the inverted gasoline can should be a minimum of 30 cm (1') above the level of the needle valve of the Yukon stove. It should not be higher than 1.50 meters (5') if the valve is to operate smoothly. If the fuel can is wobbly or if there is some wind the can must be tied to the tripod for additional protection. Make certain that the can is tilted so that air is trapped in the uppermost corner. The stove is assembled, operated, and maintained in accordance with TM 10-735.

c. Precautions. The following precautions must be observed when the Yukon stove is used:

(1) *Burning liquid fuels.*

(a) All stovepipe connections must be tight and necessary tent shields adjusted properly.

(b) Stove must be level to insure that the burner assembly will spread an even flame within the stove.

(c) The fuel hose must be protected so it cannot be pulled loose accidentally. If necessary, a small trench may be dug and the hose imbedded where it crosses the tent floor.

(d) The fuel line must not be allowed to touch the hot stove.

(e) When adjusting the fuel flow, the drip valve lever must be turned carefully to prevent damage to the threads.

(f) Rate of fuel flow must be checked at regular intervals. The rate of flow will change as fuel supply level drops and will require some adjustment. The stove should never be left unattended. Maintaining a hotter fire than necessary may cause the stove body to become overheated and warp.

(9) If the flame is accidentally extinguished, or if the fuel can is being changed, the drip valve must be closed. When the stove has cooled, any excess fuel inside the stove

must be wiped up and 2 or 3 minutes allowed for gas fumes to escape before relighting the burner. *The burner must be cool before relighting stove. If stove lit before burner is cool, the fuel will vaporize prior to ignition, causing an explosion.*

(h) All fuel supplies must be kept outside the tent. Spare cans of gasoline or other fuel should never be stored inside the tent. Fuels used in combat areas in the north are normally low temperature fuels which will flow freely.

(2) *Burning solid fuels.*

(a) Fuel should be fed a small amount at a time until the bed of coals is burning brightly.

(b) Stove should not be allowed to overheat.

(c) Oil or gasoline should not be poured on the fire.

(d) Ashes should not be allowed to accumulate below the grate.

(e) Clinkers should be removed to prevent grate from becoming blocked.

3-9. Heating of Semipermanent Tents With Tent Stove, Ml941

Stoves of this type normally are used to provide heat for the semipermanent, frame-type, sectional tent. The stove may be operated with wood or coal or with various types of oil and gasoline. This stove has the same general characteristics and safety features outlined for the Yukon stove in paragraph 3–8.

3-10. Fuel Economy

The minimum daily fuel consumption per Yukon stove approximates five gallons of gasoline per 8 to 12 hours of operation. The M1941 Tent Stove will burn five gallons in 3 to 4 hours. Prior planning must be accomplished to reduce the number of stoves required, especially for operations that are some distance from a road net. Wood should be used as fuel whenever possible. Cooking and heating are combined and, when extra heat is required to dry clothes, all individuals should dry clothes at the same time, when possible.

3-11. Lighting Tents

Candles will provide light in forward areas. In rear areas, gasoline lanterns or lighting equipment sets may be used.

3-12. Tools

a. Handtools are needed by small units for several purposes such as erection and striking the tent, building ski and weapon racks, building field latrines, chopping firewood, etc. Tools are also needed for trailbreaking, preparation of positions, and similar tasks. Because entrenching tools are lightly constructed, they are of little value for work in heavy timber or frozen ground. The following tools are needed by squad sized units to accomplish routine tasks in cold regions, regardless of the season of the year:

(1) One axe, chopping.
(2) One saw (Buck or Swede).
(3) Two machetes with sheaths.
(4) One shovel, general purpose.

b. Tools must be kept sharp, clean, oiled and in good condition. Care must be taken to preclude small tools and items of equipment from being left in the snow or thrown aside where they may become buried and lost in the snow. Particular care must be exercised while wearing gloves because ice or frost may form on the gloves and cause the tools to slip from the users hands, resulting in injury to nearby personnel and/or loss of equipment.

Section III. IMPROVISED SHELTERS

3-13. Requirement for Improvised Shelters

a. There are many occasions when tents or other regular shelters are not available. In summer, if the weather is mild, individuals may need protection only from insects. In winter, however, individuals cannot stay in the open for long periods unless they are moving. The requirement for improvised shelters may arise for several reasons, e.g., vehicles carrying tents may be unable to reach the troops due to difficult terrain or enemy action. In case of emergency, each individual must know how to protect himself from the effects of the weather.

b. If suitable natural shelters such as caves or rock shelves are available, they should be used. If natural shelters are not available, a temporary improvised shelter must be established.

c. The type of improvised shelter to be built depends on the equipment and materials available By the proper use of materials available, some sort of shelter can be built during any season of the year. In open terrain a shelter can be built using ponchos, canvas, snowblocks, or other materials. Snow caves, snow trenches, or snow holes may be constructed in the winter if the snow is both deep and well-compacted. In the woods, a lean-to is normally preferable to other types of shelter. In northern areas, nature provides the individual with the means to prepare a shelter. His comfort, however, greatly depends on his initiative and skill at improvising.

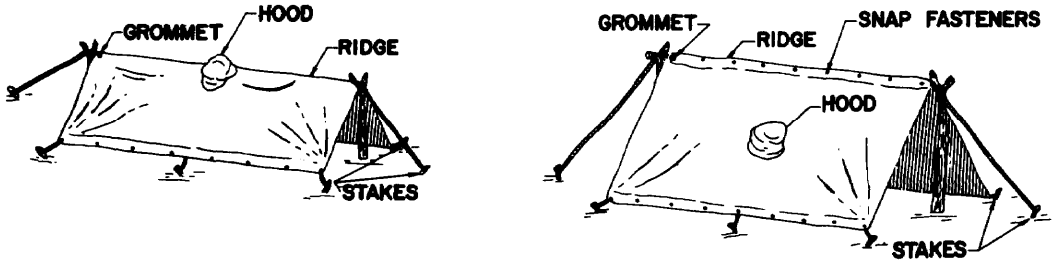
d. A shelter should always provide adequate protection from the elements, retain heat, have suitable ventilation, and provide drying facilities.

3-14. Poncho Shelters

A poncho is a part of an individual's uniform. It is a multipurpose piece of equipment that may be used as a rain garment, a waterproof bedcover, a ground sheet, or a shelter. The simplest type of shelter can be made by merely pulling the poncho over the sleeping bag. For additional comfort, various types of shelters and lean-tos may be made by attaching ponchos to trees, tree branches or poles.

a. One-Man Shelter. A one-man shelter (fig. 3-9) may be made from one poncho. The poncho is spread, hood side up, on the ground, and the hood opening is tightly closed by adjusting and typing the hood drawstrings. The poncho is raised at the middle of its short dimension to form a ridge, and then staked out at the corners and sides. Side stakes should not be driven through the grommets at the corners or sides, because this may tear the poncho. A short piece of rope is tied to the grommets and, in turn, to the stakes. Snow, sod, or boughs are used to seal two sides and one end of the shelter to provide additional protection from the wind and to retain heat inside the shelter.

b. Two-Man Shelter. To construct a two-man shelter (fig. 3-9), ponchos are spread on the ground, hood side up, with the long sides together so that the snap fastener studs of one poncho may be fastened to the snap fastener sockets of the other poncho. Hood openings must be tightly closed by adjusting and tying the hood drawstrings. Ponchos are raised where they are joined to form a ridge; ropes are then attached to grommets at the ends of the ridge and run over forked sticks. The shelter tent is then staked out at the corners and sides, as described in *a* above. A third poncho may be snapped into the other ponchos to form a ground cloth.



1. ONE – MAN SHELTER

2. TWO – MAN SHELTER

Figure 3–9. Poncho shelters.

3-15. Lean-To

a. Materials. The lean-to shelter, used in forested areas, is constructed of trees and tree limbs. String or wire helps in the building, but is not necessary. A poncho, a piece of canvas, tarpaulin, or a parachute, in addition to the baughs, may be used for covering.

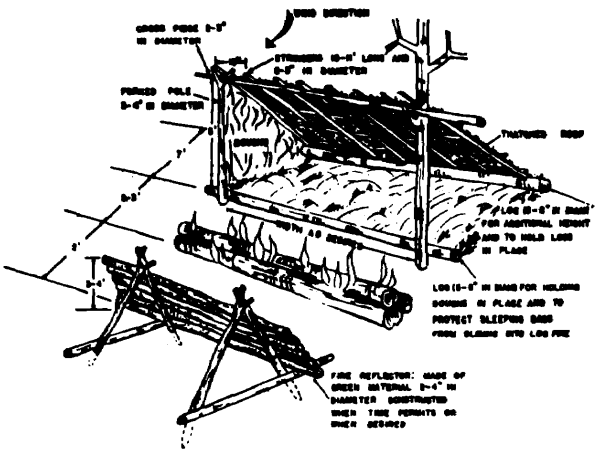


Figure 3–10. Single lean-to.

b. Size. The lean-to is made to accommodate a variable number of individuals. It may be built for one man only, teams, gun crews, patrols, or similar small groups. From a practical point of view, a rifle squad is the largest element to be sheltered in one double lean-to.

c. Types. Depending on the number of individuals to be sheltered, two types of lean-tos, single and double, are used.

d. Construction.

(1) Single lean-to (fig. 3-10). To save time and energy, two trees of appropriate distance apart, and sturdy enough to support the crosspiece approximately 1.50 meters (5') off the ground, are selected when operating in forested areas. It may be necessary to cut two forked poles of desired height, or construct two A-frames to hold the crosspieces, or use a combination of these supports when bivouacking in sparse wooded or semi-open areas. A large log is then placed to the rear of the lean-to for added height. Other methods that may be used are packing the snow down or using snowblocks instead of a heavy log. Stringers approximately 3 meters (10') long and 5 to 8 centimeters (2" to 3") in diameter are then placed, approximately 46 cm (18") apart, from the crosspiece over the top of the log in the rear of the shelter. Material such as cardboard, canvas or ponchos may be placed over the framework to preclude falling or melting snow, warmed by the fire, from dropping through. One or both sides of the lean-to and the roof are then thatched.

(2) Double lean-to (fig. 3-11). Two single lean-tos are built facing each other and approximately 1.50 to 2 meters (5' to 6') apart. The space between single lean-tos must be sufficient to permit the occupants to move freely around the log fire placed along the centerline of this space and to allow the smoke to get out through the opening instead of gathering under the roofing. If desired, one end of the middle space may be covered by a wall made of boughs or other materials for additional protection from the draft and wind.

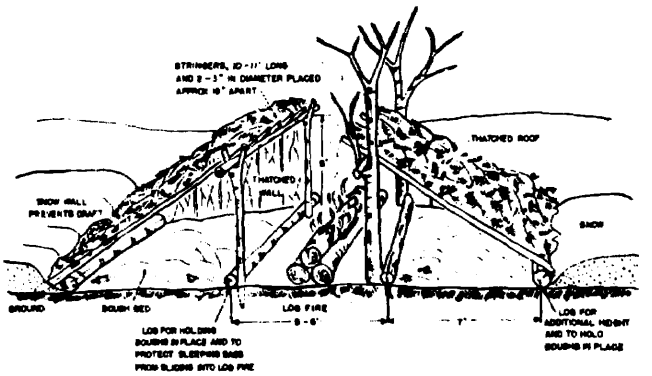


Figure 3–11. Double lean-to.

e. Heating. In heating a lean-to, any kind of oven fire may be used. The best type for large size lean-tos, however, is the log fire, so the heat will be evenly distributed over the entire length of the lean-to, see paragraph 3-21 *d.* In employing open fires for heating, precautions must be taken to prevent the fire from burning

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too hot and burning down the shelter or setting the roof on the with sparks.

3-16. Tree Shelter

a. Tree-Pit Shelter. In wooded areas, the deep snow and tree-pit shelter (fig. 3-12) furnishes temporary protection. To construct a tree-pit shelter a large tree is selected with thick lower branches and surrounded with deep snow. The snow is shaken from the lower branches and the natural pit is enlarged around the trunk of the tree. The walls and floor are then lined with branches and the roof thickened. Canvas or other material on hand may be used for the roof.

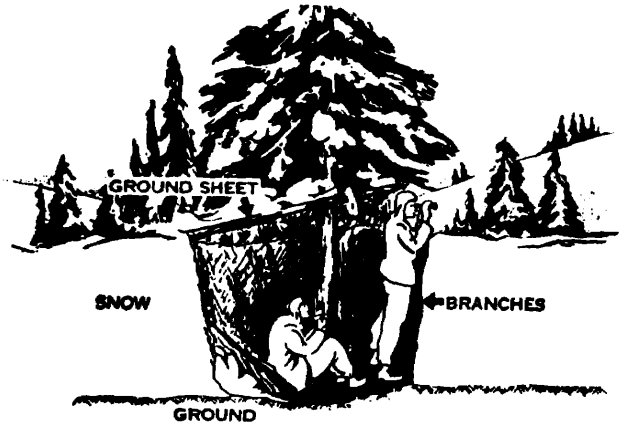


Figure 3–12. Tree-pit shelter.

b. Fallen Tree Shelter. An emergency shelter for one man can be constructed by cutting down a coniferous tree at a point about one meter (3') from the ground. The underside is trimmed and the cut material placed on the ground to provide insulation. This shelter will provide some protection from the elements for a man in his sleeping bag. Another way to build this shelter is to tie a pole to a tree and drape a poncho or similar material over the pole.

3-17. Wigwam

A conventional wigwam or tepee can be built in wooded areas by typing a number of poles near the top and spreading them at the bottom to form a large circle. This framework is then covered with available tree boughs, canvas, cardboard, or other suitable material.

3-18. Snow Wall

In open terrain with snow and ice, a snow wall (fig. *3-13)* may be constructed for protection from strong winds. Blocks of compact snow or ice are used to form a windbreak.

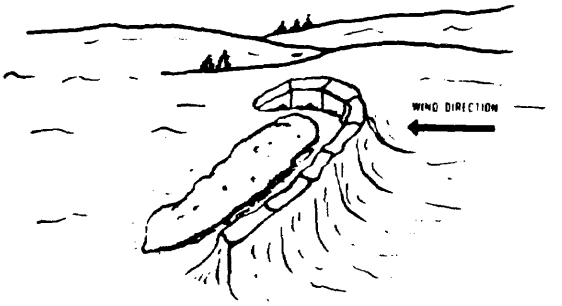
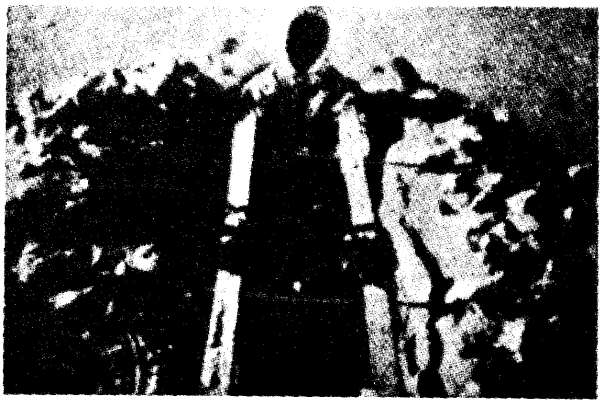


Figure 3–13. Sleeping behind snow wall.

3-19. Snow Hole

A snow hole (fig. 3-14) provides shelter quickly. It is constructed by burrowing into a



1 Snow hole partially constructed.

2 Snow hole completed.

Figure 3–14. Snow hole.

snowdrift or by digging a trench in the snow and making a roof of ponchos and ice or snow-blocks supported by skis, ski poles or snow-shoes. A sled provides excellent insulation for the sleeping bag. Boughs, if available, can be used for covering the roof and for the bed.

3-20. Snow Cave

a. Location. A snow cave (figs. 3-15 and 3-16) can be used as an improvised shelter in the open areas where deep and compacted snow is available. Normally, a suitable site is located on the lee side of a steep ridge or riverbank wher drifted snow accumulates in unusual depths.

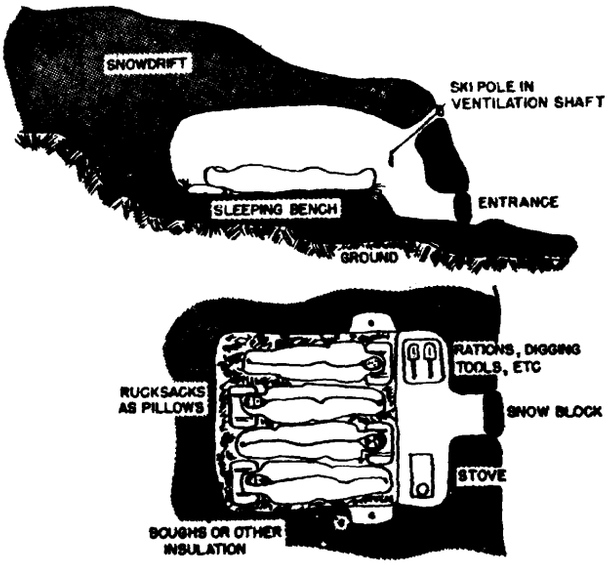
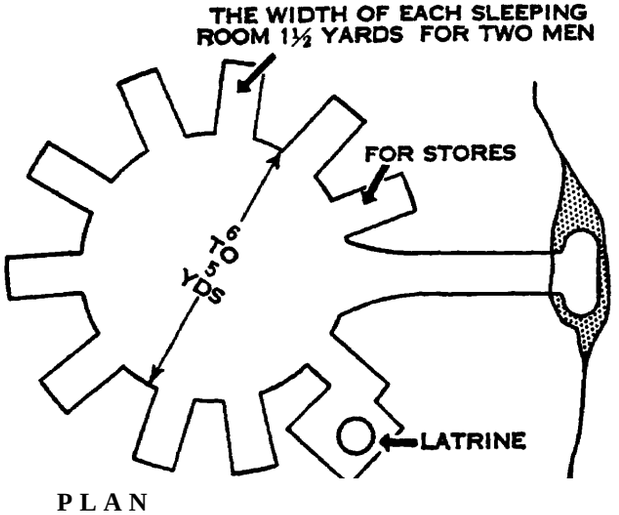


Figure 3–15. Snow cave for four men.



PLAN

Figure 3-16. Snow cave for sixteen men.

b. Basic Construction Principles. Basic principles for construction of all snow caves are as follows:

(1) The tunnel entrance must give access to the lowest level of the chamber, which is the bottom of the pit where cooking is done and equipment is stored.

(2) The snow cave must be high enough to provide comfortable sitting space.

(3) The sleeping areas must be on a higher level than the highest point of the tunnel entrance so that the rising warm air will permit the men to sleep more comfortably.

(4) The roof must be arched both for strength and so that drops of water forming on the inside will not fall on the floor, but will follow along the curved sides, glazing over the walls when frozen.

(5) The roof must be at least 30 cm (1') thick.

c. Size. The size of the snow cave depends upon the number of men expected to occupy it. A large cave is usually warmer and more practical to construct and maintain than several small caves. In good snow conditions a 16- to 20-man cave is the most practical.

d. Shape. The shape of the snow cave can be varied to suit conditions. When the main cave is built, short side tunnels are dug to make one- or two-man sleeping rooms, storage space, latrine and kitchen space.

e. Construction. The following steps should be observed in construction:

(1) A deep snowdrift at least 243 cm (8') deep is located. Newly fallen, powdery or loose snow should be avoided.

(2) The depth of a snowdrift may be tested with a sharpened sapling approximately 365 cm (12') in length, or in the absence of trees the shorter ski pole or avalanche probe (The availability of an avalanche probe is discussed in FM 31-72.)

(3) The entrance is chosen carefully so the wind will not blow into the cave or the entrance become blocked by drifting snow.
(4) A small tunnel is burrowed directly into the side of the drift for one meter (3'). A chamber is excavated from this tunnel.
(5) Excavation is done to the right and left so that the length of the chamber is at right angles to the tunnel entrance.
(6) Due to the fact that the individuals digging will become wet, they should wear the minimum amount of clothing possible to insure that they have a change of dry clothing upon completion of the task.

f. Heating and Safety Measures. The cave can be heated with the one-burner gasoline stove or with candles. The fires should be extinguished when individuals are sleeping, thus reducing the danger of fire and asphyxiation. If the weather is severe and it becomes necessary to keep a fire going while the individuals are asleep, an alert fire guard must be posted in each cave. The ventilation holes must be inspected every 2 or 3 hours to insure that they have not become clogged by snow or by icing.

g. Insulation. To insure that the cave is warm, the entrance should be blocked with a rucksack, piece of canvas, or snowblock when not in use. All available material, such as ponchos, cardboard, brush, boughs, etc., should be used for ground insulation.

h. Other Precautions. Walking on the roof may cause it to collapse. At least two ventilators, one in the door and one in the roof, are used. A ski pole can be stuck through the roof ventilator to clear it from the inside. Extra care must be exercised to keep air in the cave fresh when heating or cooking. The entrance should be marked by placing a pair of skis or other equipment upright on each side of the entry way.

3-21. Campfires

a. Matches and Fire Starters. A supply of matches in a waterproof container, heat tablets, or fire starters must be carried by all individuals operating in cold weather. They are a necessity, especially where snow and ice add to the problems of securing tinder for starting a fire. In emergencies, matches should be used sparingly and lighted candles used to start fires whenever possible, or if available, a little engine oil will help ignite wet or frozen wood without the flash hazard of the more volatile petroleum fuels. As a safety precaution, it should be remembered that fire starters are extremely inflammable and must be kept away from open flames and heat.

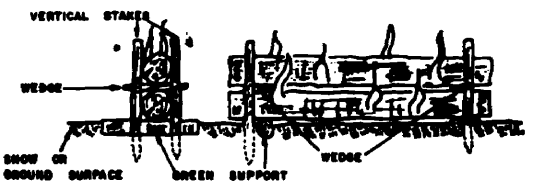
b. Selecting Site. Individuals building a fire in the field should carefully select a site where the fire is protected from the wind. Standing timber or brush makes a good windbreak in wooded areas, but in open country some form of protection must be provided. A row of snowblocks, the shelter of a ridge, or a scooped-out side of a snowdrift will serve as a windbreak on barren terrain.

c. Starting and Maintaining Fire. Before using matches, a supply of tinder must be on hand. The use of heat tablets is recommended for the safe starting of fires. In inclosed areas, gasoline or other high inflammable fire starters will not be used. In the open, and under very strict control, small quantities of gasoline may be used to start fires when other means are not available. Many types of fuel are available for fires. The driest wood is found in dead, standing trees. Fallen timber may often be wet and less suitable. In living trees, branches above snow level are the driest. Green and frozen trees are generally not suitable because they will not burn freely. Splitting green willows or birches into small pieces provides a fairly good method of starting and maintaining a fire, if no deadwood is available. Also, dry grass, birchbark, and splits of spruce bark with pitch tar are excellent fire starters. It is good practice to secure a sufficient amount of firewood to last throughout the night, before retiring.

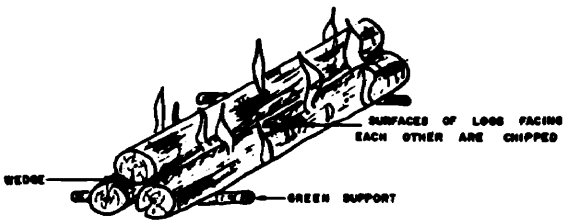
d. Types of Fire. Any kind of open fire may be used with most of the improvised shelters. In deep snow, a fire base (fig. 3-17) of green wood should be built first to protect the campfire from sinking into the snow. For a single lean-to or snow wall, afire reflector (fig. 3-10) may be built of green logs or poles to reflect the heat into the shelter and to serve as a

steadily. The most suitable types for single and double lean-tos are the log fires (fig. 3-18).

(1) Two, preferably three, logs are used for this type of campfire. Dry, hardwood logs, if possible, 20 to 40 cm (approx 1') in diameter and approximately the same length as the lean-to



1 Two-log fire

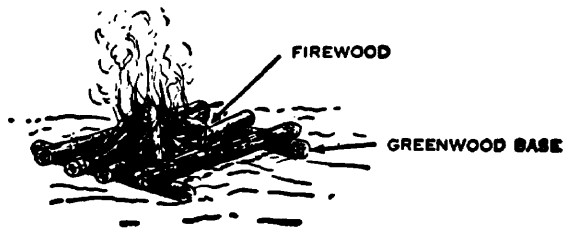


2 Three-log fire

Figure 3–18. Log fires.

are selected and brought to the fire site. First, two logs are place side by side on small green blocks to support them above the snow or ground for a better draft. Then the third log is placed in the middle and on the top of the other two logs. For better burning, the surfaces of logs which face each other are chipped. Before lighting the fire, small wedges are placed between the chipped surfaces of the logs for better draft. Fire is then started at several places to help it spread the entire length of the logs. A log fire of this type will burn all night with only minimum care.

(2) When only two logs are used, four vertical stakes must be driven into the snow to keep one log on top of the other. A disadvantage of this type of log fire is the fact that the vertical stakes tend to give way when the snow starts melting around the fire.



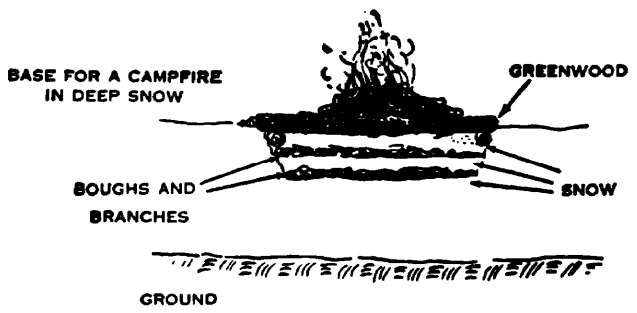


Figure 3–17. Camp fire and fire base on snow.

Section IV. FOOD AND WATER

3-22. Principles

a. Importance of Balanced Meals. Army rations are well balanced. The ration for 1 day provides all the essential foods the body requires. However, all the ration must be eaten if all the caloric value is to be obtained. Some items may, at times, not appeal to the individual sense of taste, but they must be eaten. The tendency to be lazy about preparing and eating satisfactory morning and evening meals

before and after a hard day on the trail must be avoided, since it is exceedingly detrimental to continued good health. After having been without normal supplies for a period of time, it is essential that men be provided with a balanced meal containing the three basic food requirements (fats, protein, and carbohydrates). When possible and especially when troops are involved in rigorous activity, it may be desirable to feed four times daily. A desirable feeding plan would be the normal heavy breakfast meal, a light midmorning meal, a light afternoon meal, with the supper meal being the main meal of the day. The midmorning and midafternoon meal should consist of foods high in carbohydrates and include a hot liquid. Concentrated foods found in some special and survival rations are suitable for this purpose. Hot soup or tea are most desirable for the liquid. The evening meal should be heavily fortified with protein and eaten just before going to sleep. This heavy protein meal will increase body combustion above basal level, resulting in what is known as specific dynamic heat. This increase in the output of heat within the body also aids in keeping the individual warm while sleeping. If awakened by cold a small snack eaten inside the sleeping bag may increase heat production enough to permit further comfortable sleep.

b. Importance of Liquids. In cold regions, as elsewhere, the body will not operate efficiently without adequate water. Dehydration, with its accompanying loss of efficiency, can be prevented by taking fluids with all meals, and between meals if possible (para 3–34). Hot drinks are preferable to cold drinks in low temperatures since they warm the body in addition to providing needed liquids. Alcoholic beverages should not be consumed during cold weather operations since they can actually produce a more rapid heat loss by the body.

c. Use of Mess Gear. Individual mess gear will be difficult to clean and sterilize, therefore arrangements must be made for return of dirty mess gear to the battalion trains area where it is cleaned under the supervision of the mess stewards. Clean mess gear is sent forward with subsequent meals. During periods of extreme cold, it may be advisable to utilize paper plates and cups instead of mess gear. If utilized, they should be issued with the rations and sent forward to companies with the meal. When using paper plates and cups, commanders must insure that they are not haphazardly left in the unit area. Controlled disposal must be practiced by burning at squad level or by consolidating at company level and returning them to the battalion trains area. This problem is minimized, and cooling of food is minimized, by the use of individual operational rations which may be consumed directly from their containers.

3-23. Rations

Many types of rations are used for operations in cold weather. The type of ration to be used will be determined by the location, supply situation, mission, and duration of the operation. Rations are normally prepared in the unit kitchens. Insofar as possible two hot meals per day should be served. These generally will be the breakfast and supper meals. In situations where this is not practicable, group rations are utilized and prepared by one member of the small unit. Under certain conditions an individual ration may be issued to each man. When serving meals without shelter, food may become cold or frozen before it can be eaten. Therefore, and whenever possible, shelters should be provided for the preparation and serving of food. Certain packaged rations and food packets are ideal under these circumstances because they are precooked and some components or all of the ration can be eaten without heating. However, one of the components should be heated when possible.

a. Bulk Supplied Rations. Rations of this type are desirable whenever possible. They are characterized by a need for maximum time and effort for preparation, high palatability, a large variety in menus and a high caloric content. These rations are also heavy and bulky.

(1) *"A" Ration.* The standard "A" Ration consisting of fresh foods is issued whenever possible. The caloric content of the ration is increased to compensate for the added caloric re-

quirements of cold weather operations.

(2) "B" Ration. The standard "B" Ration is the field ration used for mass feeding in areas where kitchen facilities, with the exception of refrigeration, are available. The ration consists of approximately one hundred nonperishable foods. These are canned and dehydrated. Hot meals furnish approximately 3,900 calories per day with a 15-day cycle of menus. Caloric content may be varied to meet requirements of varying climatic conditions or degree of physical activity.

b. Packaged Operational Rations. Rations found in this category are characterized by a need for minimum time and effort for preparation. They have a high caloric content, limited menus and are lightweight. Maximum advantage is taken of dehydration and concentration. They are for the most part served hot, but certain components may be consumed cold.

(1) *Ration, individual, trail, frigid.* This ration is designed for trail use under cold weather conditions. While hot meals can and are intended to be prepared from this ration, all components, except the dehydrated soups and beverages may be eaten without preparation. Components of the ration such as, processed cheese, fruitcake bars and candy are especially adaptable to consumption in mobile situations. The inclusion of several condiments enables maximum flexibility in component preparation. The ration supplies a minimum of 4,400 calories. It is intended for use by members of small patrols or trail parties for short periods of time during which resupply is not feasible.

(2) *Meal, combat, individual.* This ration is designed for and is issued as the tactical situation dictates. It can be used in individual units as a meal or in multiples of three meals as a complete ration. Twelve menus are available. Each meal furnishes approximately one-third of the minimum nutrient intake prescribed by Army regulations.

(3) *Food packet, long-range patrol.* The packet was designed for use by forces in remote areas where resupply may be uncertain for as long as 10 days, under tactical situations that require men to eat as individuals, but where normal supply of water is available. There are eight menus, all flexibly packaged. Each furnishes over 1,000 calories, and consists of a precooked, dehydrated, combination item as the main component, with a confection, a cereal, or fruitcake bar, coffee, cream, sugar, toilet paper and matches. Five menus also include cocoa beverage powder. The average volume is 40 cubic inches and the average gross weight is 11 ounces. The principal menu components are packaged in a flexible combination package attached to a chipboard base which gives the package a rigid bottom while the food is being reconstituted in the bag. The main component may be eaten dry with drinking water or reconstituted. If hot water is used the main component will reconstitute in 2 minutes, if cold water is used, in 5 minutes.

(4) *Survival rations.* Survival rations are designed for use in emergency situations. The food is highly concentrated, lightweight and requires little or no preparation. Per volume it is high in caloric content but contains much less than the minimum required nutrient prescribed by Army regulations. These rations, when available, are especially good to supplement the special rations discussed above.

3-24. Individual or Small Unit Messing

Frequently, while on patrol or during combat conditions, individuals will find it necessary to prepare their own meals or to combine rations with other individuals within the unit.

a. Equipment.

(1) The one-burner M1950 gasoline cook-

ing stove is a cooking and heating unit for a group of from 2 to 5 men operating in an isolated or forward area where the use of heavier equipment is not practical. The mountain cookset is combined with the stove to make the one-burner cooking outfit.

(2) Rations may also be heated on the M1950 Yukon stove. The top and to a small degree the area underneath the stove is used for this purpose.

(3) Any fuel-burning device will give off carbon monoxide, which is poisonous. Adequate ventilation must be provided when using fuel-burning equipment under shelter.

b. Preparation.

(1) First priority is the procurement of water (para 3-30). If snow or ice must be melted to obtain water, all available stoves are utilized for this purpose. After water is obtained, the stoves are used for food preparation. For convenience in preparation of meals and for conservation of fuel and labor, cooking should be done for as large a group as the situation permits.

(2) Meals must be prepared efficiently and as quickly as possible. Areas sheltered from the wind should be chosen for stoves or fires. A few blocks of snow or ice or a hole dug in the snow will serve as a windbreak and provide for more efficient use of fires. Heating tablets are not efficient in extremely cold weather accompanied by high winds. Individuals may have to prepare and eat one item at a time, but a hot meal will be worth the effort.

(3) Instructions for preparing the components of the rations will be found on, or inside, the package. The possibility of combining the various ration components, i.e., mixing meat and vegetables to make stew, should also be considered.

(4) Canned foods are cooked and require little heat to make them edible. Overcooking will waste fuel. The juices in canned vegetables are tasty, and contain vitamins and minerals. Drinking them will conserve the water supply. Cans must be punctured or opened before heating by open fires or stoves. Failure to do this may result in an explosion. No puncturing is needed if the can is submerged in water during the heating process.

(5) Food, including frozen meat, should be thawed before cooking. Partly frozen meats may cook on the outside while the center remains raw. Fresh meats must be cooked thoroughly to kill any germs or parasites that may be present.

(6) Whenever possible, dried fruit should be soaked overnight in cold water, then simmered slowly in the same water until tender, and sweetened to taste.

(7) Canned rations, either frozen or thawed, can best be heated by immersion in boiling water. This water can then be used for making tea, coffee, or soups and for washing soiled utensils or personal hygiene.

c. Storage.

(1) In winter the simplest way to preserve certain perishable foods such as meat products is to allow them to freeze. Rations should be stacked outside the shelter and their location carefully marked. Only as much food as can be thawed and consumed before spoiling should be brought into the shelter.

(2) Frozen food should not be placed near heat where it may be thawed and later refrozen. Once thawed, certain foods may spoil. Meat thawed and refrozen two or three times is tasteless and watery, and resultant bacterial growth may be sufficient to cause food poisoning.

d. Eating. Meals should be prepared at regular times and as much time as possible allowed

for cooking and eating. Men should be allowed to relax after each meal. There will be times when it may not be possible to prepare a meal. Under such circumstances the meal or components of meals must be distributed to individuals before breaking camp. Any frozen food is thawed before issue to individuals. These items are wrapped in spare clothing and placed in the rucksack or in the pack to prevent them from refreezing. If time permits, halts should be made for the purpose of heating food and drink. To the extent possible, preparation of the following day's food should be done during the night bivouac in order to shorten the time required to break camp in the morning.

e. Suggestions.

(1) Organize and control cooking.

(2) Insure that all food is eaten; save any usable leftovers for snacks between meals.

(3) The squad leader supervises the meals and makes sure that each man is receiving his portion.

(4) Check continuously to see that each man's mess equipment is kept clean.

(5) Food is prepared for as large a group as possible.

(6) Fuel is conserved by prethawing food. This may be done by utilizing heat in the engine compartment of a vehicle or by placing cans of food under and around the tent heating stove.

(7) Canned rations, either frozen or thawed, can best be heated by immersion in a pot of hot water on the stove. This water can then-be used for washing soiled utensils.

(8) Adequate training of all men in the preparation and cooking of cold weather rations is imperative.

(9) One-pot meals, such as stews, save preparation time and fuel and can be kept warm more easily than several different food items.

3-25. Small Unit Messing

a. One Man Responsible. One man should be responsible for the preparation of each meal and this job should be rotated throughout the squad. The squad leader is responsible for supplying any additional assistance needed by the cook.

b. Ingenuity in Cooking. Ingenuity on the part of the man assigned to cook for the small unit will aid immeasurably in the success of field messing in cold weather. Potatoes, onions, or bacon, when available, will increase the palatability of the food and can satisfactorily be added to many foods. The habit of making the morning coffee the night before, or using two stoves to melt snow or ice for the evening's water supply, and of thawing out those rations that are going to be used the next morning, will save time and greatly simplify food preparation at mealtime.

c. Eating Arrangement. When the weather is moderate, the mess line feeding system may be used. During cold weather in a bivouac area the food can be prepared hot and then carried in insulated containers to each tent for consumption in a heated shelter. Food may also be transported in this manner to frontline troops by using track vehicles or other methods of transport.

3-26. Natural Food Resources

a. In some cold regions, animals are abundant at certain seasons of the year. In other areas, very little game can be found during any season of the year. A person without food in these areas must know how to "live off the land" and subsist on what is available. Fish are present in fresh-water lakes and rivers during all seasons of the year, and some salt water near shore will normally yield fish. Fish will form the most readily available and largest portion of available nourishing foods.

b. Small animals and birds are also present in most areas at all times of the year. Large animals, because of migratory habits or other characteristics, are not a reliable source of food in many areas. Game should not be shot unless necessary for survival. Animals to be used for food should be thoroughly bled, internal organs removed, and the carcass chilled as soon as possible. This will prolong the keeping time of the meat. To expedite the

chilling clean snow can be packed in the body cavity. All meat should be cooked thoroughly as a safeguard against harmful micro-organisms and parasites that might be present in the carcass. Only healthy animals should be used; in the absence of a person qualified to determine if the animal is healthy, meat from the animals that appear sick should not be handled or eaten. For additional information, see FM 21-76.

3-27. Animals of Cold Regions

a. Caribou and Reindeer.

(1) These are mainly herd animals found in the high plateaus and mountain slopes as well as in the grassy tundra areas. Their favorite year-round food is the lichens or "reindeer moss." Their summer diet consists of grasses, shrubs, and brush tips. They are very curious animals and will often approach a hunter merely from curiosity, thus presenting a good target. Sight of a human may have no effect on them but the slightest hint of human scent will send them galloping. It is possible to attract them near enough for a shot by waving a cloth and moving slowly toward them on all fours. In shooting, the aim should be for the shoulder or neck rather than the head.

(2) Reindeer have long been domesticated in Scandinavia and northern Asia for their meat, milk, hide, and as draft animals.

(3) Both caribou and reindeer should be skinned promptly. Animal heat is the largest factor in meat spoilage. Fast and complete field dressing will eliminate most of this hazard and airing will finish the work. The bones and muscles can hold heat for as long as 48 hours, if the surrounding temperature is not below freezing. Fat should be kept with the carcass, not with the skin. If time does not allow skinning, at least the entrails and genitals should be cleaned out of the animal.

(4) A poncho may be used for wrapping the meat, whether for packing it out or if it is to be left hanging for the second trip. Meat should be raised off the ground as soon as possible because this will cool it sooner and keep it away from predators. Dirt and contamination should be washed from the meat and the meat then dried, if possible. A carcass should never be washed until it has cooled and is ready to be butchered and stored.

b. Mountain Sheep and Goats.

(1) These animals are available in many northern areas. Although they normally live in the higher elevations, during periods of heavy snow, they may be more readily available than other animals.

(2) The procedures for skinning and care of caribou and reindeer are also applicable to sheep and goats.

c. Moose.

(1) The moose is the largest known species of the deer family. They are found in most areas of the northern hemisphere. Full grown bulls weigh from 1,000 to 1,200 pounds and may stand two meters (6') high at the shoulder. They require a large amount of forage and usually may be found in areas where food of this type is plentiful, such as burn-offs, swamps, and lake areas.

(2) The procedures for the skinning and care of caribou and reindeer meat are applicable to moose.

d. Seals.

(1) Seals are widely distributed and generally common. Their flesh is an excellent food. The liver should be avoided since it may contain toxic levels of Vitamin A.

(2) The seals should be shot as they come to the surface of the water to breathe or as they are basking on rocks. The aim should be for the head. Most of the seals shot through the head will

float, while about half of those shot through the body will not. Seals will also be found in the open leads in the icepack or may be found at their breathing holes in the ice. However, hunting seals through breathing holes requires extreme patience and the holes are difficult to locate without the use of dogs.

(3) In the spring, mother seals and their pups may sometimes be located under snow hummocks adjacent to and over breathing holes, where they have given birth to their young. In the spring, also, seals lie on the ice and bask in the sun. They must be carefully stalked and the hunter must be close enough at the time he shoots to retrieve the dead seal before it slips into a hole in the ice.

(4) It takes great skill to stalk a seal. The Eskimo usually tries to imitate noises made by the seal, and he may use a white screen behind which he crawls while the seal sleeps, remaining absolutely still when the seal raises its head to look around. Seals normally sleep only for a few seconds at a time and then look around for their enemies for a few seconds before sleeping again. Seal meat from which the blubber (fat) has not been entirely removed will turn rancid in a short time.

e. Walrus. The meat and blubber (fat) of walrus are edible, as are the clams which may be found in their stomachs.

f. Bears. All bears are edible, although the flesh must be thoroughly cooked to guard against trichinosis. The liver of the polar bear should not be eaten because of toxic Vitamin A concentration. All bears are dangerous and hard to kill. There should be two or more hunters in the party when hunting; soft-nosed bullets should be used. The shoulder shot is best. If the bear stands up, the aim should be at the base and center of the throat for a shot which will sever the vertebrae.

g. Wolves and Foxes. Wolves and foxes are edible. Wolves follow caribou herds. Arctic foxes follow polar bear and eat their leavings. Foxes will hang around a camp or follow a trail party and try to steal food.

h. Rabbits or Hares. Rabbits or hares can be snared or shot. They should be shot in the head or very little meat will be left. A whistle will probably cause a running one to stop long enough for an aimed shot. When cooking hare or rabbit, fat of some sort, should be added as the meat is very lean. They should not be dressed or cut up with bare hands because of the danger of contracting tularemia (rabbit fever) from contact with the raw flesh. Completely cooked flesh is safe to handle and eat.

i. Marmots. Marmots are woodchuck-like animals that live above the treeline in the mountains. They are excellent food, especially in late summer when they are very fat. The hunter should wait until the marmot moves away from his den before shooting or he may fall into his burrow.

j. Porcupines, Beavers, and Muskrats. These animals are found throughout the colder regions. Porcupines are excellent food, as are both beaver and muskrat. All are easily obtained. The porcupine, beaver, and muskrat when found on land, can be easily killed with sticks.

k. Ground Squirrels. Ground squirrels abound in most cold areas and are easy to catch. They can be easily dug out of their burrows. They are especially common along streams with sandy banks.

3-28. Birds

All birds and their eggs found in cold regions are edible. Certain nonmigratory birds are found in cold regions in wintertime. Several species of grouse, like the ruffed, sharp tail, spruce, and ptarmigan (which turn white in winter) are common. To obtain the greatest food value from birds, they should be plucked rather than skinned.

3-29. Fish

Fish form a large part of the native diet in cold regions and are almost the entire diet of work dogs in these areas. Along the coast, salmon, tomcod, flounder, sculpin, sand sharks,

herring and other fish are found. Inland waters yield salmon, several varieties of whitefish, blackfish, and suckers. All fish and shellfish are edible, with the exception of the black mussel. Mussels from Pacific waters should be avoided entirely. Mussells are easily distinguished from clams and oysters by their orange-pink flesh. Shellfish can be cooked by boiling them in water.

3-30. Water

Water points, operated by Corps of Engineer personnel, offer the best source of water supply for all troop units in any area and in any season. Under normal operating conditions, an Engineer unit with a water point capability will be attached to task forces of brigade size or larger. Engineer water point operations under cold weather conditions are discussed in FM 31–71. This paragraph, together with paragraphs 3–31 and 3–56 offers possible solutions to the problem of water supply that confronts individuals and small detachments operating in isolated areas away from normal support activities.

a. Water is plentiful in most cold regions in one form or another. Potential sources are streams, lakes and ponds, glaciers, fresh-water ice, and last year's sea ice. Freshly frozen sea ice is salty, but year-old sea ice has had the salt leached out. It is well to test freshly frozen ice when looking for water. In some areas, where tidal action and currents are small, there is a layer of fresh water lying on top of the ice; the lower layers still contain salt. In some cases, this layer of fresh water may be 50 to 100 cm (20" to 40") in depth.

b. If possible, water should be obtained from running streams or lakes rather than by melting ice or snow. Melting ice or snow to obtain water is a slow process and consumes large quantities of fuel, 17 cubic inches of uncompacted snow, when melted, yields only 1 cubic inch of water. In winter a hole may be cut through the ice of a stream or lake to get water; the hole is then covered with snow-blocks or a poncho, board, or a ration box placed over it. Loose snow is piled on top to provide insulation and prevent refreezing. In extremely cold weather, the waterhole should be broken open at frequent intervals. Waterholes should be marked with a stick or other marker which will not be covered by drifting snow. Water is abundant during the summer in lakes, ponds, or rivers. The milky water of a glacial stream is not harmful. It should stand in a container until the coarser sediment settles.

c. In winter or summer, water obtained from ponds, lakes and streams must be purified by chemical treatment, use of iodine tablets or in emergencies by boiling.

d. During chemical, biological, and/or nuclear warfare, precautions should be taken against using contaminated water sources. In general, cold weather conditions tend to prolong or conceal contamination hazards, and unexpected contamination may thus be encountered. When snow or ice is thawed to provide water supplies, detection tests should be conducted during or after the melting operation, since frozen contamination may not be detectable. Radiological contamination which has been covered with snow or ice may or may not show up on radiac instruments, depending upon the thickness of the cover. Boiling or treating with water purification tablets has no effect on radioactive contaminants in water. In emergencies, water suspected of radiological contamination may be filtered through a 15 cm (6") column of loose dirt and then chlorinated or iodinated. Purification of water showing, or suspected of containing, chemical contaminantion should not be attempted.

e. After the water is obtained, the problem of transporting and storing it arises. Units operating in the field under cold weather conditions may store water in 5-gallon water cans with insulated covers, or other similar type containers for use by small detachments or individuals. Immersion-type heaters may be used to prevent freezing of water supply tanks. Some points to be remembered are-

(1) Transportation of water by wheeled vehicles in barren, sparsely settled areas under snow and ice conditions is practicable only when there is a road net established. The best way to transport water in cold regions is by the use of track-laying vehicles which are not dependent on roads for ma-

neuverability. If 5-gallon cans are used to carry water, they are filled only three-quarters full to allow agitation of the water and help prevent freezing while in transit. Cans are stored off the floor in heated shelters as soon as they are delivered. Sled-mounted, 250- to 300-gallon water tanks in which immersion-type heaters have been installed have proved satisfactory.

(2) For small units of two to four men, the 5-gallon insulated food container is satisfactory for water storage. These can be filled at night and will hold enough water for the next day's needs for about four men. The insulation of these containers is sufficient to keep water from freezing for as long as 40 hours at an ambient temperature of –20° F., if the temperature of the water was at boiling point when the container was filled.

3-31. Types of Ice and Snow

a. When water is not available from other sources, it must be obtained by melting snow or ice. To conserve fuel, ice is preferable when available; if snow must be used, the most compact snow in the area should be obtained. Snow should be gathered only from areas that have not been contaminated by animals, humans, or toxic agents.

b. Ice sources are frozen lakes, rivers, ponds, glaciers, icebergs, or old sea ice. Old sea ice is rounded where broken and is likely to be pitted and to have pools on it. Its underwater part has a bluish appearance. Fresh sea ice has a milky appearance and is angular in shape when broken. Water obtained by melting snow or ice may be purified by use of water purification tablets, providing it has not been contaminated by toxic agents.

c. If chemical, biological, or radiological contamination is detected, procedures as outlined in paragraph 3-30 *d* will be followed.

3-32. Procedures for Melting Snow and Ice

a. Burning the bottom of a pot used for melting snow can be avoided by "priming." Place a small quantity of water in the pot and add snow gradually. If water is not available, the pot should be held near the source of heat and a small quantity of snow melted in the bottom before filling it with snow.

b. The snow should be compacted in the melting pot and stirred occasionally to prevent burning the bottom of the pot.

c. Pots of snow or ice should be left on the stove when not being used for cooking so as to have water available when needed.

d. Snow or ice to be melted should be placed just outside the shelter and brought in as needed.

e. In an emergency, an inflated air mattress can be used to obtain water. The mattress is placed in the sun at a slight inclined angle. The mattress, because of its dark color, will be warmed by the sun. Light, fluffy snow thrown on this warm surface will melt and run down the creases of the mattress where it may be caught in a canteen cup or other suitable container.

Section V. HYGIENE AND FIRST AID

3-33. General

In cold weather, the care of the body requires special emphasis. If men are allowed to go without washing, fail to eat properly, do not get sufficient liquids or salt, efficiency will suffer. Lowered efficiency increases the possibility of casualties, either by cold injury or enemy action.

3-34. Dehydration

a. Definition and Principle. Dehydration means to lose or be deprived of water or the elements of water. A growing plant loses (uses) water in the growing process. If this water is not replaced by either natural means (rain) or by watering, the plant will wither and eventually dry up. The same principle applies to the human body which loses water and,

an additional element, salt. A certain amount of this loss is taking place constantly through the normal body processes of elimination; through the normal daily intake of food and liquids, these losses are replaced.

b. Dangers. When individuals are engaged in any strenuous exercises or activities, an excessive amount of water and salt is lost through perspiration. This excessive loss creates what is known as "imbalance of liquids" in the body and it is then that the danger of dehydration arises, unless this loss of liquids and salt is replaced immediately and individuals are allowed sufficient rest before continuing their activities.

c. Training and Discipline. The danger of dehydration for troops operating under cold weather conditions and over ice and deep snow is a problem that does exist and cannot be overemphasized. It is equally important, however, to recognize that the problem can be overcome and will present no great obstacle to well trained, disciplined troops who have been thoroughly oriented in the causes, the symptoms, and the effects of dehydration and who have been properly instructed in preventive measures.

d. Differences. It is important, therefore, to be aware that the danger of dehydration is as prevalent in cold regions as it is in hot, dry areas. The difference is that in *hot weather* the individual is conscious of the fact that the body is losing liquids and salt because he can see and feel the perspiration with its saline taste and "feel" it running down the face, getting in the eyes, and on the lips and tongue, and dripping from the body. In *cold weather*, it is extremely difficult for an individual who is bundled up in many layers of clothing to realize that this condition does exist. Under these conditions, perspiration is rapidly absorbed by the heavy clothing or evaporated by the air and is rarely visible on the skin.

e. Cause, *Symptoms, Effects, Preventive Measures, and Treatment.*

(1) Dehydration results from failure to correct the body's "imbalance of liquids" through replacing liquid and salt which has been lost.

(2) The symptoms of cold weather dehydration are similar to those encountered in heat exhaustion. The mouth, tongue, and throat become parched and dry and swallowing becomes difficult. General nausea is felt and may be accompanied by spells of faintness, extreme dizziness and vomiting. A feeling of general tiredness and weakness sets in and muscle cramps may occur, especially in the legs. It becomes difficult to keep the eyes in focus and fainting or "blacking out" may occur.

(3) The effect of dehydration on the individual is to incapacitate him for a period of from a few hours to several days. The effectiveness of the individual's unit is likewise reduced by the loss of his contribution to the accomplishment of the unit mission. Small patrols and detachments operating beyond range of immediate help from the parent unit must be extracautious to avoid dehydration since they run the risk of a secondary but more dangerous effect of dehydration, that of becoming cold weather casualties while incapactiated.

(4) Dehydration can be prevented during cold weather operations by following the same general preventive measures applicable to hot, dry areas. Salt and sufficient additional liquids are consumed to offset excessive body losses of these elements. The amount will vary according to the individual and the type of work he is doing, i.e., light, heavy, very strenuous, etc. Rest is equally important as a preventive measure. Each individual must realize that any work that must be done while bundled in several layers of clothing is extremely exhausting. This is especially true of any movement by foot, regardless of how short the distance.

(5) In treating a person who has become dehydrated, the individual should be kept warm but his clothes loosened sufficiently to allow proper circulation; liquids and salt should be fed to him gradually and, most important

of all, he must have plenty of rest. When salt tablets are not available, common table salt may be used. Approximately one-half of a level mess spoon of salt mixed in one gallon of water makes a palatable solution. The individual should receive prompt attention of trained medical personnel.

3-35. Personal Hygiene

Because of the extremes in temperatures and lack of bathing and sanitary facilities, keeping the body clean in cold weather will not be easy.

a. The entire body should be washed at least weekly. If bathing facilities are not available, the entire body can be washed with the equivalent of two canteen cups of water, using half for soap and washing, and half for rinsing. If circumstances prevent use of water, a rubdown with a dry cloth will help. Care should be taken not to abrade the skin. The feet, crotch, and armpits should be cleaned daily.

b. A temporary steam bath can be built in a large-size tent. Stones are piled up to form a furnace. The furnace is either heated inside the tent (ventilation flaps wide open) or in the open with the tent pitched over the furnace after the stones are heated. Wood is used for fuel. Seats and water buckets are taken into the tent after the stones are nearly red-hot and the fire has died down, so that they do not get sooty. The pouring and washing water is usually heated outside the tent. The water is thrown on the hot stones in small quantities. Thus it does not drop into the ashes and the temperature does not rise too fast. A naked person spends from 15 minutes to 1 hour in this steam bath. After thoroughly perspiring, the body is washed with tepid water.

c. Beards should be shaved or clipped close. Hair should be combed daily and not allowed to grow too long. A beard or long hair adds very little in insulation value and soils clothing with the natural hair oils. In winter, a beard or a mustache is a nuisance since it serves as a base for the buildup of ice from moisture in the breath and will mask the presence of frostbite. All individuals should shave daily, when possible. Because shaving with a blade and soap removes the protective face oils, the individuals should shave, if possible several hours before exposing his face to the elements. This action will reduce the danger of frostbite. Shaving with an electric razor will not remove the protective oils. Under chemical or biological warfare conditions a beardless face and daily shaving are especially important, since an airtight seal of the protective mask is difficult to obtain with even stubble on the face.

d. Socks should be changed and the feet washed daily. If this is not possible, the boots and socks should be removed, and the feet massaged and dried. By sprinkling the feet liberally with foot powder and then rubbing the powder off, the feet can be efficiently dry-cleaned.

e. Sleeping bags should be kept clean. Subject to operational requirements, the best method is to wear the minimum clothing in the sleeping bag. Never wear damp socks or underwear in the sleeping bag. Dry underwear and socks should be put on before going to sleep and the other set hung up to dry. Perspiration will soil a sleeping bag, and cause it to become damp, therefore, the bag should be aired as frequently as possible. In the morning, the bag should be opened -wide and air pumped in and out to remove the moist air within the bag.

f. Teeth should be cleaned daily. If a toothbrush is not available, a clean piece of gauze or other cloth wrapped around the finger, or end of a twig chewed into a pulp may be used in lieu of a toothbrush.

g. Underwear and shirts should be changed at least twice weekly; however, if it is not possible to wash the clothing this often the clothing should be crumpled, shaken out, and aired for about 2 hours.

3-36. Cold Injury

a. Frostbite. Frostbite is the freezing of some part of the body by exposure to temperatures below freezing. It is a constant hazard in operations performed at freezing temperatures, especially when the wind is strong. Usu-

ally there is an uncomfortable sensation of coldness followed by numbness. There may be a tingling, stinging, or aching sensation, even a cramping pain. The skin initially turns red. Later it becomes pale gray or waxy white. For all practical purposes frostbite may be classified as superficial or deep. Treatment and management are based solely upon this classification.

(1) It is easier to prevent frostbite, or stop it in its very early stages, than to thaw and take care of badly frozen flesh. Clothing and equipment must be fitted and worn so as to avoid interference with circulation. To prevent severe frostbite-

(a) Sufficient clothing must be worn for protection against cold and wind. The face must be protected in high wind, and when exposed to aircraft prop blast.

(b) Every effort must be made to keep clothing and body as dry as possible. This includes avoidance of perspiring. For heavy work in the cold, remove outer layers as needed, and replace as soon as work is stopped. Socks should be changed as needed whenever the feet become moist, either from perspiration or other sources.

(c) Any interference with the circulation of the blood reduces the amount of heat delivered to the extremities. All clothing and equipment must be properly fitted and worn to avoid interference with the circulation. Tight fitting socks, shoes and hand wear are especially dangerous in very cold climates.

(d) Cold metal should not be touched with the bare skin in extreme-low temperatures. To do so could mean loss of skin.

(e) Adequate clothing and shelter must be provided during periods of inactivity.

(f) The face, fingers, and toes should be exercised from time to time to keep them warm and to detect, any numb or hard areas. The ears should be massaged from time to time with the hands for the same purpose.

(g) The buddy system should always be used. Men should pair off and watch each other closely for signs of frostbite and for mutual aid if frostbite occurs. Any small frozen spots should be thawed immediately, using bare hands or other sources of body heat.

(2) Some cases of frostbite may be superficial, involving the skin. But if freezing extends to a depth below the skin it constitutes a much more serious situation, demanding radically different treatment to avoid or minimize the loss of the part (fingers, toes, hands, feet). If a part of the body becomes frostbitten it appears yellowish or whitish gray. Frequently there is no pain, so keep watching one another's face and hands for signs. The face, hands, and feet are the parts most frequently frostbitten. The problem is to distinguish between superficial and deep frostbite. This can usually be told with respect to the face. The hands and feet are a different matter. A person may be able to judge by remembering how long the part has been without sensation. If the time was very short the frostbite is probably superficial. Otherwise assume the injury to be deep and therefore serious.

(3) For treatment of superficial frostbite in the field—

(a) Cover the cheeks with warm hands until pain returns;

(b) Place uncovered superficially frostbitten fingers under the opposing armpits, next to the skin.

(c) Place bared, superficially frostbitten feet under the clothing against the belly of a companion.

(d) Do not rewarm by such measures as massage, exposure to open fires, cold water soaks, rubbing with snow.

(e) Be prepared for pain when thawing occurs.

(4) In treatment of deep frostbite (freezing injury) the following measures must be taken: If freezing is believed to be deep, do not attempt to treat it in the field. Get to a hospital or aid station by the fastest means possible. *If transportation is available, avoid walking.* Protect the frozen part from additional injury but do not attempt to thaw it out by rubbing, bending, massage. Do not rub with snow; do not place in either cold or warm water; do not expose to hot air or open fires; do not use ointments or poultices. Thawing in the field increases pain and invites infection, greater damage, and gangrene. There is less danger of walking on feet while frozen than after thawing. Thawing may occur spontaneously, however, during transportation to a medical facility. This cannot readily be avoided since the body in general must be kept warm.

b. Trenchfoot. Trenchfoot is the thermal injury sustained as a result of exposure to cold, short of freezing, in a damp or wet environment. Arbitrarily, it is said to occur in the temperature range between 32° F. and 50° F. Partial causes include immobility of the limbs (legs and feet down as in sitting or standing), insufficient clothing, and constriction of parts of the body by boots, socks, and other garments. This type of cold injury is almost identical with gradual frostbite, which might be expected, since the primary causes are the same except for differences in the degree of cold. In the early stages of trenchfoot, feet and toes are pale and feel cold, numb, and stiff. Walking becomes difficult. If preventive action is not taken at this stage, the feet will swell and become painful. In extreme cases of trenchfoot the flesh dies and amputation of the foot or of the leg may be necessary. Because the early stages are not painful, individuals must be constantly alert to prevent the development of trenchfoot. To prevent this condition—

(1) Feet should be kept dry by wearing waterproof footgear and by keeping the floor of shelters dry.

(2) Socks and boots should be cleaned and dried at every opportunity, preferably daily.

(3) The feet should be dried as soon as possible after getting them wet. They may be warmed with the hands. Foot powder should be applied and dry socks put on.

(4) If it becomes necessary to wear wet boots and socks, the feet should be exercised continually by wriggling the toes and bending the ankles. Tight boots should never be worn.

(5) In treating trenchfoot, the feet should be handled very gently. They should not be rubbed or massaged. If necessary, they may be cleansed carefully with plain white soap and water, dried, elevated, and allowed to remain exposed. While it is desirable to warm the patient, the feet should always be kept at room temperature. The casualty should be carried and not permitted to walk on damaged feet.

c. Immersion Foot. Immersion foot is a form of injury which follows prolonged immersion of the feet in water not sufficiently cold to cause freezing or frostbite. It has been observed after exposure in subtropical waters also. Clinically and pathologically, it is indistinguishable from trenchfoot which would be expected, since its cause is essentially the same, lowering of the temperature of the part of the body involved. It is usually associated with dependency (legs and feet down as in sitting or standing) and immobility of the lower extremities and with constriction of the limbs by clothing and shoes. Other factors which play more or less important roles are-body cooling, as the result of wind; total immersion; and inadequate clothing (protection), sickness, and starvation. The incidence and severity of immersion foot however, is more directly influenced by the other factors listed. The treatment is the same as that given for trenchfoot.

d. Total immersion. Immersion in near freezing water for but a few minutes, or exposure to severe dry cold while inadequately dressed will cause total body cooling, including

a marked drop in the inner body (core) temperatures. For description and therapy see appendix F.

e. Miscellaneous. The length of time that a casualty may be exposed to the weather without danger of cold injury varies directly with the temperature and wind velocity. The lower the temperature and the stronger the wind, the sooner injury will occur. There is a great variation in individual reactions to cold. To give competent care to the injured in extreme cold, the medical personnel must have heated shelter in which to operate. Battle wounds in the cold are no different from those sustained in more temperate climates, and should be treated in the same manner. Morale is helped by the assurance that the sick and wounded can be rapidly evacuated from the battlefield to hospitals, and that for the nontransportable cases requiring prompt lifesaving surgery, hospitals with highly skilled surgical personnel are available adjacent to division clearing station level.

3-37. Shock

Shock is brought about by a reduction of the circulating blood volume within the body. This can be caused by severe injuries, loss of blood, pain, emotional disturbances, or any of many factors. The normal reaction of the body to severe cold, reduction of the volume of blood circulating to extremities, is very similar to the reaction of the circulatory system to the condition of shock. Shock will usually develop more rapidly and progress more deeply in extreme cold than in normal temperature.

a. Signs of Shock. The signs of shock are apprehension; sweating; pallor; rapid, faint pulse; cold clammy skin; and thirst. If the patient is not given good first aid treatment immediately the condition of shock may progress until the patient passes into unconsciousness and further into death.

b. First Aid for Shock.

(1) The injured person should be made as comfortable as possible.

(2) Pain may be relieved by proper positioning, good bandaging and splinting. Aspirin will also help, if it is available and if there is no known or suspected abdominal injury.

(3) The litter should be positioned so that the patient is comfortable and not apt to inhale vomitus.

(4) The patient should be kept warm with blankets and sleeping bags.

(5) When the patient is conscious he should be given warm soup, chocolate, coffee, or tea if there is no known or suspected abdominal injury.

(6) The patient should receive medical attention as soon as possible.

3-38. Sunburn

An individual may get sunburned when the temperature of the air is below freezing. On snow, ice, and water, the sun's rays reflect from all angles; in a valley the rays come from every direction. Sunlight reflected upward from the bright surfaces attacks man where the skin is very sensitive-around the lips, nostrils, and eyelids. The exposure time which will result in a burn is reduced in the clear air of high altitudes. Sunburn cream and a chapstick should be carried in the pocket, and applied to those parts of the face that are exposed to direct or reflected light. In mild weather protection of the neck and ears can be improvised by draping a handkerchief over the back of the head which is held in place by the cap in the manner of a desert neckcloth. Soap or shaving lotions with a high alcoholic content should not be used because they remove natural oils that protect the skin from the sun. If blistered, report to an aid station as soon as possible, as the blistered area, especially lips, may become badly infected.

3-39. Snow Blindness

Snow blindness occurs when the sun is shining brightly on an expanse of snow, and is due to the reflection of ultraviolet rays. It is particularly likely to occur after a fall of new snow, even when the rays of the sun are partially obscured by alight mist or fog. The risk is also increased at high altitudes. In most cases, snow blindness is due to negligence or failure on the part of the soldier to use his sunglasses. Waiting for discomfort to develop

before putting on glasses is folly. A deep burn of the eyes may already have occurred by the time any pain is felt. Putting on the glasses then is essential to prevent further injury but the damage has already been done. Symptoms of snow blindness area sensation of grit in the eyes with pain in and over the eyes made worse by eyeball movement, watering, redness, headache, and increased pain on exposure to light. First aid measures consist of blindfolding, which stops the painful eye movement, or covering the eyes with a damp cloth, which accomplishes the same thing. Rest is desirable. If further exposure to light is unavoidable the eyes should be protected with dark bandages or the darkest available glasses. The condition heals in a few days without permanent damage once unprotected exposure to sunlight is stopped.

3-40. Constipation

a. When operating under cold weather conditions there is a general tendency for individuals to allow themselves to become constipated. This condition is brought about by the desire to avoid the inconvenience and discomfort of relieving themselves under adverse conditions. This condition is also caused by changes in eating habits and failure to drink a sufficient amount of liquids.

b. Constipation can usually be prevented by adjusting the normal eating and drinking habits to fit the activities in which engaged, and by not "putting off" the normal, natural, processes of relieving the body of waste matter. Medical personnel should be consulted if constipation persists. Each individual must be educated concerning the consequences of neglecting personal hygiene habits.

3-41. Carbon Monoxide Poisoning

a. Whenever a stove, fire, gasoline heater, or internal combustion engine is used indoors there is danger of carbon monoxide poisoning. A steady supply of fresh air in living and working quarters is vital. Carbon monoxide is a deadly gas, even in low concentration, and is particularly dangerous because it is odorless.

b. Units should appoint a qualified carbon monoxide safety officer. AR 386-55 and TB Med 269 should be used as references by these safety officers.

c. Generally there are no symptoms. With mild poisoning, however, these signs may be present-headache, dizziness, yawning, weariness, nausea, and ringing in the ears. Later on, the heart begins to flutter or throb. But the gas may hit without any warning whatsoever. A soldier may not know anything is wrong until his knees buckle. When this happens, he may not be able to walk or crawl. Unconsciousness follows; then death. Men may be fatally poisoned as they sleep.

d. In a case of carbon monoxide poisoning, the victim must be moved into the fresh air at once, but must be kept warm. In the winter, fresh air means merely circulating air that is free from gases. Exposure to outdoor cold might cause collapse. If the only fresh air is outdoors, the patient should be put into a sleeping bag for warmth. A carbon monoxide victim should never be exercised, because this will further increase his requirements for oxygen. If a gassed person stops breathing or breathes only in gasps, mouth-to-mouth resuscitation should be started immediately. In the latter case, the operator's movements must be carefully synchronized with the victim's gasps. Breathing pure oxygen removes carbon monoxide from the blood faster than does breathing air and greatly hastens recovery. Carbon monoxide is serious and a victim who survives it must be kept absolutely quiet and warm for at least a day. Hot water bottles and hot pads are helpful in maintaining body temperatures.

3-42. Care of Casualties

If any member of a group is injured, the most important course of action is to get him to competent medical aid as soon as possible. The casualty should be given first aid treatment, protected from the cold and shock ef - fects, and evacuated to an aid station with a minimum of delay. He should be placed in a casualty bag, sleeping bag, or the best available substitute. He should have warm drinking water or other hot drinks, *except in the case of abdominal injury.*

Warning: **Once a tourniquet has been applied, the wounded man should be examined by a medical officer as soon as possible.**

If possible, the tourniquet should not be loosened by anyone except a medical officer who is prepared to stop the hemorrhage or bleeding by other means and to administer other treatment as necessary. Repeated loosening of the tourniquet by inexperienced personne is extremely dangerous, can result in considerable loss of blood, and endanger the life of the patient. Halting of circulation to the extremities is an invitation to frostbite. If morphine is to be administered, caution must be exercised to avoid overdosage.

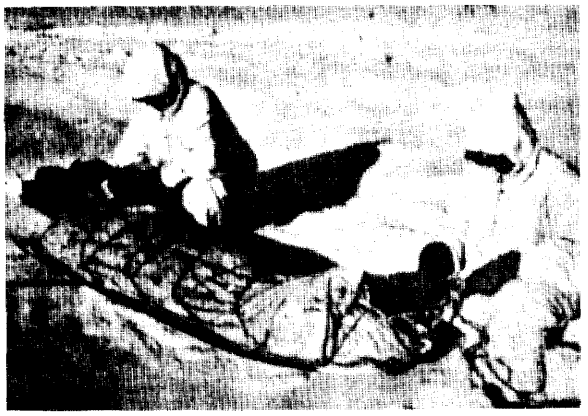


Figure 3–19. Evacuation of wounded on sled.

3-43. Emergency Evacuation

Personnel who have been wounded should be evacuated to the nearest medical facility by the fastest means of transport available. Sleds can be used if oversnow vehicles or air evacuation facilities cannot be obtained. It may be necessary to use manhauled sleds to move the wounded a safe distance behind the frontlines before they can be transferred to faster means of transport (fig. 3-19). Speed in evacuation is essential because of the combined effects of severe cold and shock on the wounded.

3-44. Body Parasites

a. General. Body parasites are very common in the more populated cold regions because of the crowded living conditions and shortage of bathing and cleaning facilities. When in the midst of a native population, or when occupying shelters which have been used before, individuals must inspect clothing and body each night for parasites.

b. Means of Control. If clothing has become infested with lice, the following methods of removing them are recommended:

(1) While extreme cold does not kill lice, it paralyzes them. The garments should be hung in the cold; then beaten and brushed. This will help rid the garments of lice, but not of louse eggs.

(2) An appropriate insecticide powder can be used to free the body and clothing of body parasites.

Section VI. BIVOUAC ROUTINE

3-45. Location of Bivouac Sites

The selection of bivouac sites in northern areas is all-important and requires careful consideration. The problem of selection varies with the tactical situation, weather conditions and terrain. Terrain hazards such as steep rock faces concealed by snow, glaciers, crevasses and avalanches are typical, especially in mountainous areas. Guides familiar with terrain peculiarities must be used to the greatest extent during the troop movement.

a. If possible, the bivouac area should be tactically located in accordance with the principles of security and defense. It should be located so that it would be advantageous for future operations. If contact with the enemy is imminent, the bivouac should be located on high ground; this, at times, is disregarded in favor of cover and concealment, more suitable ground conditions, etc.

b. Cover and concealment against air and ground observation is essential for the bivouac area. Forested areas pose few problems in comparison to that area north of the treeline. Particular attention must be given in selecting areas in cold regions to insure that local camouflage materials are available.

c. In the winter, protection from the wind is

a prime consideration. This is particularly true in areas of northern operations, where violent local gales frequently occur. In wooded areas the wind has little effect on tentage or individuals.

d. The condition of the ground is important and, if possible, the bivouac should be located on hard, dry ground.

e. Construction materials play an important part in the selection of a bivouac. When making a reconnaissance for the area, such things as the availability of firewood, water, snow for snow shelters, boughs, etc., must reconsidered.

3-46. Bivouac in Forests

a. Most forests in cold regions provide excellent bivouac sites and should reutilized whenever possible. Forests provide many natural materials such as boughs for insulation, firewood, and camouflage construction materials. They also provide excellent concealment against enemy air and ground observation. Coniferous (cone-bearing trees) provide better protection from wind and better insulation material and firewood than deciduous forests. Pine and spruce forests, normally found on well drained soil, offer the best hardstand for shelter.

b. Tracks are visible in both summer and winter. On dry ground, however, they normally are not as noticeable as on wet soil. Consideration should be given to building dummy positions for the purpose of misleading the enemy (fig. 3-20). Track discipline must be rigidly enforced in the bivouac area. Once tracks are made, all movement within the areas should be restricted to those tracks.

3-47. Bivouac on Marshy Ground

a. In winter, when the ground is frozen, good bivouac sites may be found in areas which otherwise would not be usable. Some swampy areas may not freeze during the winter, because of warm water springs or gases. They provide poor facilities for the bivouac site. If it becomes necessary to establish the bivouac on swampy ground, flooring for shelters must be constructed. If tree trunks are available, a "float" may be built under the shelter (fig. 3-21). In the absence of tree trunks, brush matting will serve the same purpose.

b. Areas to be used for extended periods of time require draining, clearing of existing creeks, digging of ditches around the shelter, or preparing a water trench inside the shelter.

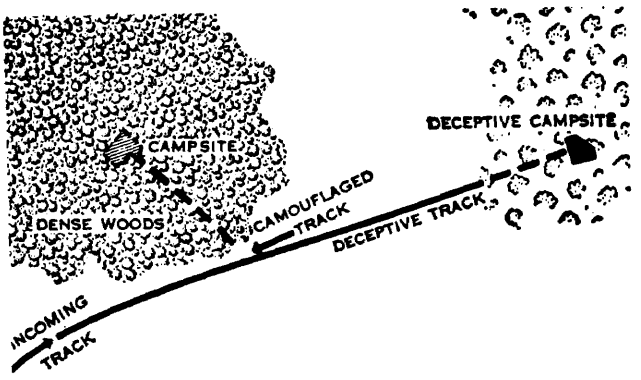


Figure 3–20. Selection of route when entering bivouac in forest.

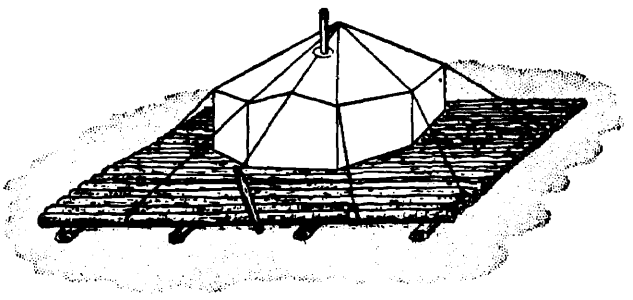


Figure 3–21. "Float" under shelter.

3-48. Bivouac in Open Terrain and on Ice

a. Due to strong winds, drifting snow, and poor concealment, bivouac areas in the barren tundra must be carefully chosen.

b. Tents should be pitched where they can be sheltered by natural windbreaks whenever possible. The windbreak may consist of depressions in the ground or pressure ridges on the ice. A visual inspection will indicate the degree of drifting, direction of the prevailing wind, and more suitable protected areas for locating the shelters. In areas where natural windfalls do not exist, snow walls may be constructed to provide protection from winds and

enemy small arms fire, as well as concealment from ground observation. In open areas with high winds, snow gathers rapidly on the lee side, making it necessary to clear the sides and tops of the tents periodically to prevent the weight of the drifting snow from collapsing the tent. The entrance to the shelter should face downwind from the prevailing wind. This will prevent the snow from blocking the exit and cutting off the ventilation.

c. When the tent is pitched on ice, holes are chopped where the tent pins are normally set. "Deadmen" are inserted in the holes at right angles to the tent. The holes are then packed with snow or filled with water and left to freeze.

3-49. Bivouacs in Mountains

a. Mountainous terrain is characterized by strong turbulent winds, cold and general lack of concealment above the timberline. The wind overhead creates an extensive lee near the mountain. The overhead lee resembles the dry space behind waterfalls caused by water having such speed that it shoots over the edge of the cliff and descends in a curve. An inland wind blowing 50 miles an hour (43 kts) may not strike the ground for several kilometers after passing the edge of a cliff or a very steep slope. While such a lee is an attractive bivouac site from the standpoint of wind protection it should be noted that such a lee area is often an area of maximum snow deposit. The requirement to constantly dig out vehicles, walkways, and weapons positions may offset the windfree advantages of a lee site during snowfall or snowblowing weather.

b. Cold air is heavier and frequently settles in valleys. The point where the temperature starts changing is low in summer and higher and more noticeable in winter. Therefore, in some instances it is better to establish a bivouac up the hillside above the valley floor and below the timberline, where applicable. Avalanche hazard areas must be carefully avoided.

3-50. Establishing Bivouac

a. General. Setting up a bivouac is a routine based on SOP which enables the commander to control the bivouac area, have it always protected, camouflaged, and the personnel ready to fight. Only the minimum amount of time should be devoted to pitching and striking the shelters and to general housekeeping. Bivouacking in a routine manner allows more time for daily movement, establishing an effective security system, and defense of the bivouac site. Finally, it allows more time for rest and to make preparations for the continuation of the operation.

b. Responsibilities of Unit Leader. On entering the bivouac site, the unit leader is responsible for—

(1) Posting a security guard.

(2) Checking the bivouac site.

(3) Determining exact tent locations providing the best natural shelter and camouflage.

(4) Designating an area from which construction material and firewood will be obtained.

(5) Selection of a water point, or marking off the snow area to be utilized for water.

(6) Designating latrine and garbage disposal sites.

(7) Designating a site for weapon and ski racks. Temporary placement for weapons and equipment must be arranged until the bivouac has been established.

(8) Breaking a minimum number of trails between the tent site and area assigned for firewood and construction material, water point, and latrine.

(9) Maintaining camouflage and track discipline at all times.

(10) Organization and assignments for the work details as follows:

(a) Clearing and leveling the shelter sites. In winter the snow is dug to the ground level or in an emergency, packed down by trampling with skis, snowshoes, or tracked vehicles.

(b) Pitching tents (when used).

(c) Cutting, trimming, and hauling

trees and boughs for construction of improvised shelters and bough beds (when tents are not available).

(d) Construction of improvised shelters best suited to the area concerned.

(e) Construction of windbreaks, if necessary.

(f) Building necessary weapon and ski racks. Special care must be given to the protection of the weapons from the elements.

(g) Construction of field latrines and garbage disposal sites.

(h) Preparing a water point.

(i) Gathering and cutting a supply of firewood.

(j) During cold weather, situation permitting, starting fires and preparing hot drinks for all individuals.

(k) Upon completion of shelter construction, starting a warm meal.

(11) Maintaining and emphasizing cleanliness, tidiness, and teamwork.

(12) Upon completion of the bivouac, arranging equipment within the outside of shelters.

(13) Preparing defensive positions and breaking and marking a trail from the shelters to the positions.

(14) Maintaining a duty roster for exterior guards, fire guards, and similar assignments.

(15) Rotating individuals on all jobs on a daily basis.

(16) Assigning specific sleeping areas for all individuals in accordance with the duty roster.

(17) Upon establishing the bivouac, removing the exterior guard in case the parent unit has taken over the security of the area.

(18) Inspecting the area, examining the security, camouflage, cover, weapons, skis, sleds, vehicles (if applicable), and the conditions of the men and their equipment.

(19) Outlining and rehearsing the action to be taken in the event of attack.

(20) Assuring that necessary safety precautions are taken to eliminate or control any hazards that could result in unnecessary accidental loss of men and their equipment.

3-51. Shelter Discipline

a. When a shelter is finished, the first man entering it will arrange all equipment in the proper place. The stove, water can, firewood, tools, and rations are placed in the most convenient place by the door of the tent. In a snow shelter, a special storeroom may be dug for these items.

b. In low temperatures, weapons should be left outside on improvised weapon racks in order to avoid condensation. However, as a word of caution commanders must insure that weapons left outside are properly secured, e.g., providing security guards or securing the weapons in an unheated shelter. When cold weapons are taken into heated shelters, condensation will form as the warm air comes in contact with cold metal. This "sweating" will continue for about one hour. If weapons are brought into a warm shelter they should be placed at floor level away from direct heat to minimize condensation. To avoid freezing of moving parts, moisture must be removed and Lubrication Oil, Weapon (LOW) applied to the weapon before it is taken outside. If the situation requires that weapons be taken inside and later outside before they can be dried, the working parts must be hand operated until the moisture is frozen and there is no danger of parts freezing together.

c. Before entering the shelter, hoarfrost and snow must be brushed off clothing and equipment. This keeps the clothing dry and the shelter clean.

d. To live comfortably in a shelter is not an easy art. Individuals usually are crowded and must keep their equipment orderly and out of the way of other occupants of the shelter. Unnecessary running in and out of the shelter should be avoided whenever possible.

e. The use of fire and lights in the shelter

must be carefully supervised. Security, fuel economy, and the prevention of fire and asphyxiation are essential. When wood is available, it is burned in the stoves in place of gasoline. Lamps must be extinguished before retiring for the night. All lamps and cooking stoves must be filled and lighted outdoors. A stand or bracket should be made for the lamps or candles and they should be placed where they are least likely to be knocked over. Sparks on the tent or lean-to must be extinguished at once. Smoking while in the sleeping bag is not permitted.

f. As many tasks as possible should be accomplished before retiring in order to conserve time in the morning. All eating utensils should be cleaned, snow melted, canteens or thermos bottles filled, and all weapons should be checked.

g. Upon breaking the bivouac in the morning all personal equipment should be rolled, warm drinks and breakfast should be consumed, and last-minute details accomplished prior to resuming the march.

3-52. Heat Discipline and Fire Prevention

Heat discipline presents a paramount problem during periods of extreme cold.

a. Overheating the shelter is very common and can and should be avoided. It causes sweating of individuals and increases the fire hazard.

b. There are many ways to save fuel. Cooking and heating may be combined. The melting of snow and ice uses large amounts of fuel and should be avoided when water from other sources is available. In cooking, liquid fuel is used sparingly. Wood should be burned when available. In extreme cold it may be necessary to keep the fire burning throughout the night in order to keep the men warm, especially when living in temporary shelters which provide little heat. The drying of wet clothing and the providing of hot drinks for combat reliefs are also necessary throughout the night.

c. Fire prevention during both summer and winter seasons is extremely important. The combination of low humidity and the drying effect of continuously heated shelters is conducive to fire. Shifts in wind and the accumulation of frost or soot in the stovepipe lead to backfiring of flaming fuel into the shelter. The excessive spilling of fuel containers, lamps, and candles create additional hazards. The stamping of feet to shake off snow or frost may cause stoves and small heating units to spill and spread fire. The strict enforcement of all regulations is necessary in order to avoid fire hazards. No set rules can be given for each occasion. Common sense in the handling of all kinds of fires, fuels, and flammable materials is essential; alert, wide-awake fire guards must be on duty in each shelter at all times when men are sleeping and a fire is burning. Applicable technical manuals should be consulted prior to operating tent stoves, cooking stoves or gasoline lanterns.

d. A base made from green logs must be placed under the stove if the snow has not been shoveled away from the tent site. Fire reflectors may be used not only to get more warmth, but also to keep the fire burning evenly and to help avoid sparks.

e. Care must be exercised when lighting the gasoline-type stove; it may flare up and either damage the tent or set it on fire. All stovepipes must be cleaned frequently. When using wood as fuel, cleaning must be done every day in order to maintain a good draft and avoid fires in the stovepipes. Stoves burning petroleum fuels tend to accumulate more soot when operated at low settings because of cooler pipe temperatures. It is better to turn the stove off in mild weather than to run it at low settings. Detailed instructions for operating stoves are covered in TM 10–735 (Yukon stove) and TM 10–725 (Stove M1941). Precautions against forest and ground fires in summertime are extremely important. Coniferous forests are highly inflammable during the summer season. Ground fires can burn for months in muskeg and are extremely hard to to put out. A fire ditch is always dug before lighting fire. A base of green wood, gravel, or rocks must be used under the fire; the fire must be made on high ground when the forest is dry. Before leaving the campsite, individuals must always be sure that the fire is completely out.

3-53. Drying Clothes

a. Keeping dry is important in low temperature. At times it is impossible to avoid sweating. The drying of clothes and footgear is therefore a necessity. Every opportunity must be used by each individual to dry his clothing.

b. When drying outside using an open fire, clothes should not be placed downwind from the fire, due to the sparks and smoke. Clothes hung for drying should be frequently checked and not left unattended. Clothing should never be placed too close to the fire or stove in the shelter. Leather items are extremely vulnerable to extreme heat. Clothing being dried in the shelter is placed on drying lines.

c. The use of a "Christmas Tree" (fig. 3-22) for drying in the shelter is handy when operating in a wooded area. Branches are cut off a dry or green tree which is then made to stand up in the shelter next to the center pole so that it is in the air current. This offers an excellent place for drying heavy items such as boots and parkas. The Tent, 10-Man, Arctic, is also equipped with strong hooks at the inside peak for suspending lighter weight clothing for drying.

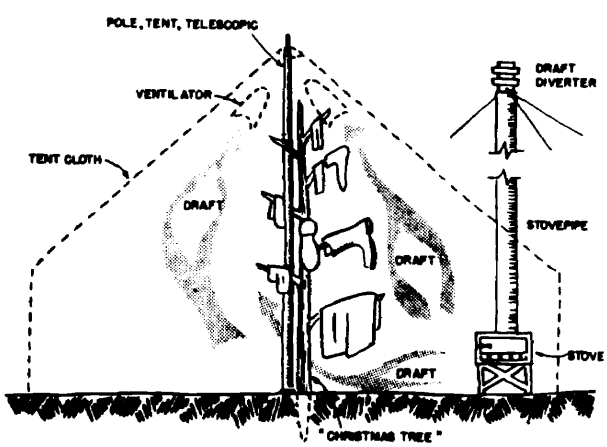


Figure 3-22. "Christmas Tree" for drying clothing.

3-54. Sleeping Arrangements in Bivouac

a. When arranging the sleeping procedures in a tent or improvised shelter, the position of every man, especially the position of reliefs for sentries, is planned. Each man must know where his relief is sleeping. Therefore, the floorspace is occupied by the individuals in accordance with the duty roster. The number one man sleeps next to the door, number two man towards the rear. In this manner, starting from the door, the relief is easily located without waking up all occupants. The systematic sleeping arrangement will also permit exit from the tent in an organized manner in case of alert.

b. Ground insulation is most important. Often the occupants may have to improvise insulation using all available material. Backboards, snowshoes, man-hauled sleds, and empty cartons may be used. In timbered areas evergreen boughs are especially suitable. On the tundra, dry lichen, grass, or shrubs provide effective insulating material. To make a bough bed, one single bed is constructed for all; the size varies with the number of persons, For improvised shelters, logs approximately 8 cm (3") in diameter are pegged or fitted around the bough or grass bed. This helps to keep the boughs in place, If material and time permit, a 15 to 30 cm (6" to 12") thick shingled bed made from spruce, fir, or balsam boughs (fig. 3-23) gives excellent insulation and provides a soft mattress.

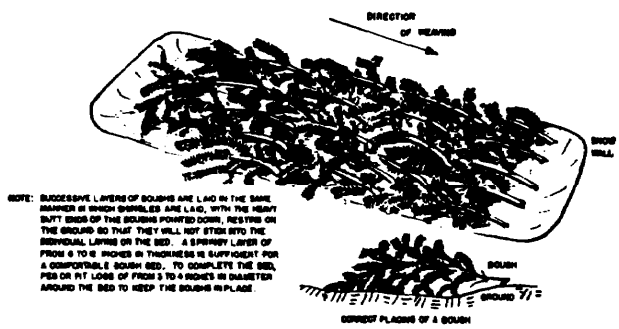


Figure 3-23. Building bough bed.

c. The tactical situation dicates whether or not sleeping bags are used. The amount of clothing to be worn when sleeping on a bough bed or in the sleeping bag can be best judged by experience and will depend on temperature and the tactical situation. As a minimum, outer clothing is usually removed when the sleeping bag is used. The removed clothing is placed beneath the individual for additional

insulation and instant availability. In an emergency it may be necessary to dress in the dark. In the morning all ice and frost is removed and the bag ventilated before rolling it up. Time permitting, it is hung up by the strings and thoroughly dried.

d. When sleeping in a heated tent without a sleeping bag, boots are usually removed, situation permitting. The parka is used like a blanket. The rucksack makes a good pillow. The clothing is always loosened.

3-55. Water Points and Snow Area Locations

During the winter it may be necessary to obtain water by melting snow or ice. When such a source is utilized for drinking purposes, an area should be set aside and restricted to this purpose only. A preferable site is one upwind from the bivouac and isolated from the latrine and garbage disposal areas. If such an area is not available, then snow should be gathered from the branches of trees or lightly skimmed from a carefully isolated area adjacent to the individual shelters. Water obtained in this manner must be boiled for one minute or chemically treated. Chemical sterilization of water under freezing conditions requires a longer period because the disinfecting compounds act with retarded efficiency under such conditions. The time allotted for contact with purification tablets should be two to four times the normal period of one-half hour. Eating ice or snow is unsatisfactory and may result in injury to lips or tongue. Contamination may also be a hazard. If no other water source is available, as in a survival situation, snow can be eaten but it must first be brought to the melting point by holding it in the bare hand. It may then be eaten slowly and in small amounts. This is best done during periods of temporary heat excess, as during marching, or while in the sleeping bag. The risk of frostbite to the hand must be considered and balanced against the need for fluids. Should some water be available in an uninsulated canteen during a survival situation, this should be warmed under the clothing or in the sleeping bag. Then snow may be added to the canteen after each drink to replace the water consumed. Body heat stored in the slightly warmed water will thus melt the snow with less risk of cold injury to hands or lips. A glass bottle or plastic bag can be used in place of an uninsulated canteen.

3-56. Bough and Firewood Areas

The areas for cutting boughs and firewood should be immediately designated when a bivouac site is selected.

a. Bough Area. The area for cutting boughs for bedding as well as for construction of improvised shelters should be common to all individuals of the group. It is selected in a dense area of woods in which springy, unfrozen boughs are available, and should not be too close to the bivouac site. It is advisable to use sleds in hauling material to the shelter site. Due to the camouflage and track discipline, only one well-concealed trail is used. When cutting boughs, the unnecessary felling of trees should be avoided because trees lying on the ground can be easily observed from the air. Instead of felling trees, only the lower branches should be used.

b. Firewood Area. It is advisable to have the firewood area nearby the area designated for bough cutting so that the same track can be used. Dry, dead pine trees make the best firewood. If no dead trees are available, green birch trees may be chopped; they possess excellent burning qualities even when frozen. The top parts of dead trees should be burned during the daytime, as they give off lighter colored smoke. The lower part of the trunk has more resin and tar, and burns better, but makes more and much darker smoke.

3-57. Storage

Storage problems in winter are increased by snow, low temperatures, thaws, limited storage space, and the increased problems of transportation. Space in any shelter is limited. Only items which are affected by cold, or which must be immediately available, should be stored inside. All other stores must be concentrated, well marked, covered, and left outside. On the other hand, some perishables which are difficult to preserve in summer may be kept during the winter months in a natural "deepfreeze" over an extended period of time. In areas where permafrost exists, a hole can

be dug or blasted out and then covered with insulating material, such as boughs. A constant low temperature can thus be maintained.

a. Rifle Stand and Hanging of Weapon. In wooded terrain a weapon rack may be built from poles placed in a horizontal position and covered with boughs (fig. 3-24). When boughs are not available, various other materials such as empty cardboard boxes, tent or sled covers, waterproof bags or ponchos can be utilized to protect the weapons from rain, dust, and falling or drifting snow. When weapons are hung outside on stacked skis, or suspended above the snow in some other manner, they are hung with the muzzle down to keep falling or blowing snow out of the barrel and working parts.

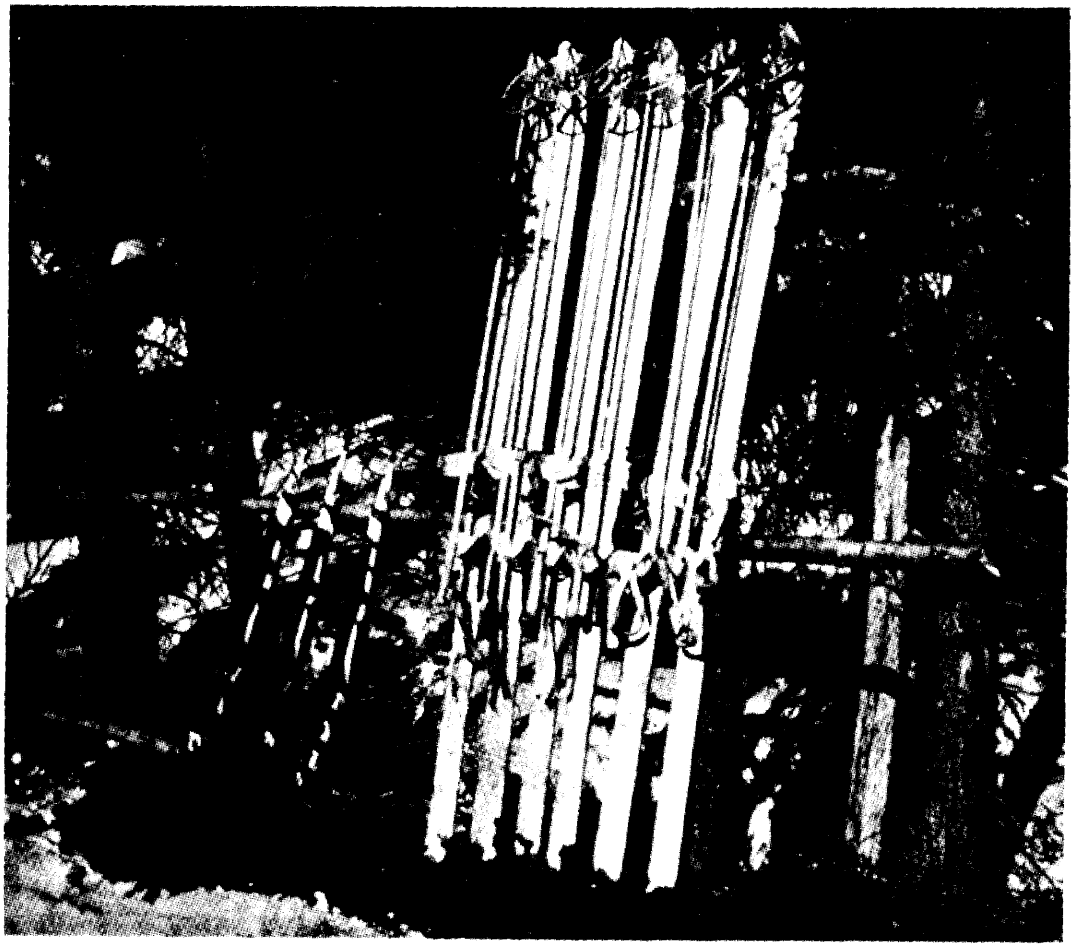


Figure 3–24. Rifle and ski stand.

b. Ski Racks and Stacking of Skis. Care of skis in the field is highly important because unit and individual mobility depends upon them. If left lying on the snow in the bivouac area the bindings and running surfaces will freeze and render the skis unusable for a long period of time, or they may be entirely lost under drifting snow. Therefore, the skis and ski poles are placed on an improvised ski rack made of one or two long poles which have been secured between two growing trees horizontal position (fig. 3–24). In open areas, skis are simply stuck upright or stacked in the snow as described in appendix C.

c. Sleds. Sleds are placed on their sides or on end outside. If loaded sleds are left on the snow, sticks, poles, or branches are laid under the runners to prevent them from freezing to the snow. Heavy cargo sleds, 1-ton or larger, must be placed on top of heavy poles or logs

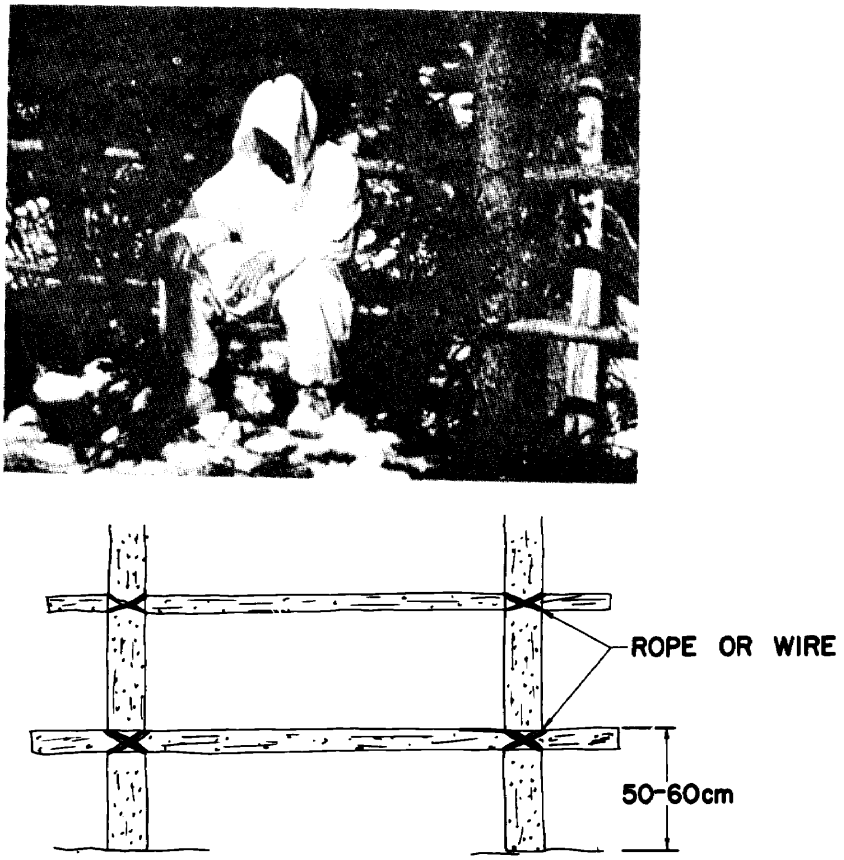


Figure 3-25. Field latrine in the forest.

due to the fact that sled runners remain hot after extensive usage and tend to settle into the snow and become frozen, making movement of the sled difficult the following day.

d. Vehicles. Vehicles are driven under a big tree or in lee of a shelter or snowdrift. Vehicles should be parked so the least amount of snow can get into the engines and parked on brush, logs, dry ground, or other surfaces not liable to thaw from heat of tires and tracks and refreeze.

e. Ammunition and Fuel. Ammunition and fuel are stored separately outside. Ammunition boxes should be stacked off the groung in a dry place and covered with canvas or boughs. In order to locate stacks if snow-covered, a pole should be erected near them. Boughs or poles are placed under fuel containers to prevent them from freezing to the snow.

3-58. Field Sanitation

a. Waste Disposal. Field sanitation in the colder regions is based on the same principles as in temperate climates. The extremes in climate and weather, however, make the problem more acute. The wastes that present constant and real problems are human excreta, garbage, and trash.

(1) In bivouac areas, pit or "cross-tree" type latrines are used for the disposal of human waste (fig. 3-25). One latrine will usually serve the needs of individuals occupying 3 to 4 shelters, or a unit of platoon size. The latrine is placed downwind from the bivouac, but not so far from the shelters as to encourage invididuals to break sanitary discipline. Ration boxes or similar material should be used to collect waste. A urinal, designated for each shelter, should be located within 4 to 5 meters (4 to 5 yards) of the shelter. A windbreak of boughs, tarpaulins, ponchos, or snow wall should

be constructed to protect the latrine from the wind.

(2) When breaking bivouac, the human waste that has accumulated in the latrine will be burned or buried. All closed latrine sites, tactical situation permitting, will be clearly marked.

b. Trash and Garbage Disposal.

(1) In winter the edible portion of food waste may be collected in receptacles and disposed of by burial in the snow at a safe distance from the bivouac. Every effort should be made to burn the bulk of the trash and garbage. During seasons and in locations where bears are found, all edible garbage should be burned to avoid attracting bears to campsites.

(2) All trash and garbage dumps should be marked with appropriate signs to warn troops who might occupy these disposal sites at a later time.

(3) Strict camouflage of all trash and garbage is essential. Dark trash on the white snow is easily seen from the air. Glittering tin cans or bottles may be seen by the enemy. Trash and garbage should be placed under any available cover and camouflaged with snow, branches, or other materials.

c. Rats and Mice. Rats and mice will be found in most of the habitable cold regions of the earth. They are a definite menace to health and property and should be kept under strict control. Rat poisons or traps should be used when available.

CHAPTER 4

SKIING AND SNOWSHOEING

Section I. INTRODUCTION

4-1. Purpose and Scope

a. The purpose of this chapter is to provide information concerning—

(1) Techniques used in military skiing and snowshoeing.

(2) Application of these techniques to facilitate the oversnow mobility of troops engaged in military operations.

b. This chapter also describes-

(1) Equipment available for military skiing and snowshoeing.

(2) Maintenance and care of that equipment.

4--2. General Considerations

a. The Need for Individual Mobility.

(1) Warfare in snow-covered areas requires oversnow mobility off the roads. Well-trained ski and snowshoe troops are a definite asset on the snow-covered battlefield. In deep snow (61 cm (2') or greater in depth) the individual has almost no mobility without the aid of skis or snowshoes. Troops on skis attain mobility, are not roadbound, and are able to move cross-country over all types of snow-covered terrain. They are ideally suited for reconnaissance, security missions, and deep penetration patrols conducting unconventional type operations. Aggressive action can be carried out with advantage against the enemy flanks, rear, or communication lines by lightly equipped, fast-moving troops on skis.

(2) Deep snow hinders movement on foot. By using snowshoes, individual mobility will be restored to a point approximately equal to that of foot movement on hard ground. Skis, on the other hand, provide individual mobility usually exceeding that possible on foot.

b. Need for Certain Techniques.

(1) During cross-country marches and in combat the soldier on skis or snowshoes will be required to negotiate various types of terrain conditions. He will be moving and operating in different weather and snow conditions. Carrying a rucksack-and a weapon, he will be required to move in forests, over open terrain, uphill and downhill, and often while pulling a sled.

(2) In order to execute his mission with the least wasted effort, the soldier must apply the proper techniques of skiing and snowshoeing required for the various conditions under which he will operate.

c. Use of Oversnow Equipment to Achieve Mobility.

(1) The means available to the individual soldier for obtaining oversnow mobility are skis and snowshoes. When operating in snow-covered terrain the soldier must be equipped with either skis or snowshoes at all times. Using skis, he is normally able to execute long marches with less effort and in less time than when using snowshoes. Cross-country movement by soldiers on skis can be facilitated by towing

the skiers with tracked vehicles or animals (skijoring). Snowshoes are more suitable than skis in confined areas, when working close to heavy weapons, or when training time is limited.

(2) Rates of movement over snow-covered terrain cannot be given in exact time requirements. They vary in each situation. However, as a guide, the following rates are listed. Rates are given for movement over flat or gently rolling terrain while individuals are carrying a rifle and loaded rucksack.

	Unbroken trail	*Broken trail*
On foot (less than 30cm (1′) of snow).	1–2 mph	1¼–2 mph
On foot (over 30cm (1′) of snow).	¼–¾ mph	1¼–2 mph
Snowshoeing	1–2 mph	2–2½ mph
Skiing	1–3½ mph	3–3½ mph
Skijoring	N/A	5–15 mph (depending on terrain)

Section II. SNOW AND TERRAIN

4-3. Snow Composition

Snowflakes are formed from water vapor, at or below 32° F., without passing through the liquid water state. Newly fallen snow undergoes many alterations on the ground. As the snowmass on the ground packs and becomes denser, the snowflakes consolidate and the entrapped air is expelled. These changes are caused by effects of temperature, humidity, sunlight and wind.

a. Temperature. In general, the lower the temperature, the drier the snow and the less consolidation. As the temperature rises, the snow tends to compact more readily. Temperatures above freezing cause wet snow conditions. Lowered night temperatures may refreeze wet snow and form an icy crust on the surface.

b. Sunlight. In the springtime, sunlight may melt the surface of the snow even though the air temperature is below freezing. When this occurs, dry powder snow is generally found in shaded areas and wet snow in sunlight areas. Movement from sunlit areas into shaded areas is difficult because the wet snow will freeze to skis and snowshoes. After sunset, however, wet snow usually refreezes and the ease of movement improves.

c. Wind. Wind packs snow solidly. Wind-packed snow may become so hard that skiing or even walking on it makes no appreciable impression on its surface. Warm wind followed by freezing temperatures may create an icy, unbreakable crust on the snow. Under such conditions, skiing and snowshoeing are very difficult. Another effect of wind is that of drifting the snow. The higher the wind velocity and the lighter the snow, the greater the tendency to drift. All troop movement is greatly affected by drifting snow and wind, the effect depending on the relative direction and velocity. In addition, as the wind, increases, the effect of extreme cold (windchill effect) on the body may slow down or temporarily stop movement, possibly requiring troops to take shelter. The snowdrifts created by wind usually make the snow surface wavy, slowing down movement, especially in darkness.

4-4 Snow Characteristics

The characteristics of snow which are of greatest interest to the soldier are—

a. Carrying Capacity. Generally, when the snow is packed hard, carrying capacity is greater and movement is easier. Although the carrying capacity of ice crust may be excellent, movement generally is difficult because of its slippery surface.

b. Sliding Characteristics. All-important to the skier are the sliding characteristics of snow. They vary greatly in different types of snow and temperature variations and materially increase or decrease the movement of the skier, according to the conditions that exist.

c. Holding Capicity. The holding capacity of snow is its ability to act upon ski wax in such a way that backslapping of the skis is prevented without impairing the forward sliding capability. Holding capacity changes greatly with different types of snow, making it

necessary to have a variety of ski waxes available.

4-5. Effects of Snow and Terrain on Individual Movement

a. Skis or snowshoes are usually employed in military operations when the depth of snow is 30 cm (1') or more. This equipment is needed in deep snow conditions to provide the necessary oversnow mobility of the individual and the maneuverability of troops.

b. Snow cover, together with the freezing of waterways and swampy areas, changes the terrain noticeably. Generally, the snow covers minor irregularities of the ground. Many obstacles such as rocks, ditches, and fences are eliminated or reduced. Lakes, streams, and muskeg, impassable during the summer, often afford the best routes of travel in the winter when they are frozen and snowcovered. During breakup periods this advantage is reduced, since the snow becomes slushy and the carrying capacity is poor. Even so, skiing or snowshoeing, although slow, is often the only practical way to move during this period. The drop in temperature at night will still freeze the snow surface, creating a good route for a skier or snowshoer during the night and early morning.

c. The effects of snow and terrain on individual movement vary in different areas.

(1) The arctic tundra and vast subarctic plateaus are similar. They are characterized by large plains and gently rolling terrain with scant vegetation where rocky ridges, scattered rock outcroppings, riverbanks, and scrubby brush still create obstacles to individual movement, when encountered. The shallow snow cover normally found in these areas, as a rule, is firmly packed by wind action and will usually support a man on foot. When the snow has not been wind packed and is still soft, mobility will be increased by the use of skis or snowshoes.

(2) Forested areas include vast coniferous forests, dense brush, swamps, and numerous lakes and rivers. Skiing and snowshoeing are relatively easy on frozen, snow-covered rivers, lakes, and swamps. In wooded areas concealment is best, but movement is hampered by vegetation and soft snow, therefore, greater skill is required in skiing to avoid trees and other obstacles. These disadvantages are reduced by careful selection of the best routes and following proper trailbreaking procedures. Woods retard the melting of snow in spring often allowing skiing after the open fields are clear of snow. In autumn, the situation is reversed; the deeper snow is generally found in the open fields allowing skiing earlier than in wooded areas.

(3) Mountains present special problems. Their varied and steep terrain place additional demands upon the skill of a skier and make movement on snowshoes or skis very difficult. Slopes which are easy to negotiate in summer often become difficult and dangerous to cross in winter because of deep snow cover which is prone to avalanche. Large drifts and snow cornices present other obstacles and dangers. Snow cover on glaciers obscures crevasses and makes their crossing hazardous (FM 31-72).

Section III. MILITARY SKIING

4-6. Advantages and Disadvantages

a. Advantages.

(1) In snow-covered terrain the weakest and the most vulnerable points of the enemy are usually the open flanks, rear areas, and the lines of communication. Attacking, defending, or delaying troops require a high degree of oversnow, cross-country mobility to reach these objectives. Units on skis are the most suitable troops to be used for surprise attack on distant objectives.

(2) A trained individual or a unit on skis

can execute cross-country marches on roadless, variable, and snow-covered terrain more efficiently and quickly than on snowshoes or on foot.

(3) Skiing over snow-covered terrain by properly trained troops is comparatively less tiring than marching on snowshoes or on foot. Sliding characteristics obtained by the skier increase speed, mobility, and rate of march.

(4) Due to increased weight bearing surface, a skier or a unit on skis is able to cross frozen lakes and rivers when the ice will not support a man on foot.

(5) The use of oversnow vehicles and other suitable means of towing troops further increases their mobility.

b. Disadvantages.

(1) Individuals require a considerable amount of training before becoming proficient in the use of skis for military purposes.

(2) Certain terrain features, such as very dense brush and windfall areas, materially decrease the rate of march of a ski unit.

(3) Skis often require rewaxing for changing snow conditions, which consumes time. Skis also do not provide good traction regardless of wax used, for pulling loads.

4-7. Training Objectives

a. General Considerations. A soldier on skis must be capable of moving under control across diversified, snow-covered terrain while carrying the arms and equipment necessary for tactical operations. Since skis are often the most efficient means of transportation in winter warfare, the soldier should be so skilled in their use that skiing becomes a natural method of movement. Since the skiing soldier will utilize his skis for the greater portion of movement over snow-covered terrain, it is important that he acquire good skiing technique in order to be able to move anywhere required both quickly and with the least expenditure of energy. The soldier must develop these techniques so that his movement either uphill or downhill will not delay the movement of his unit. When operating in mountainous areas, the soldier must possess efficiency in both basic and advanced military ski techniques in order to move easily and safely over steep and rough terrain; the soldier must possess endurance and must be in top physical condition.

b. Training Time Required. To walk on snowshoes, one day of instruction is generally sufficient. However, several days use of snowshoes during normal training will rapidly increase proficiency. In a period of 2 weeks a soldier can be taught enough ski techniques to enable him as an individual to negotiate flat or rolling terrain with greater speed than if he were on foot or snowshoes, but he will not yet be able to operate effectively as a combat skier within a unit. At least 8 weeks of intensive training are needed in order to become a military skier capable of operating proficiently in any type of terrain. It should be noted that the level of skiing skill developed by the soldier during any period of ski instruction is improved by participating in unit training which is done on skis.

4-8. Ski Equipment

a. Skis. Military skis were formerly issued in 198 cm (61/2'), 213 cm (7') and 229 cm (7½') lengths. The standard issue ski is now 213 cm long (7') ; however, until stocks are depleted the other length skis may be issued in lieu of the standard ski. The standard skis are of laminated wood construction with hickory tops and running surfaces. They are all terrain cross-country skis with steel edges (fig. 4-l). The metal edges give better gripping action in turns and on icy and hard packed snow which results in better control. All skis are painted white and have a hole in the tip through which a cord can be threaded when it is necessary to pull them as ski bundles or as an improvised sled.

b. Ski Binding, All Terrain. The binding consists of a toeplate, toe straps, soleplate, heel cup, quick-release fasteners and mounting hardware (fig. 4-2). The toe plate is aluminum; the toe strap and heel cup are made of white rubber and three plies of dacron, the soleplate is made of fiberglas. This binding will accom-

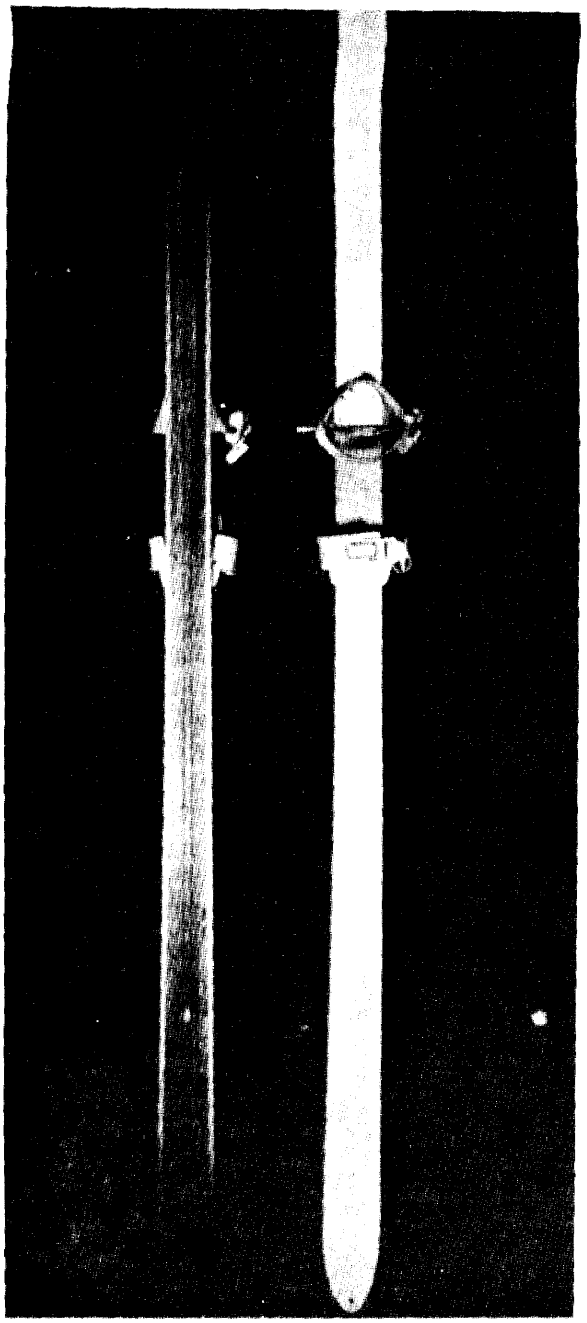


Figure 4–1. Ski, military, all terrain.

modate all types of cold weather footgear and is easily put on and removed. The soleplate is flexible and allows free vertical movement of the heel which assists normal foot movement.

c. Ski Poles. Nonadjustable tubular steel poles, 130 (51"), 137 (54") and 147 cm (58") in length, are the standard item of issue, however, the adjustable ski pole is being used until stocks are depleted. Figure 4-3 illustrates the different parts of the ski pole. In an emergency, the poles can also be used for tent poles, markers, or in the construction of emergency litters.

d. Ski Repair Kit and Emergency Ski Tip. This kit contains pliers, screwdriver, screws, wire, drill, strips of steel edging, and leather thongs for use in emergency repair of skis, poles or bindings while in the field. An emergency ski tip is also available. This can be used to repair or replace broken ski tips and allow the individual to continue the march until replacement skis can be obtained. Ski repair kits and emergency ski tips are usually issued to units and are not intended for individual issue. One ski repair kit per rifle platoon and one emergency ski tip per squad is usually sufficient.

e. Ski Waxes. Ski wax is used to obtain the sliding and climbing characteristics necessary for efficient military skiing. The waxing of skis is covered in paragraph 4-10.

f. ***Ski Climbers.*** Climbers are strips of canvas with mohair secured to the running surface, which are attached to the bottom of the skis by means of straps (fig. 4-4). When attached, the mohair material lies with the ends pointing towards the heel of the skis. Forward movement of the ski does not disturb the material, thereby allowing the ski to slide. Backward pressure, however, causes the material to become roughened, preventing the skis from backslapping. Climbers are used by troops to make the climbing of steep slopes faster and less tiring, providing the ascent is sufficiently long to justify the time required to put them on and take them off. They may also be used to give more traction while pulling sleds, and for descents where sliding is not desired.

4-9. Preparation of Skis

a. General. Pine tar or ski lacquer is applied to the running surface of the skis to fill the pores of the wood and to furnish a base so that the skis may be properly waxed. They are also applied to the running surface of the skis to prevent moisture from being absorbed by the wood. For military skiing, pine tar is preferred as a base. If this is not available, ski lacquer is a suitable substitute. They must

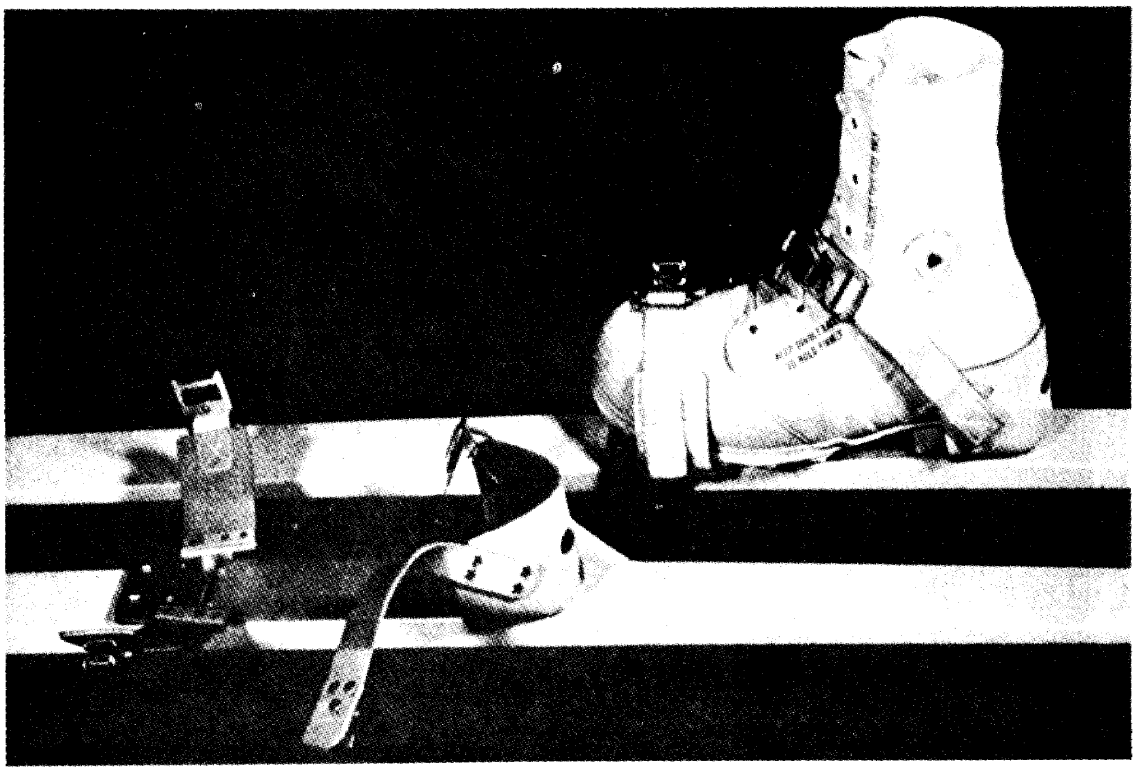


Figure 4–2. Ski binding, all terrain.

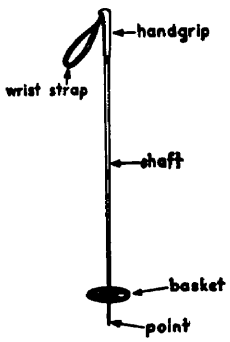


Figure 4–3. Ski pole.

be used separately since they do not mix together.

b. Application of Pine Tar or Ski Lacquer.

(1) *Preparation of skis.* The running surface must be clean to prepare the skis for pine-tarring or lacquering. If the ski has been used, the old base and wax must be removed. The easiest way to accomplish this is to use a scraper and sandpaper. Caution should be exercised to insure that the running surface of the ski is not damaged. Old wax can also be removed by the use of steel wool or a rag moistened with a high flashpoint solvent. Solvent should only be used in an adequately ventilated working area with no smoking or open flames. If conditions are such that these materials are not available, heat can be used to remove the wax.

(2) *Tarring procedure.* After the ski has been cleaned, a light coat of pine tar is then applied with a soft brush or a rag. If the pine tar is stiff, it should be heated slightly so it can be evenly distributed. Heat is then applied to the running surface to cause penetration of the pine tar into the pores of the wood. The source of heat may be a blowtorch (fig. 4-5), one burner stove, or an open fire (fig. 4-6). To obtain the best penetration, work

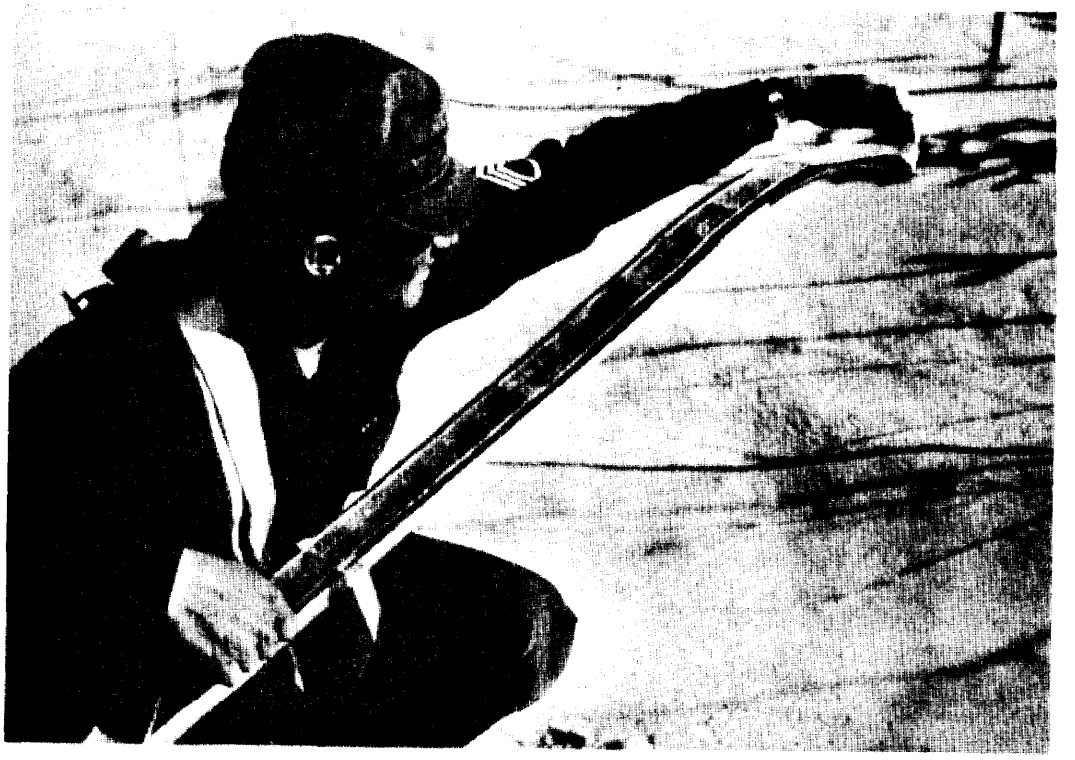


Figure 4–4. Attaching ski climbers.

progressively on one section at a time rather than heating the whole surface of the ski. Care must be taken to avoid burning or scorching the wood by application of too much heat. It may be necessary to repeat this procedure several times to obtain a sufficient coating. Excess pine tar is removed during the heating process by means of a rag. When finished, the running surface of the ski should be dry and not sticky to the touch.

(3) *Lacquering procedure.* After the ski has been cleaned, the surface is allowed to dry thoroughly before applying the lacquer. The lacquer is applied with a clean brush, rag, or sponge, starting at the tip and working towards the heel using smooth, even strokes in a continuous motion. None of the lacquered areas should be touched until the lacquer incompletely dry. This requires several hours. The application should be made at room temperature for best results. At least two separate coats should be applied, making certain that each one is completely dry before the next one is applied. It is recommended that the surface be lightly sanded with fine sandpaper or steel wool, between coats. Care must be exercised not to inhale toxic lacquer fumes. For prolonged or repeated exposure to such fumes, unapproved respirator should be worn. No smoking or open flames should be permitted in or around the work area and adequate ventilation should be provided.

4-10. Waxing of Skis

a. General. There are no standard ski waxes available in the supply system therefore commercial waxes must be procured and used. The purpose of ski wax is to provide the ski with necessary climbing and sliding qualities to prevent backslip in various snow conditions. When snow conditions and temperature change, the

Figure 4–5. Heating pine tar with a blowtorch.

type and method of application of ski wax will also differ. Before wax can be properly selected and applied, the individual must learn to recognize the different types of snow conditions. It is also valuable to have some knowledge of how ski wax performs in relation to snow. After snow has fallen on the ground, its crystalline structure is continuously altered by the effects of temperature, wind, and humidity. In very cold weather these changes occur much more slowly than when temperature is near 32° F. Therefore, the most important factor of waxing is the effect that temperature has on the character of the snow and its sliding qualities.

b. Snow and its Effects on Wax.

(1) *The effects of snow crystals.* It is important to understand the relation of wax to the holding and sliding capabilities of the snow. For this reason there are specific waxes to use in cross-country skiing under different snow surface conditions.

(a) Proper wax. When the soldier is skiing on the level, or uphill, his body weight gives maximum pressure to the skis. The soft quality of the wax allows the crystal structure of the snow to penetrate the wax under this pressure and thus keep the ski from backslapping. When the pressure is lifted and the ski allowed to slide forward, the penetrating snow crystals will slide free from the surface of the wax reducing friction. Continuous forward motion, as in sliding, keeps the crystals from penetrating the wax.

(b) Wax too soft. When the skis slide poorly, the following condition generally exists: the snow crystals have penetrated into the wax but will not slide free. This causes clogging of the snow on the running surface and may eventually cause ice to form. Under these conditions the soldier will find that even vigorous sliding of the ski will not break the snow loose from the wax surface. Little or no forward slide can be gained.

(c) Wax too hard. When the skis slide well, but backslip on the level and when moving uphill, the following condition exists: the snow crystals are not penetrating the wax. The soldier will find he has excellent sliding when going downhill, but climbing uphill or skiing on level ground is very exhausting because of backslip. This is the primary deterrent to the use of "downhill" waxes for cross-country skiing.

(2) Classification of snow. Snow is classified here into four general types. This classification is intended to assist the soldier in snow identification, choice of wax, and its proper application under these different conditions.

(a) Wet snow. This type of snow is

Figure 4–6. Heating skis over an open flame.

mostly found during the spring, but it may also occur in the fall or late winter, particularly in regions of moderate climate. This type of snow can be readily made into a heavy, solid snowball. In extreme conditions, wet snow will become slushy and contain a maximum amount of water.

(b) Moist snow. This type of snow is generally associated with early winter, but may also occur in midwinter during a sudden warmup period. This type of snow can be made into a snowball, but will not compress as readily or be as heavy as a wet snowball. It will have a tendency to fall apart.

(c) *Dry snow.* This type of snow is generally associated with winter at its height, but it can occur in late fall as well as in spring, when abnormally low temperatures occur. This snow is light and fluffy. It cannot be compressed into a snowball unless the snow is made moist by holding it in the hand. At extremely low temperatures, such as those found in the far northern regions, this snow is like sand, and has very poor sliding qualities.

(d) *New snow.* This is snow which is still falling or has recently fallen on the ground, but has not been subject to changes due to the sun or temperature variation. It can be wet, moist, or dry in nature.

c. Proper Selection and Application of Waxes. Cross-country ski waxes are formulated to provide optimum sliding and climbing characteristics for various types of snow conditions. Each type is labeled with appropriate instruc-

tions on its intended use, i.e., wet, moist or dry snow conditions. Since the types of wax vary between manufacturers, no particular type of wax can be prescribed for each classification of snow; however, the instructions on each container specifies the weather conditions and type of snow where performance of the wax is best. Proper application of all waxes is important to achieve desired results whether they be traction or sliding action. As a general rule, the wax that gives the best sliding surface for all types of snow provides an excellent base for application of other waxes. To provide traction, varying amounts, combinations, and methods of application of other waxes are used. When pulling a sled or carrying a heavy load, thicker coats of wax may be required to insure traction.

d. Waxing Procedure.

(1) Whenever possible, the waxing of skis should be done before the march when shelter and heat are available, as the running surface of the ski should be warm and dry to obtain best results. When on the march, ski wax should be carried in the pockets, if possible, so that body heat will keep the wax soft and easy to use. If the skis need waxing during the march, the running surfaces are dried as much as possible by the use of paper or dry mittens. Whenever possible, old wax should be removed before rewaxing skis particularly when a different type of wax is being used. Refer to paragraph 4-9 *b* (1) for proper method for removing old wax.

(2) To apply, cover the running surface with wax. Next, smooth the wax by rubbing it with the hand, using the heel of the palm or the fingers (fig. 4-7), a waxing cork, or a heated iron. When heat is available, this process can be made easier by warming the wax that has been applied. It is normally best to work progressively on a section at a time, from the ski tip towards the heel. If the waxing is done in a shelter, or heat is used, the skis should be allowed to cool to outside air temperature before being used. Do not place the running surfaces of skis on snow immediately after waxing if heat is used or if waxing is done in a heated room or shelter as the snow may stick and freeze to the running surface. For the same reason protect the running surfaces against wind driven snow. To insure that wax is properly chosen and applied, the skis should be tested before being used on an extended march.

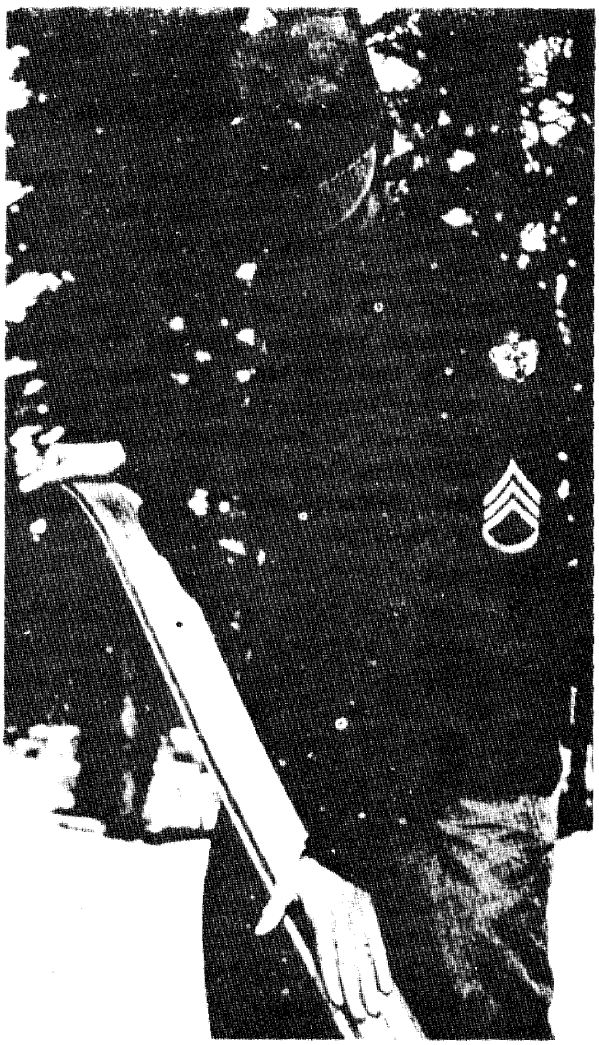


Figure 4–7. Smoothing wax with bottom of hand.

4-11. Care of Ski Equipment

a. General.

(1) A broken ski or binding may put a

soldier at the mercy of the enemy and the elements and prevent him from accomplishing his mission. If the soldier keeps his skis and equipment in good condition, he will find that ski marches are easier and less tiring and that he will not be the cause of any unnecessary delays and halts by his unit. Care of ski equipment is the responsibility of the individual soldier—he must check it before starting out on a mission, during breaks, and when in bivouac. At least once a week the ski equipment should be thoroughly checked by unit leaders. During combat the inspection must be done whenever the situation permits.

(2) Skis must be checked for proper base of pine tar, evidence of possible warping and splitting, loss of camber, defective edges, and broken steel edge sections or screws. At the same time bindings must be checked for worn straps, missing rivets and screws, and proper adjustment. Ski poles should be checked to insure that wrist straps, handgrips, baskets, and points are firmly fastened and that no breakage has occurred.

b. Daily Care.

(1) After each day's use, the skis and the skiing equipment should be checked and necessary repairs made by the individual as follows:

(a) Skis. Remove any snow or ice that has frozen to the ski. This may be done with heat. If heat is not available, this can be done with a mitten, wooden stick, or piece of metal. Check the heels and tips of the skis for cracks. Badly cracked skis must be replaced, as they are weakened and break easily. At the same time, check for and replace defective or missing edges and screws. The condition of ski bottoms is then checked and, if needed, additional pine tar or base wax is applied. The surface waxing for the next day's march is deferred until snow conditions are determined in the morning or shortly prior to departure. After maintenance of skis is completed, they should be placed indoors, preferably in a ski rack (fig. 4-8). Under field conditions, skis are placed in an improvised ski rack, planted upright in the snow or stacked.

(b) Bindings. Insure that all straps, buckles, screws and rivets are present and in good condition. Replace parts which are unserviceable. If necessary, readjust the fit of the bindings.

(c) Poles. Check wrist straps, handgrips, shafts, baskets, and points to insure that they are in good condition. Broken parts should be replaced at the first opportunity. Temporary repairs can be made with wire, cord, or tape.

(2) When snow cover is comparatively thin, be careful not to damage the skis while skiing in rocky or stumpy terrain. Sometimes there is water under the snow cover on frozen rivers or lakes. Try to cross them at a dry place; make an improvised hasty bridge from trees or boughs, if time permits. If the skis become wet during a crossing of water, the ice which forms on the skis must be removed after reaching the bank. A long march or sudden change in temperature may require rewaxing of skis during the march. When skis are removed, do not leave them on the snow. It may stick and freeze on the running surface. Remove the snow from the skis and stack them beside the ski tracks or lean the skis against a tree. A ski stack can be built by each squad.

c. Repair.

(1) *General.* Repair of unserviceable ski equipment requires qualified personnel with necessary tools and facilities, Therefore, the soldier will only be permitted to make emergency repairs such as replacing bindings, screws, and steel edges.

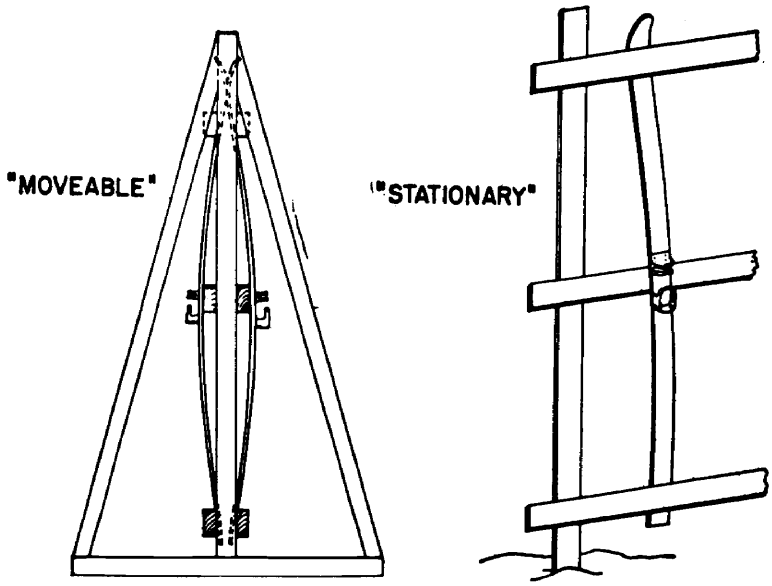


Figure 4–8. Two types of ski racks.

(2) *Emergency repair.* The repair of ski equipment under field conditions is emergency repair. In many cases broken skis or worn out parts of ski equipment must be replaced. To facilitate this, the following arrangements are necessary:

(a) Every unit should have replacement skis, bindings, and poles. There should also be available, ski repair kits, pine tar or lacquer, and waxes.

(b) Every squad should have one emergency ski tip (fig. 4-9) and each platoon, one ski repair kit.

(c) Every man should have the following in his possession at all times:

1. Emergency thong.
2. Pocketknife.
3. Piece of light wire (malleable) or nylon cord.

(3) *Combat repair.* During combat, the most suitable time for maintenance and repair of skis and ski equipment is when the unit is in reserve.

d. Storage.

(1) Proper storing of skis and skiing equipment is most important , during off seasons. Improper care in storage procedures will damage this equipment, making it unserviceable.

Figure 4–9. Attaching an emergency ski tip.

(2) When the skiing season is over, skis and poles are turned in by the using unit for storage. Before doing so, the

skis must be cleaned and old waxes removed.

(3) Skis and poles are then checked thoroughly. Those in good condition are separated from those in need of repair or salvage. Necessary repairs are made. Ski bindings are not removed. All skis should be pine-tarred or lacquered. If needed, skis are repainted. Skilled personnel are needed for repairing skis and poles and for preparing them for storage.

(4) In further preparation, the skis are tied together by matching pairs according to their factory markings not unit markings. A piece of string or cord is used to tie the skis at their tips and heels with running surfaces facing each other. A wooden block (waxing cork may be used) is then placed-between the skis at the metal toe plates. The correct spread is about 6 to 8 cm (2" to 3"). After being Mocked, the skis are stored in a vertical position, with the tips down. If the skis must be stored horizontally, they should be supported at both ends and at the middle, with the end supports on the top side of the ski and the middle support beneath and arranged so that tension is maintained on the camber. Each ski should be supported individually when stored horizontally. The storage room should be dry with an even temperature and good ventilation (fig. 4-10).

(5) After ski poles are checked, repaired, and reconditioned, they should be placed in the same storage area as the skis.

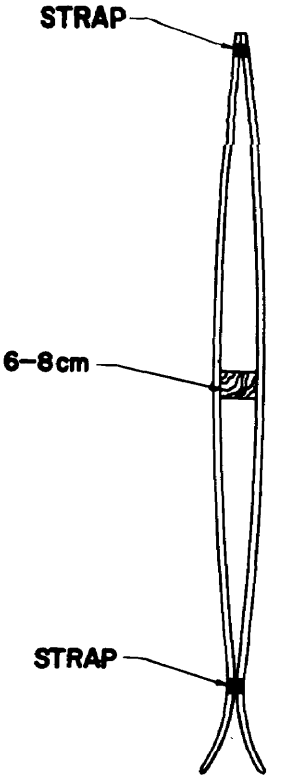


Figure 4–10. Blocked skis for storage.

4-12. Basic Movement

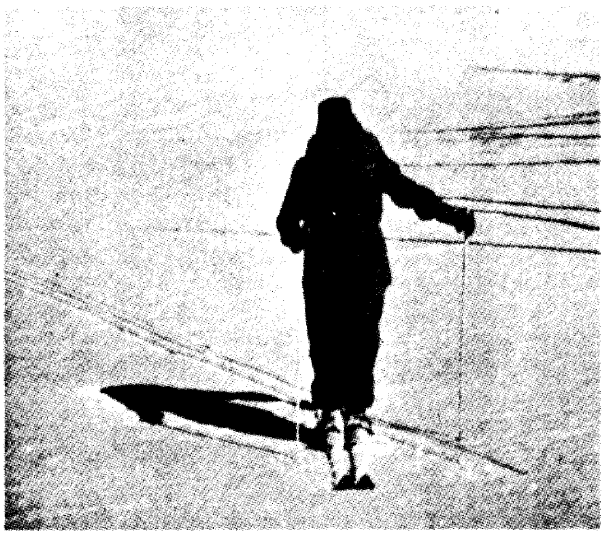
a. General. In moving on skis for the first time, most beginners find that skis are awkward to handle due to the difficulty of obtaining the necessary balance and coordination. To overcome these difficulties, the first instructional phase is devoted to step turns and walking on level ground in order to obtain the balance, correct body position, coordination, and rhythm necessary in skiing. In addition, this

1 From the starting position the right ski will be placed approximately 45° to the right.

Figure 4–11. Step turn.

2 After placing the right ski, the left ski will be brought alongside and placed parallel.

Figure 4–11—Continued.



3 As the left ski pole is finally brought in alongside the left ski, the cycle is completed.

Figure 4–11—Continued.

basic movement is a means of forming the foundation for further instruction. Ski drill techniques are covered in appendix C.

b. Skiing Without Poles. The soldier will find that in performing duties, especially in combat, he will be required to ski either with poles carried in one hand or without poles. For

4 As many repetitions of this cycle as necessary are made until the new desired direction of travel is reached.

Figure 4–11—Continued.

this reason, it is important that he practice all techniques with and without the use of ski poles. This is especially important in the beginning stages of skiing, as practice without ski poles will aid in learning proper transfer of body weight, balance, timing, and control of the skis.

4-13. Step Turn

a. Use. The step is the simplest means of changing direction from a standing position. It is particularly valuable in brushy and wooded terrain (fig. 4-11).

b. Technique.

(1) From the standing position the right (left) ski tip is raised, the ski is rotated to the right (left) side, using the heel of the ski as a pivot.

(2) The ski is placed on the snow and the body weight shifted onto it.

(3) The left (right) ski is moved along side the right (left) in the same manner.

(4) Each pole is raised, moved, and placed with the corresponding ski (i.e., right ski, right pole).

(5) The same movement is repeated until the desired direction is obtained.

(6) In confined areas it may be necessary to use the tip of the ski instead of the heel as a pivot point. In turning to the right (left) the heel of the left (right) ski is raised off the snow and moved to the left of its original position. Then the right (left) ski is moved alongside the left (right) ski and this sequence repeated until the desired direction is achieved.

4-14. Kick Turn

a. Use. The kick turn is a method for reversing the direction of a skier when in a standing position. It is used on both flat and steep terrain. In combat, it is also useful to conceal a change of direction in a ski track (fig. 4-12).

b. Technique.

(1) Beginning in the standing position with skis level, the left (right) pole is placed alongside the left (right) ski approximately 45 to 60 cm (18" to 24") in front of the toe of the foot. At the same time the right (left) pole is placed alongside the right (left) ski about 45 to 60 cm (18" to 24") behind the heel of the foot.

Prepared for a kick turn to the right by swinging the right foot and ski to the rear a slight amount.

Figure 4–12. Kick turn.

(2) The right (left) leg is swung forward and upward until the ski is momentarily perpendicular, its heel alongside the tip of the left (right) ski. To obtain sufficient momentum for this movement, a preliminary backward movement of the right (left) ski should first be made.

2 The right ski is then swung forward and the heel placed in the snow, approximately even with the left ski tip.

Figure 4–12—Continued.

3 From the vertical position the right ski is allowed to swing away from the body, keeping the heel in place, and rotated until it is parallel with the left ski.

Figure 4–12—Continued.

(3) The right (left) ski is then pivoted on its heel and lowered, pointing in

4 The left ski is lifted and rotated around to the new position, parallel with the right ski.

Figure 4–12—Continued.

the opposite direction and parallel to the left (right) ski.

(4) The body weight is shifted to the right (left) ski, bringing the left (right) ski and pole around and alongside the right (left) ski in the new direction, placing the ski pole in the snow.

(5) On a gentle slope the procedure is the same, except the uphill ski should be turned first.

(6) On a steep slope, the skis are placed horizontally across the slope and edged into the slope for necessary stability. The movements in executing the turn are the same as described above except that both ski poles are initially placed in the snow above the skis and the downhill ski is turned first. Then the uphill ski and pole are brought around simultaneously to complete the turn.

4-15. The Walking Step

a. Use. This is the simplest movement in skiing and is used as the basic step in forward motion. In military skiing, its application is for situations where walking or climbing is necessary. On level ground, sliding action of variable degrees can be obtained.

b. Technique.

(1) From the position of attention on skis (para C-17) left unweighted ski is slid flat over the surface of the snow and straight forward as in normal walking.

(2) At the same time, both knees are bent and the body weight is gradually shifted onto the advanced foot. The heel of the rear foot is raised.

(3) The right ski pole is moved forward and the basket is placed close to the right ski, towards the tip, with its shaft leaning to the front.

(4) A push to the rear with the pole is made, assisting in the forward body motion.

(5) The above motion is repeated with the right ski.

(6) On level ground the skis are kept flat and parallel.

(7) The skis are not lifted off the snow, and the weight of the skis is carried by the snow.

4-16. One Step

a. General. The basic movement of the one step is the walking step. Forward motion and glide are increased when the skier applies more effort to his step. This added effort is obtained by a lunge coordinated with an increased push from the poles.

b. Use. The one step is the most widely used of all skiing steps. It is applied under all types of snow conditions on level ground (fig. 4-13).

c. Technique.

(1) The one step is started by a forward lean of the body, with well bent knees and ankles. The feet are kept flat and the body weight is on the right ski, from which the initial movement (lunge) is made.

(2) The left, unweighted ski is slid flat and straight forward by a springing motion from right ankle, knee, and hip, straightening the body and transferring the weight to the left sliding ski.

(3) The springing motion (lunge) above,

Figure 4–13. One step.

is completed by straightening the right knee and pushing off from the right foot, thus completing the weight transfer.

(4) The body weight is kept on the sliding (left) ski and, as the glide nears completion, the left knee and ankle are bent in preparation for the next lunge. Meanwhile, the right leg is relaxed and moves the ski forward in preparation for the next step. As this leg reaches a position approximately alongside the left leg, the next step is made with the right ski by lunging from the left leg.

(5) When using the poles, the lunge is executed as above except that as the left foot is slid forward the right ski pole is swung straight to the front and placed towards the tip of the right ski or, when the right ski is slid forward, the left ski pole is brought forward.

(6) The slide is increased by a push with the ski pole. The ski pole is leaned slightly to the front and the arms kept close to the body.

(7) The pushing action of the ski pole is increased progressively by the muscles of arms and shoulders. The push is finished off by a sharp straightening of the arm for added power. When the push has been completed the arm is relaxed and brought forward close to the body in preparation for the next poling action.

(8) During the coordinated movement of poles and lunge, correct timing and a long glide are emphasized. The main power glide is obtained from the lunge executed by each leg, the poling action provides only a secondary source of momentum. All motions are rhythmic and fluent. Poles are used in a relaxed manner and the pressure of pushing is allowed to come on the wrist strap.

4-17. Two Step and Three Step

a. Use. This step is used to attain a longer and faster glide on the level. It is also used as an aid through dips and over bumps.

b. Technique. The technique of the two step is a combination of an accelerated walking step and a one step. In the two step the push is obtained by the use of double poling (fig. 4-14).

(1) From a standing position with the knees slightly bent, a walking step is made with the left ski to start the body in motion initially.

(2) A lunge is then made from the left

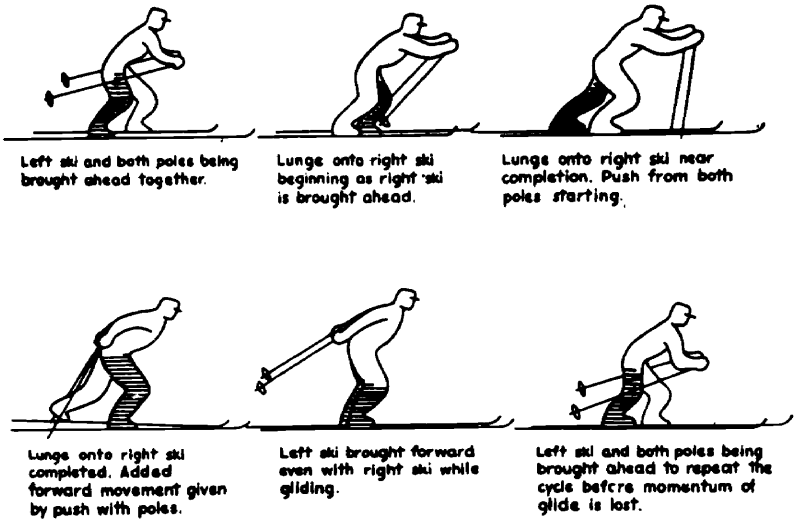


Figure 4–14. Two step.

leg, in a continuous rhythmic motion, to produce a long glide on the right ski.

(3) While gliding on the right ski, the left ski is brought slowly forward and even with the other ski to complete the first two step and in preparation of the next two step. This action should be started before the momentum of the glide has been lost.

(4) As the first step is made, both ski poles are brought straight to the front in a comfortable reach and set into the snow alongside the skis in coordination with the lunge of the second step.

(5) The pushing action with the poles is applied in the same manner as described above in using one pole. As the poles leave the snow, they are brought forward in a straight line in preparation for the execution of the next step. It is most important to time this motion properly to coordinate with the next lunge.

c. Three Step. In addition to the two step, the three step may be used anytime when changing ski steps and when sliding is poor. The initial steps are intended to produce more initial power. It has an advantage over the two step since it allows double poling and lunging from alternate feet. The step is made in the same manner as the two step except that two walking steps are taken before each lunge.

4-18. Variations and Applications of Ski Steps

a. In long, cross-country movement, particularly when skiing with pack and rifle, it is most important to apply techniques properly according to the terrain to insure that energy is spent wisely and conserved as much as possible. To this end, the individual must attempt to obtain as much glide as possible from his skis during each step. Although lasting only for a short moment, the glide will allow the skier to rest temporarily. In addition, all movements must be made in a relaxed manner, which necessitates continuous individual training. The constant use of the same step is monotonous and increases fatigue. To avoid this, various steps are used temporarily. The same effect is also necessary in poling. In order to relax arm and shoulder muscles, a series of steps may be made without poling. In the one step, for instance, the first two steps can be made without using the poles. Any additional combination of steps and poling may be made at one's discretion for the same reason, placing more emphasis on leg rather than arm work, or vice versa.

b. In bumpy terrain, ski steps and poling

may be used individually or in various combinations to provide a strong pushoff to provide the skier with sufficient glide for a continuous motion through a dip and over a bump. When a series of bumps and dips is encountered, the poling action is generally applied on the crest of the first bump in order to obtain sufficient momentum to reach the top of the next bump in a continuous glide. A step supported by double poling may be applied when skiing through the dip. There are other situations where double poling may be applied to gain or increase forward motion of the ski without taking a step.

4-19. Falling

a. General. In military skiing there are two types of falls, controlled and unintentional.

(1) *Controlled falls.* The controlled fall has definite value. It can be used to avoid excessive speed or to avoid hitting obstacles if other means are not possible. The controlled fall can be done safely only at slow to moderate speeds. It is used to take cover quickly, assume a firing position or for a quick stop to avoid hitting an object. When properly used, it can be accomplished without injury to the individual.

(2) *Unintentional falls.* Unintentional falls are undesirable and may cause serious injury. Other undesirable resultsof an unintentional fall are increased fatigue, possible frostbite, and holes in the snow which may cause other skiers to fall. Factors which may contribute to unintentional falls are poor skiing ability, lack of control, snow conditions, fatigue, and excessive speeds.

b. Technique of Falling.

(1) If a fall is imminent, an attempt is made to relax, lower the body, and to land sideways and to the rear.

(2) While falling, an attempt should be made to stretch the body, to extend the arms and to keep the ski poles to the rear (fig. 4-15). Care should be taken to keep the knees from digging into the snow, as such action is a major cause of injury.

1 Falling on the slope

Figure 4–15. Falling and recovery.

2 Recovery from a fall on the slope.
***Figure 4–15*—Continued.**

(3) The impact of the fall should be absorbed by the hips or buttocks.

(4) The unintentional fall is avoided as much as possibie. It is often prevented by the correction of a faulty ski or body position.

(5) Landing directly on a knee or hand must be avoided since the resulting blow may cause serious injury. This is especially serious in heavy wet snow or breakable crust because the extended arm or knee may penetrate and be locked firmly in place before the body has lost momentum.

(6) Although falling or "sitting down" with the skis facing downhill is the preferred method, occasionally a fall "over the tips" cannot be avoided. The important thing to remember is RELAX.

c. Recovery.

(1) To recover from a fall, the skier must first figure out what to do before attempting to rise. A little planning will save time and energy.

(2) If necessary, the pack and other restrictive loads are removed.

(3) Skis are untangled and brought parallel, feet together. Knees are pulled up to bring the skis close to the body. The body is then moved forward and raised, pushing with the pole if assistance is needed.

(4) To use the ski poles, both hands are first removed from the straps. The poles are then placed together with baskets in the snow slightly to the rear, grasped with one hand above the basket, palm facing downward, and with the other hand close to the top, palm facing upward.

(5) The procedure for recovery from a fall on a slope is the same except that the skis are placed below the body and perpendicular (at right angles) to the fall line. To obtain this position it may be necessary to roll onto the back, lifting the skis in the air and then in the proper position. Poles are then used as described on the uphill side (fig. 4-15).

4-20. Straight Uphill Climbing

a. Use. Straight uphill climbing is a method of ascending gentle and moderate slopes.

b. Technique.

(1) Take the first step as in walking the body leaning forward with knees well bent.

(2) On gentle slopes, slide the skis forward without lifting them from the snow. On steeper slopes, more knee bend is required which causes a transfer of body weight. It may become necessary to lift the ski as the step is made, and to place it with a stamping action upon the snow. This will give the ski wax better holding qualities because it will not break down the snow crystals by first sliding over them.

(3) Use the ski poles to assist the body in its uphill movement and to minimize backslip.

(4) The degree of slope which may be ascended using this method is limited by the holding characteristics of the wax used. With repeated backslapping of the skis, the slope should be traversed thereby decreasing the angle of climb, or a different method of climbing should be used.

4-21. Sidestep

a. Use. The sidestep is an effective method of climbing a short, steep slope, where space is confined; it may be the only practical means of ascending slopes. It is also useful for stepping sideways over logs, stumps, and other obstacles.

b. Technique.

(1) The skis are placed together and perpendicular (at right angles) to the slope (fall line). To prevent slipping sideways, the uphill edges of both skis are forced into the snow by pushing both knees forward and toward the slope. Avoid leaning into the slope. Initially, the weight of the body is placed on the lower ski.

(2) The uphill is lifted in a sideways step up the slope (fig. 4-16) and the body weight placed upon it. The upper ski pole is moved at the same time and placed above and alongside this ski.

Figure 4–16. Sidestep.

The lower ski is then moved up as close as possible to the uphill ski, while the skier is supported by a push on the lower pole. This pole is then brought up and placed alongside the lower ski. This completes one cycle of the sidestep. Merely repeat until the desired elevation is reached.

4-22. Uphill Traverse

a. Use. This method of climbing is used when the slope becomes too steep for going straight uphill. Although a traverse generally involves a zigzag route, it will often be the least tiring method of ascending, thereby conserving time and energy.

b. Technique.

(1) An angle of ascent is selected which will allow climbing without backslip.

(2) The skis are edged into the slope on

each step with the ski poles used as in straight uphill climbing.

(8) In changing the direction of ascent a kick turn or a herringbone turn, (para 4-24d) can be utilized. Long traverses should be used whenever possible, since elevation is gained more effectively and with less expenditure of energy in this manner.

4-23. Sidestep Traverse

a. Use. This step is a combination of a sidestep and the uphill traverse. It allows greater vertical climb in each traverse.

b. Technique.

(1) The movement is the same as in the uphill traverse, except the ski is raised slightly and placed uphill as it is brought forward with each step.

(2) The skis are kept parallel and edged, as in the sidestep.

(3) The ski poles are moved in the same sequence as in the sidestep.

4-24. Herringbone

a. Use. The herringbone is used to climb short, moderate, or steep slopes. It provides a quicker ascent than the sidestep. It is more tiring and should be used only for relatively short ascents.

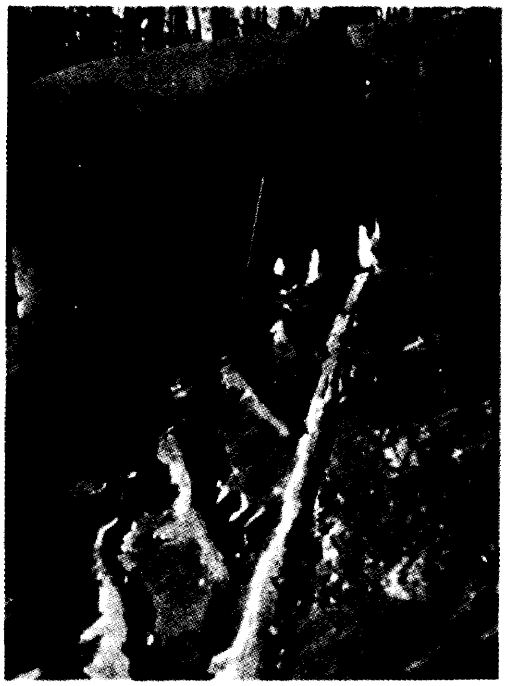
b. Technique.

(1) The body is faced uphill with skis spread to form a wide V. This is obtained by spreading both ski tips outward. The skis are edged sharply inward, to prevent backslip, by bending the knees forward and inward (fig. 4-17).

(2) The first step is made by placing the weight on one ski, raising the other slightly above the snow and moving it forward and upward. This ski is then placed in the snow, edged inward, and the body weight transferred to it. The other ski is then moved in the same manner and placed slightly ahead.

(3) The ski poles are used in the same manner as the sidestep, except they are alternately placed to the rear of

1 Herringbone



2 Half herringbone

Figure 4–17. Herringbone and half-herringbone methods of ascending.

the body and to the outside of each ski to act as a brace and to aid in the climb.

c. Half-Herringbone.

(1) *Use.* The half-herringbone is a variation of the herringbone technique and is used to aid in preventing backslip on gentle to moderate slopes in both straight uphill climbing and traversing (fig. 4-17).

(2) *Technique.* The half-herringbone is executed with one ski in the herringbone position, the other pointing in the direction of movement. The poles are used for support to prevent the ski pointed uphill from backslapping while the other ski is advanced. The downward angle and edging of this ski is increased with the steepness of the slope ascended.

d. Herringbone Turn.

(1) *Use.* The herringbone turn is a method of changing direction while traversing a slope, while climbing, or when in confined areas where a kick turn may be difficult to use. It is also used to change direction from a herringbone position.

(2) *Technique.* From a traversing position the upper ski is moved first in the desired direction, using its heel as a pivot point. This ski is then placed into the snow, as in a herringbone step, with the full body weight on it. The other ski is moved up in the same way and placed into the snow. This brings the skier into a herringbone position. Both poles are held to the rear to brace the body during this movement. This cycle is repeated until the lower ski has reached the desired direction. The upper ski is brought parallel with the lower ski into a traversing position again, completing the herringbone turn.

4-25. Straight Downhill Running

a. Use. Straight downhill running is the first technique learned in skiing downhill. It provides the individual with the balance which he must have before he can effectively descend a slope or learn more advanced techniques. Although it is the fastest means of descending, speed must be kept within the capabilities of the skier (fig. 4-18).

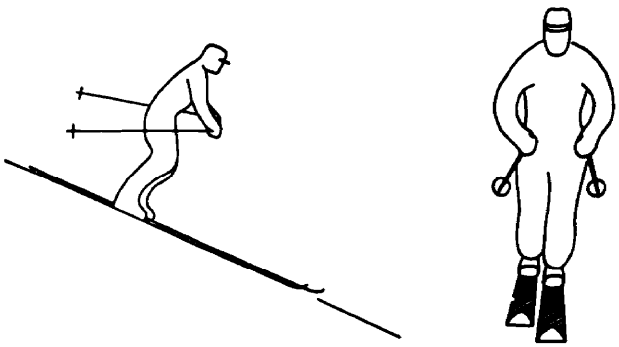


Figure 4–18. Straight downhill running.

b. Technique.

(1) In a normal standing position with skis flat and parallel, one ski is advanced 10 to 15 cm (4" to 6").

(2) Body weight is evenly distributed on both skis. The knees are bent and pushed forward from the ankles, keeping the heels flat on the skis.

(3) The body is leaned slightly forward in a relaxed and natural upright position, head up, knees and ankles flexed without bending the body at the waist to the front.

(4) Ski poles are held pointing to the rear with baskets above the snow. The arms are bent slightly at the elbows and held close to the body with hands to the front.

(5) Body and arms are kept relaxed. Knees are kept supple to act as shock absorbers. The skier must be alert at all times.

4-26. Downhill Traverse

a. Use. This is the method most commonly used in descent; either used by itself or in combination with other techniques. An individual who has learned the techniques and has chosen a gradual route of descent can, in com-

bination with a kick turn, travel over a great variety of terrain (fig. 4-19).

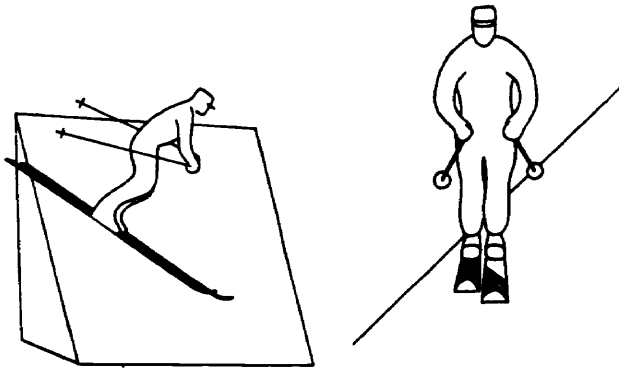


Figure 4–19. Downhill traverse.

b. Technique.

(1) The basic position is that of straight downhill running, except that the uphill shoulder and ski is always slightly advanced and most of the weight is on the lower ski.

(2) Stand directly over the skis and avoid leaning into the slope. Both skis being edged into the slope.

(3) If more edging is needed, it is controlled by knee and ankle action, and is kept even and constant.

(4) The ski poles are held as in the straight downhill positions.

4-27. Snowplow

a. Use. The snowplow is a means for controlling and slowing down forward motion in all types of terrain. In gentle or moderate terrain it can be used for-stopping. The snowplow uses fundamental positions which are employed for furthering other skiing techniques (fig. 4-20).

b. Techniques.

(1) *From straight downhill running.*

(a) To move into a snowplow, both heels are pushed outward evenly, keeping the ski tips even and close together, forcing the skis to form a wide V.

(b) The body weight is kept even on both skis. The knees are bent well

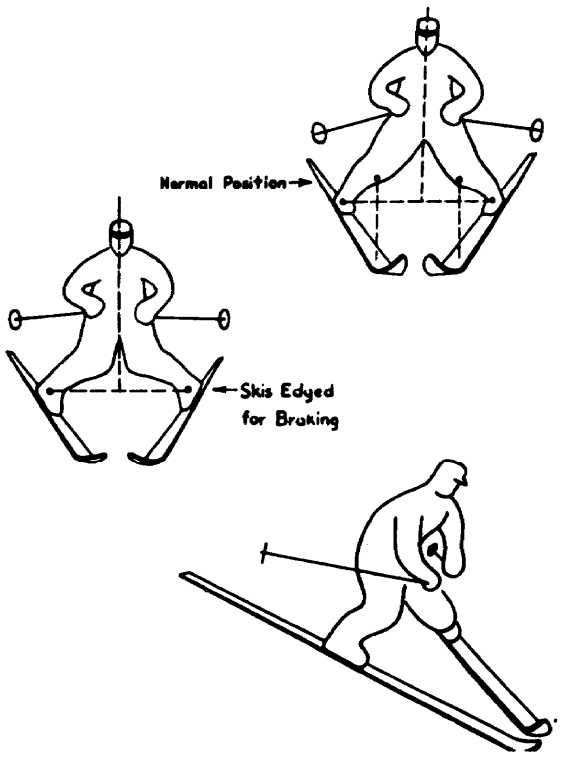


Figure 4–20. Snowplow.

forward in the direction of the ski tips, causing the skis to be edged slightly inward. The heels are kept constantly on the skis while continuous outward heel pressure upon the skis is applied.

(c) The upper part of the body and the ski poles are held as in the straight downhill running position.

(d) To increase the braking action, the skis are moved into a wider V and edged more.

(2) *Half snowplow.*

(a) When only one ski is brought into snowplow position, this is referred to as a half snowplow. The half snowplow is used in confined areas and in traversing where a full snowplow is impractical for braking action. It is also used in conjunction with basic and advanced turns.

(b) This motion is executed by pushing only one ski outward in the snow-

plow position described above. Braking action is controlled by the degree of weight placed on this ski and the amount of edging applied. It is important that the ski be edged to a pronounced degree on the inside to eliminate the possibility of "catching" an outside edge.

(3) *The snowplow while traversing downhill.*

(a) To move into a snowplow from a downhill traverse, the body weight is shifted momentarily to the uphill ski. The lower ski is then moved downhill into a half snowplow position by dropping the tail and keeping the ski tips in the same relative positions and edging slightly. The body weight is then transferred back onto this lower ski. Additional braking action can be obtained by increasing the edging of this ski and placing more weight on it. To complete the snowplow, the upper ski is flattened and pushed uphill in full V (fig. 4-21).

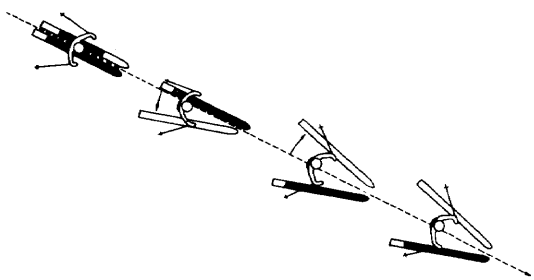


Figure 4-21. Method of getting into a snowplow while in a downhill traverse.

(b) If it is desired to continue traversing in a snowplow, most of the weight is kept on the lower ski. Braking action is increased by a wider spread of the skis and increased edging of both skis.

4-28. Ski Pole Riding

a. Use. Ski pole riding is a braking method which is sometimes necessary to use in confined areas where ability to control descent is limited by snow conditions, terrain features, or obstacles. Two different methods are used (fig. 4-22).

1 Straight downhill

2 On a downhill traverse

Figure 4-22. Ski pole riding.

b. Technique.

(1) Poles are kept together and to the rear and held between the legs for vertical descents.

(a) From a straight downhill running position the lateral spread of the skis is increased and both hands are removed from wrist straps. Both poles are held together and placed to the rear between the legs and the heels of the skis.

(b) The body is placed in a squatting position with the weight over the skis and one hand grasping the pole handles in front of the body with the palm facing upward, while the other hand is placed to the rear, grasping the shafts above the baskets, palm facing down.

(c) Control of descent is obtained by applying the required pressure on the ski poles to force the baskets into the snow.

(d) The braking action may be increased by using the half snowplow or snowplow position.

(2) Poles together and on either side of the body for traversing.

(a) From a downhill traversing position both hands are removed from wrist straps and the poles are held together on the uphill side.

(b) The hand on the uphill side grasps both pole shafts near the baskets with palm facing down and the other hand is held near the pole handles, palm facing upward.

(c) The uphill arm is braced tightly against the hips to increase the braking action.

4-29. Sideslipping

a. Use. Sideslipping is a braking method used in descending slopes at all speeds. It is especially useful in confined areas and in steep terrain where the snowplow or pole riding is impractical. It is the least tiring method of braking. In addition, it employs a sliding action which is characteristic in advanced skiing techniques.

b. Technique.

(1) A downhill traverse position is assumed. The edging of both skis is decreased by bending both knees well forward and slightly outward. This minimizes the holding power of both ski edges so that gravity will cause the skier to slide sideways down a hill (fig. 4-23).

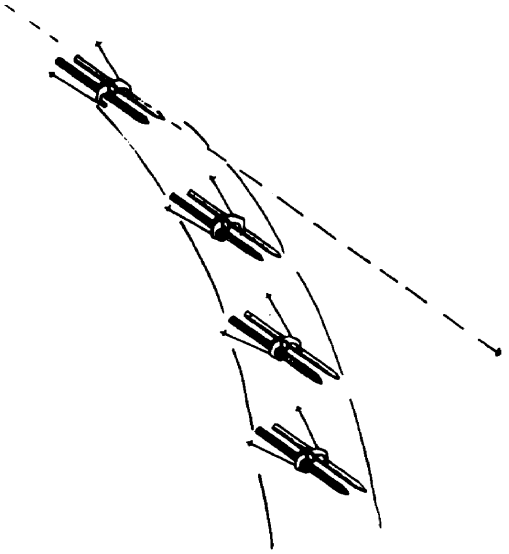


Figure 4–23. Sideslipping from traverse.

(2) Care must be taken that the weight is kept well centered on the skis and that the lower ski pole is not placed in the snow during the sliding action. The uphill pole may be used to initiate the sideslipping action and for balance. Avoid the tendency to lean on the uphill ski pole which will hinder the skier's ability to maintain a good sideslipping body position.

(3) By shifting the body weight in front of the center of the skis while sideslipping, the tips will drop toward the fall line; by bringing the weight to the rear, the heels of the skis will move toward the fall line. This is a means of correcting or controlling the angle of descent during the sideslip (fig. 4-24).

(4) The speed of descent is controlled by the degree of edging applied to the

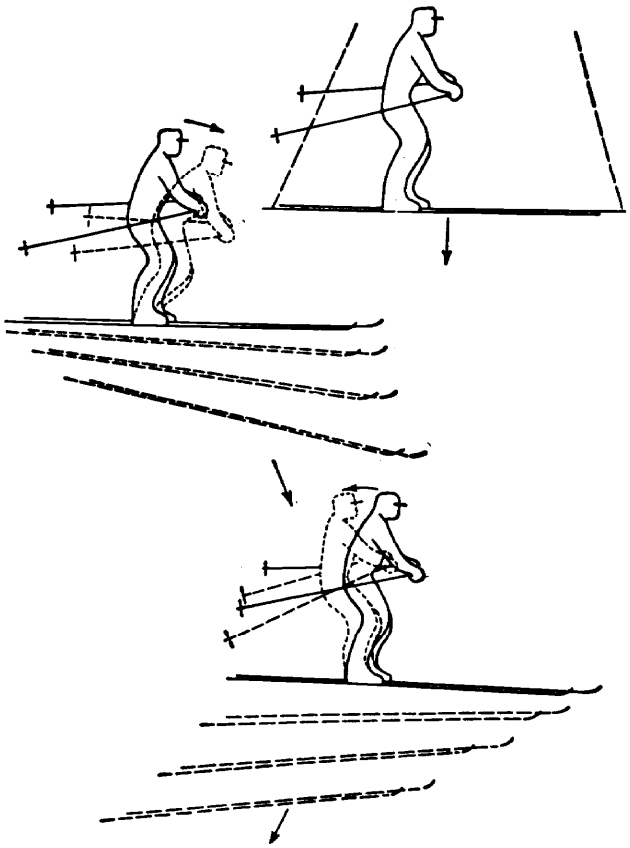


Figure 4–24. How the body position affects the skis in sideslipping.

skis. To stop sideslipping, the edging is gradually increased by pressing the knees forward and toward the slope.

(5) In adverse terrain and snow conditions the aid of both ski poles may be used on the uphill side while sideslipping. The poles are used in the same manner as in pole riding on a traverse. This method adds a third point of suspension and braking action.

(6) At all times during sideslipping, delicate control of knee and ankle action is important to prevent the downhill edges from "catching."

4-30. Step Turn in Motion

a. Use. This method of changing direction while in motion is useful at slow speeds in all snow and terrain conditions. It is particularly useful in adverse snow conditions and in confined areas.

b. Techniques.

(1) Before turning, lead with the ski which corresponds with the direction of the turn, i.e., right ski ahead when turning to the right.

(2) In turning to the right the weight is placed upon the left ski, which is then edged to the right. The unweighted right ski is then raised and placed on the snow in the new direction. The weight is transferred to this ski by moving the body in the new direction while pushing off from the left ski. The unweighted left ski is then lifted off the snow, and placed close to the right ski to complete the turn. Complete transfer of body weight is essential, and the movements must follow smoothly and almost simultaneously. The ski poles are held to the rear (fig. 4-25). The higher the speed, the more the center of gravity is lowered by bending the knees and ankles. This adds stability and aids in keeping up with the turn.

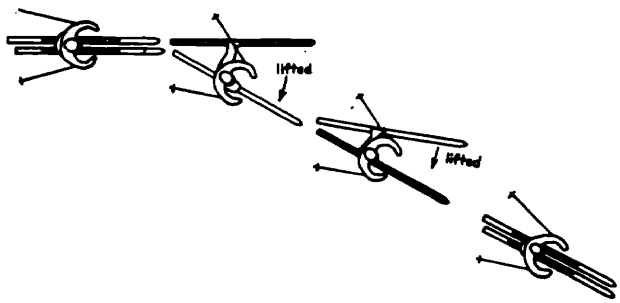


Figure 4–25. Step turn in motion.

(3) If desired, the steps can be continued as long as the skier is in forward motion and until the desired direction is obtained.

c. Variation.

(1) *Use.* A variation of the step turn in motion is the skating step. It is used to accelerate forward motion on level ground or gentle slopes and is a useful aid in developing balance, weight shifting, and coordination. Basically, the movements of shifting body weight from one ski to the other are

the same as in the step turn in motion except that direction is not changed and the skis are edged inward on each pushoff.

(2) *Technique.*

(a) From a straight downhill position body weight is placed upon either ski and knee and ankle bend is stressed:

(b) The other ski is lifted above the snow with the tip pointed slightly outward.

(c) The weighted ski is edged inward as the body is pushed off at a slight angle to the front, i.e., in the direction the lifted ski is pointed.

(d) The lifted ski is moved to the front, placed flat on the snow and weight is shifted to it.

(e) The unweighted ski is lifted from the snow and brought to the front near the weighted ski in preparation for the next step. These pushing steps are alternated left and right.

(f) A strong pushoff should be made with each step to lengthen the glide and gain acceleration. Knee and ankle bend should be stressed with each step.

(g) The step can be aided by double poling, especially to gain initial momentum.

4-31. Snowplow Turn

a. Use. The snowplow turn is efficient for use at slow speeds, especially when carrying a pack and rifle. Because the snowplow position is retained, this turn enables the individual to maintain good control. In this turn, fundamental body positions and movements are used which are an important part of advanced turns.

b. Technique (fig. 4-26).

(1) *Straight down the slope.*

(a) In executing a snowplow turn to the LEFT while snowplowing directly down a slope, the body weight is transferred smoothly onto and over the right ski (note that this ski is already pointed to the left) by a rotation of the body to the right and by a pronounced bend of the right knee to drop all body weight onto the right ski. This transfer of body weight initiates the turning action.

(b) As the turn progresses, the body is not allowed to rotate beyond the new direction of travel, i.e., face straight ahead, not uphill. The left knee is kept well bent with this ski flat and unweighted throughout the turn.

(c) Ski tips remain even and the V-angle of the skis constant. Avoid leaning into the slope. Ski poles are carried as in the snowplow position. Care must be exercised to keep them pointed to the rear as the body is rotated.

(d) As the turn is completed the body weight is either placed evenly on both skis to continue in a snowplow or gradually transferred to the left ski to start a turn to the right.

(2) *From downhill traverse.*

(a) In making a turn while traversing, the snowplow position is assumed as described in paragraph 4-27 *b* (3) *(a)*. The edging of the lower ski is decreased and the body leaned forward and both ski tips allowed to drop into the fall line in order to bring the skier into the fall line in preparation for the turn, as described above. As the tips come downhill the snowplow position must be maintained by a holding push on the tails. The turn should be continued until the skier has obtained the desired angle of descent (fig. 4-27) . As the tips pass the fall line, body weight must be transferred to the downhill ski to complete the turn.

(b) After the snowplow turn has been completed and it is desired to continue with both skis together, as

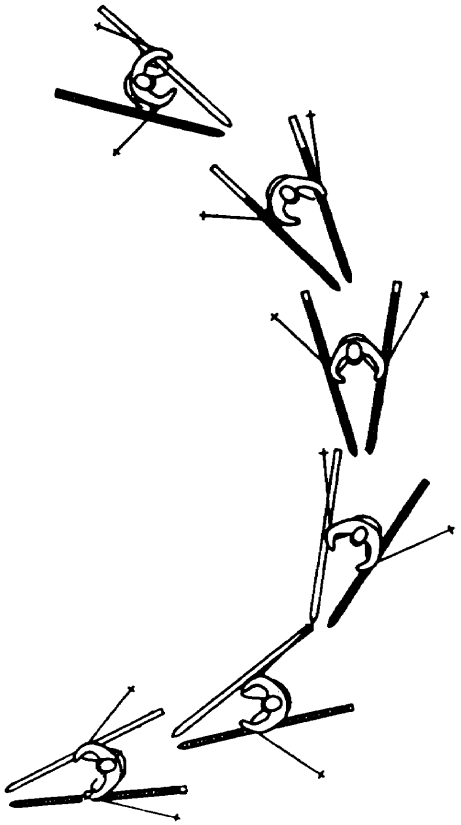


Figure 4–26. Snowplow turn.

in the downhill traverse, the body weight is kept on the lower ski while the upper unweighted ski is brought parallel with it into a traversing position (fig. 4-27). This turn is also known as stem turn.

(3) Variation. To make a snowplow turn from a traversing downhill position in variable snow conditions, and when skiing with a pack, it is advantageous to make the half snowplow with the uphill ski. In this method the body weight remains on the lower ski. The upper, unweighted ski is moved into a half snowplow, kept flat, and the tips of both skis even. The edging of the lower ski is decreased, knees bent more, and the body leaned further forward to bring the skier into the fall line. In reaching the fall line, both skis are brought into a full snowplow and the body weight is gradually shifted over and onto the other ski in executing a snowplow turn as described above.

4-32. Advanced Turns

The advanced turns used in military skiing are the christiania turns. These are applied at all speeds to change directions, to reduce speed, or to stop. These are the most advanced turns taught in military skiing and are executed with the basic motions already learned, such as forward lean, edge control, and body rotation. The application of these turns may be limited by terrain and snow conditions, as well as the degree of proficiency attained and the load carried by the individual soldier. The christiania turns are started from a variety of positions, but all are completed in the same manner (fig, 4-28).

4-33. Uphill Christiania

The uphill christiania is used to turn uphill, to reduce speed and to stop. It also forms the basic movement which is used in completing other christiania turns.

a. In preparing for the uphill christiania during a downhill traverse, the upper shoulder is brought well forward in order to increase the body rotation that will, be applied during the turn.

b. The turning action of the skis is started by decreasing the amount of edging and, at the same time rotating the lower shoulder and hip forward in the direction of the turn. Forward lean of the body and knee bend are increased and the upper ski leads throughout the turn (1, fig. 4-28).

c. During the turn, both skis are controlled by gradually edging them into the slope. The weight is directly over the skis. Avoid leaning into the slope.

d. Forward lean and body rotation are increased and continued as the turn progresses. Forward speed will gradually decrease, permitting the skier the choice of continuing in a new direction or coming to a stop.

e. Care must be exercised so that the ski poles are not allowed to swing to the front during the rotation of the body.

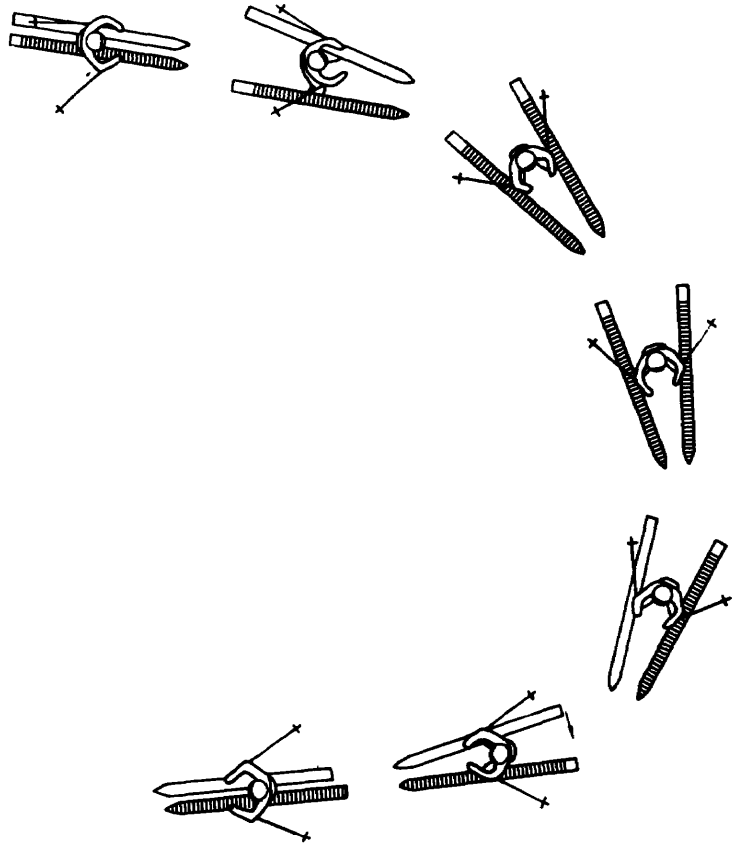


Figure 4–27. Snowplow turn made from downhill traverse back into traversing position.

f. This turn can be made from any angle across the slope to and including the fall line.

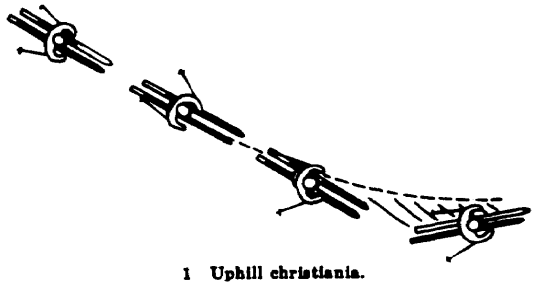
g. From a fall line the turn can be made in either direction. In preparation, the ski corresponding with the direction of turn is advanced (i.e., left ski leads for a left turn) and more of the body weight placed on the other ski. Emphasis is given to body rotation and knee bend to initiate the turning action of the skis.

h. To assist the turning action, a down-up motion can be used in this turn. As the turning action is stated as in *b* above, the body is lowered and returned to normal as the turn is completed.

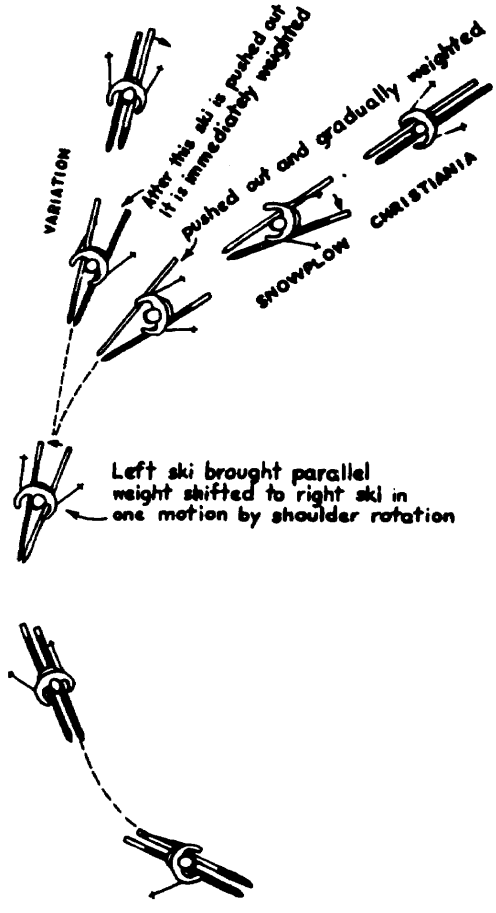
4-34. Snowplow Christiania

a. Technique. The snowplow christiania, also referred to as the stem christiania, is used on turns made downhill while traversing at greater speeds than employed in the basic turns. For this reason the turn looks complicated to the student. Basically, it is a combination of the snowplow turn and the uphill christiania. The basic techniques of the snowplow turn made from a traverse position are also used here to reach the fall line. The uphill christiania is then applied to either change direction or to stop. In combining these methods the speed must be greater, the body weight shifted more rapidly, and the spread of the skis in the snowplow position at a narrower angle. Using the snowplow christiania it is possible to link a number of turns together to control speed in a continuous descent. A breakdown of the technique is as follows:

(1) In making a downhill turn to the left from a downhill traverse, the body weight is shifted momentarily to the uphill ski. The lower ski is then



1 Uphill christiania.



2 Snowplow christiania and variations.

Figure 4–28. The christiania turns.

moved downhill into a half snowplow position, keeping the ski tips even. At the same time, the lower shoulder is brought forward. The uphill ski is then pushed uphill to form a snowplow.

(2) Body weight is then transferred back to the upper ski by body rotation, initiating the turning action.

(3) As the fall line is reached, the unweighted left ski is brought slightly forward and parallel with the right ski. The turn is then completed as in the uphill christiania (2, fig. 4-28).

(4) The upper body is kept from leaning into the slope throughout the turn, especially during the initial turning phase. Forward lean and knee bend are increased. All motions are fluent and smooth and must be well timed during the turn.

(5) When a decrease in speed is desired before starting the turn, there are two methods which can be used. In the first method the lower ski is first placed into a half snowplow position. Temporarily transferring the body weight to the ski and edging it will cause a braking action. When speed has been decreased as desired, the upper ski is pushed upward, the edging of the lower ski decreased, and the turn continued as in (2), (3), and (4) above. In the second method both skis are kept parallel and a sideslip from the moving traverse position is started. Edging of the skis in this movement will provide braking action. When speed has been decreased as desired, the turn is started as from the downhill traverse position.

b. Variations.

(1) In difficult snow and terrain conditions another method may be used to execute a snowplow christiania. In making a downhill turn to the left from a downhill traverse with this method, the upper (right) ski is brought into a half snowplow position. Leaning well forward, increasing the knee bend and decreasing the edging of the lower ski will bring the skier smoothly towards the fall line; the body weight is transferred over and onto the right ski in a smooth forward and downward motion, assisted by bringing the right shoulder forward. As the transfer of body weight is completed, the unweighted left ski is brought forward and parallel with

the right ski and the turn completed from the fall line as in the uphill christiania.

(2) As more skills and balance are acquired, the snowplow christiania may be done at higher speeds with the angle of turn kept closer to the fall line. In this method only a half snowplow with the upper or lower ski is used in the preparatory position, or skis are kept parallel and the fall line is reached with a pronounced knee bend and forward lean of the body while the turn is completed with an uphill christiania.

4-35. The Lifted Christiania

a. Use. The lifted christiania turn is very useful in adverse snow conditions and in confined terrain where a short radius turn is necessary. It is also useful for skiing at night and with heavy loads, since it is a slow turn made with one ski pole being used to increase lateral stability.

b. Technique.

(1) The turn is started by applying either of the methods described for christiania turns, except that the speed is adjusted to suit the circumstances.

(2) For a turn to the left as the skier approaches the fall line, the left ski pole is placed in the snow forward and down the slope, but not directly in front of the left ski tip. The reach should not be overextended. The right pole is held in the normal manner. Weight is then applied to the left ski pole, using it for means of support and as a pivot point.

(3) Body weight is then shifted to the right ski. Since it is difficult to turn the left ski in such a short radius, this ski is lifted and placed parallel to, and slightly ahead of, the right ski, and the turn completed as in the uphill christiania.

Section IV. MILITARY SNOWSHOEING

4-36. Purpose and Scope

a. Snowshoes are individual aids for over-snow movement. Like skis, they provide flotation in snow and are useful for cross-country marches and other activities which require movement in snow-covered terrain.

b. The snowshoe is an oval or elongated frame braced with two of three crosspieces and the inclosed space filled with a web lacing. A binding or harness attached to the webbing secures the wearer's foot to the snowshoe. Flotation is provided by the webbing, which is closely laced and prevents the snowshoe from sinking too deeply into the snow when weight is placed upon it. Depth and consistency of snow will determine the amount of support obtained on the snow cover and the rate of movement.

c. Snowshoes are particularly useful for individuals working in confined areas such as bivouac sites and supply dumps, for drivers of various types of vehicles, gun crews, cooks, mechanics, and for similar occupations where aids to movement in snow are necessary. Transporting, carrying, and storing snowshoes is relatively easy due to their size and weight. Maintenance requirements are generally negligible and little skill is required to become proficient on snowshoes. However, the requirement for physical conditioning is as great, or greater, as that needed for skiing. The use of snowshoes when pulling and carrying heavy loads is particularly practical, as the hands and arms remain free. On steep slopes, however, the use of snowshoes is considerably limited because traction becomes negligible and the showshoe will slide, causing loss of footing. Generally, the rate of movement in any type of terrain is slow because snowshoes will not glide over the snow. The gliding properties of the ski are not obtained with the snowshoes; this adversely affects the amount of time and energy spent in movement. In deep snow the trailbreaker must be changed frequently. Especially when wet, snow tends to stick to the

webbing, thereby adding weight to the snowshoe.

d. There are three types of standard issue snowshoes: the trail, the bearpaw, and the magnesium. They can be used with all types of winter footgear. The trail snowshoe weighs approximately 6.5 pounds, the bearpaw, 5.5 pounds and the magnesium, 4.6 pounds.

(1) *Trail.* The trail-type snowshoe is long, with a rather narrow body and upturned toes (fig. 4-29). The two ends of the frame connect and extend tail-like to the rear. The turned-up toe has a tendency to ride over the snow and other minor obstacles. The excellent flotation provided by its large surfaces makes the trail snowshoe best for cross-country marches, deep snow conditions, and trailbreaking.

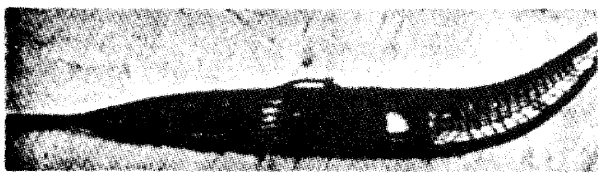


Figure 4–29. Trail snowshoe.

(2) *Bearpaw.* This type of snowshoe is short, wide, and oval in shape, with no frame extension (fig. 4-30). The bearpaw snowshoe is preferable to the trail type for close work with weapons and vehicles, in heavy brush, and in other confined areas. Carrying or storing is also easier.

(3) *Magnesium.* The magnesium snowshoe is the lightest and most durable of the three types (fig. 4-31). The snowshoe has a magnesium frame with the center section made of steel, nylon-coated wire. The magnesium snowshoe is 17.70 cm (approx 7") shorter than the standard wooden trail snowshoe but is 9.50 cm (approx 4") wider giving it approximately the same flotation characteristics.

e. The trail and bearpaw snowshoes have their own individual bindings, however, the, "Binding, Snowshoe, Bearpaw and Trail Type" has been developed for use on all three types. This binding consists generally of a toe strap and a heel and instep strap. The straps are made of nylon and are secured by keepers and cam lever quick-release buckles. The method of securing the binding to the magnesium snowshoe is snown in figure 4-32.

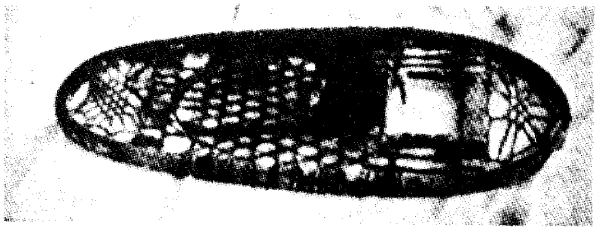


Figure 4–30. Bearpaw snowshoe.

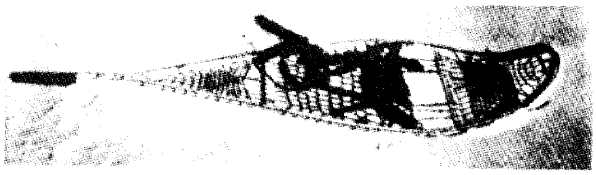
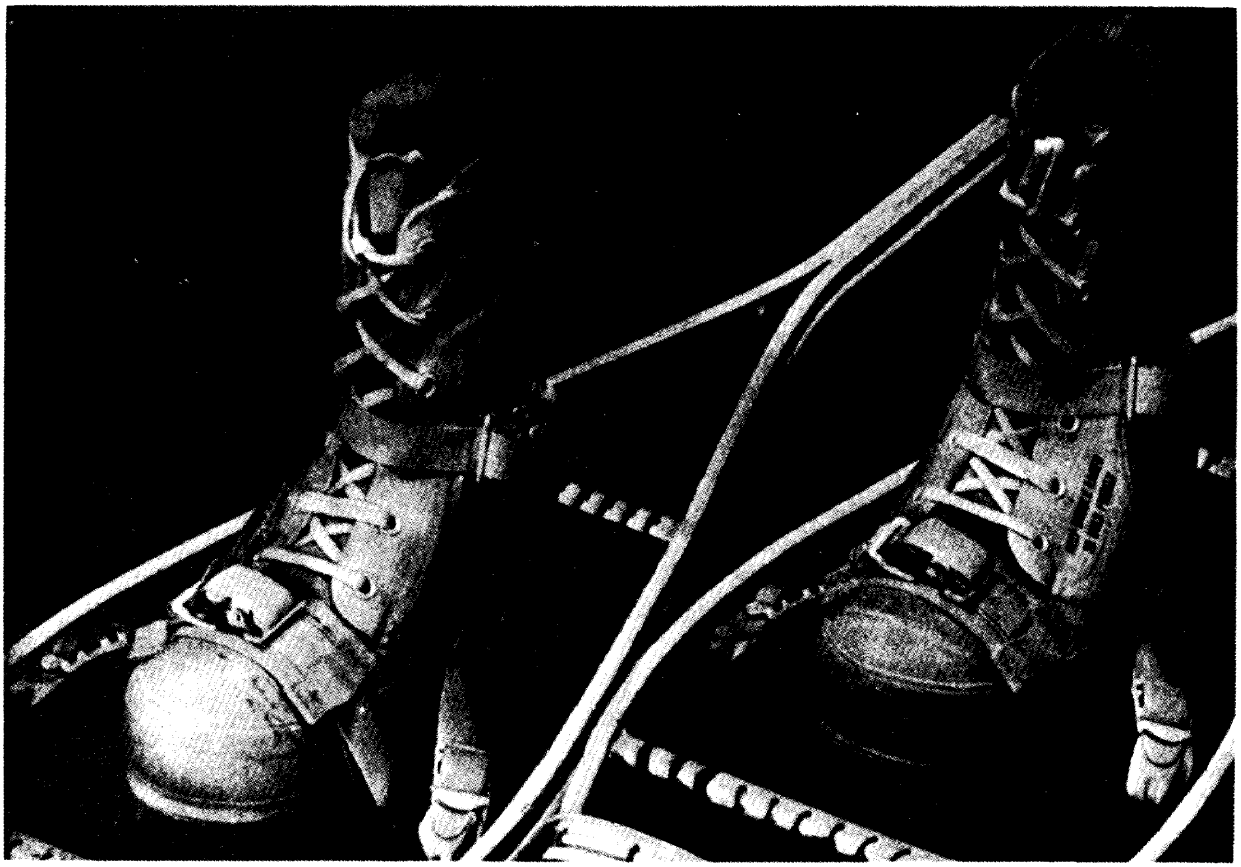


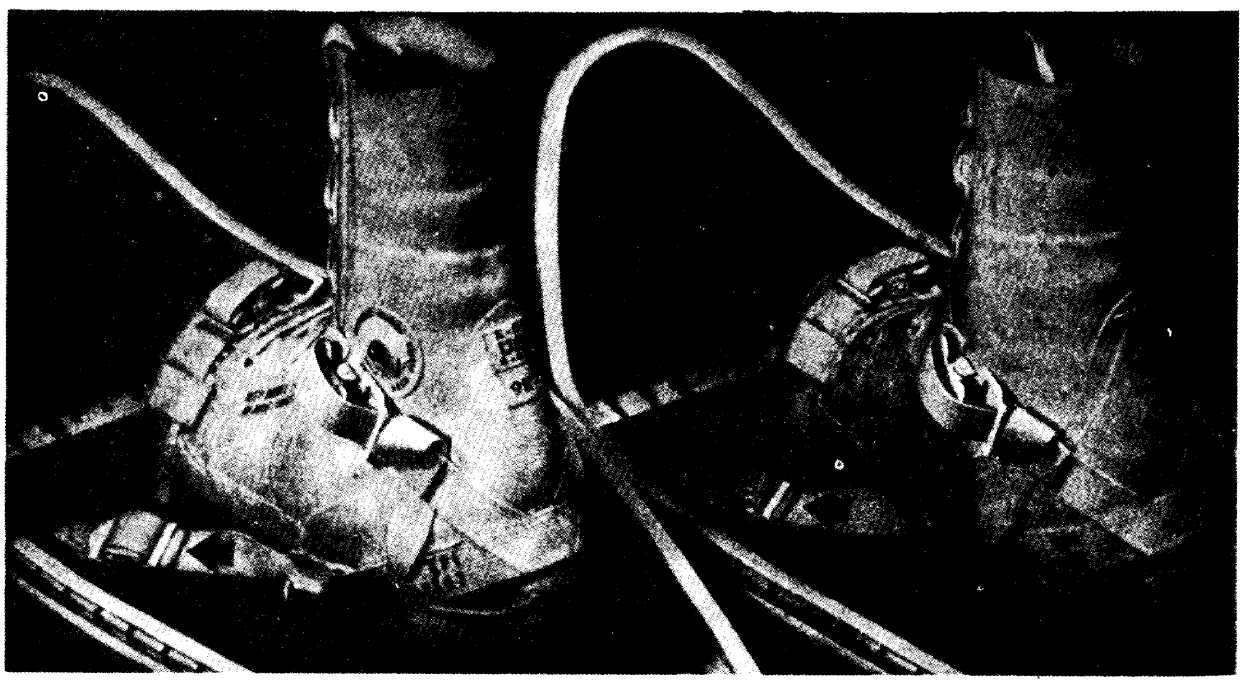
Figure 4–31. Magnesium snowshoe.

4-37. Care and Storage of Snowshoes

a. Care. Snowshoes must always be kept in good condition. Frequent checks are necessary, particularly of webbing and binding, because individual strands may be ripped or worn out. Repairs must be made immediately, otherwise the webbing will loosen and start to unravel. If unvarnished, the rawhide webbing on wooden snowshoes will absorb moisture, stretch and turn white, particularly in wet snow. It should be dried out slowly, avoiding direct flames, and be revarnished at the first opportunity. Wooden frames may fray from hard wear and should be sanded and varnished. When needed, other minor repairs should be made as soon as practicable. When snow cover is shallow, care must be taken not to step on small tree stumps, branches, or other obstacles, since the webbing may be broken or damaged. Stepping into water is to be avoided; the water will freeze and snow will stick to it. When not in use in the



Front view



Rear view

Note. After tightening, strap should be doubled back under keeper.

Figure 4–32. Binding, snowshoe, bearpaw, and trail type.

field, snowshoes are placed in temporary racks, hung in trees, or placed upright in the snow. They should be kept away from open fires and out of reach of rodents.

b. Storage. In off-seasons, wooden snowshoes are stored in a dry, well-ventilated place so that the rawhide will not mildew or rot and the frames warp. Each snowshoe is closely checked for possible damage, repaired if needed, and revarnished. As in the field, snowshoes are protected against damage and from rodents. Magnesium snowshoes are cleaned and repainted if necessary. Webbing is examined and repaired or replaced if needed.

4-38. Snowshoe Technique

a. A striding technique is used for movement with snowshoes. In taking a stride, the toe of the snowshoe is lifted upward, to clear the snow, and thrusted forward. Energy is conserved by lifting it no higher than is necessary to clear the snow and slide the tail over it. If the front of the snowshoe catches, the foot is pulled back to free it and then lifted before proceeding with the stride. The best and least fatiguing method in travel is a lose-kneed rocking gait in a normal rhythmic stride. Care is taken not to step on or catch the other snowshoe.

b. On gentle slopes, ascent is made by climbing straight upward. Traction is generally very poor on hard-packed or crusty snow. Steeper terrain is ascended by traversing and packing a trail similar to a shelf across it. When climbing, the snowshoe is placed as horizontally as possible in the snow. On hard snow, the snowshoe is placed flat on the surface with the toe of the upper one diagonally uphill to get more traction. In the event the snow is sufficiently hard-frozen to support the weight of a person, it is generally better to remove the snowshoes and proceed temporarily on foot. In turning around, the best method is to swing the leg up and turn in the new direction, as in making a kick turn on skis (fig. 4-33).

c. Obstacles such as logs, tree stumps, ditches and small streams should be stepped over. Care must be taken not to place too much strain on the snowshoe ends by bridging a gap, since the frame may break. In shallow

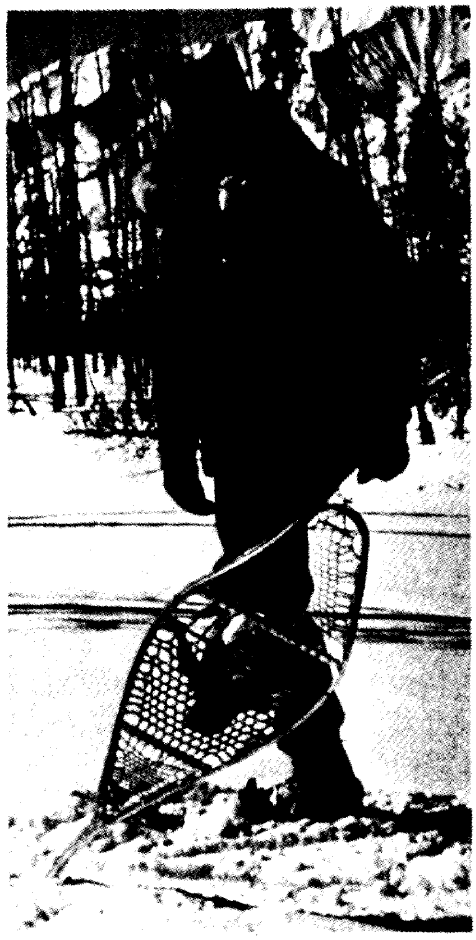


Figure 4–33. Making a kick turn on snowshoes.

snow there is danger of catching and tearing the webbing on tree stumps or snags which are only sightly covered. Wet snow will frequently ball up under the feet, interfering with comfortable walking. This snow should be knocked off with a stick or pole as soon as possible. Although ski poles are generally not used in snowshoeing, one or two poles are desirable when carrying heavy loads, especially in mountainous terrain. The bindings must not be fastened too tightly or circulation will be cut off, and frostbite may occur. During halts, bindings should be checked for fit and possible readjustment.

4-39. Training

Snowshoe training requires little technical skill. However, emphasis must be placed on the physical conditioning of the individual and the

development of muscles which are seldom used in ordinary marching. The technique, as such, can be learned in a few periods of instruction. Stiffness and soreness of muscles are to be expected at first. The initial training should be gradual with regard to loads carried and distances covered. It should be progressive, with ample time allowed for the individual to acquire physical proficiency, gradually increasing the distance covered and weight carried or pulled. Overcoming obstacles such as dense brush, fallen timber, and ditches should be emphasized during training. Trailbreaking, with frequent change of lead man, should also be stressed. Snowshoe training can be accomplished concurrently with other training requiring individual cross-country movement.

Section V. APPLICATION OF SKI AND SNOWSHOE TECHNIQUE

4-40. Skiing in Variable Terrain and Snow

a. General. As a military skier the individual must be prepared to move in a great variety of terrain and snow conditions during daylight and darkness. He must be constantly alert in order to judge conditions on the route ahead and to off set the sudden changes often encountered. The techniques of skiing which he has learned will allow him to operate effectively on slopes only if he is capable of applying these methods properly and of keeping his skis under control at all times.

b. Variable Terrain. The forward lean of the body must be increased as a slope suddenly steepens, since skis will slide faster. The opposite is true as the slope is lessened. Generally, the body should be nearly perpendicular to the slope regardless of pitch, to insure proper balance. When skiing over bumpy terrain, the stability of the skier is greatly disturbed. To minimize this the knees are kept supple to act as shock absorbers, permitting the center of the body to maintain as straight a line as possible. To further increase stability on large bumps the skier increases knee bend, lowering the body when approaching the top of the bump, riding over it in this position, and then assuming a normal running position as soon as the top is passed (fig. 4-34), i.e., allowing the skis to drop away. This action will lessen the chance of the skier being thrown into the air. When moving through a hollow the normal ski and body position is maintained, with the knees absorbing the sudden change of pressure. In deep snow the leading ski should be further advanced to improve balance. The center of gravity must be kept lower by more bending of the knees. As forward lean of the body is not practical under these conditions, weight shift will need to be controlled to a greater extent by the knees and the advancement of one ski in front of the other.

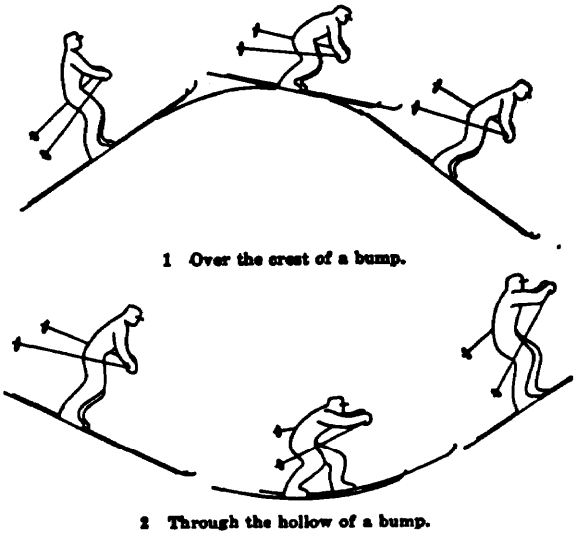


Figure 4–34. Position of the body in downhill bump riding.

c. Variable Snow. When skiing from soft snow onto hard snow the forward lean of the body must be increased, since the skis will gain speed and have a tendency to run from under the skier. The opposite is true when running from hard snow onto soft snow. In this case the body leans slightly to the rear and the leading ski is advanced farther ahead just before the soft snow is entered. Lateral stability can be increased by extending the arms sideways as is done when attempting to keep balance when walking a log or a railroad track, but the ski poles must still be kept pointing to the rear. When skiing on icy crust, stability is improved by keeping the skis farther apart or by running in a slight snowplow

position. However, if the slope is rutted snowplowing may become hazardous because the tips tend to get caught. To control speed under these conditions, sideslipping and pole riding may be used. Pole riding is less effective and in extreme cases the use of sideslipping may become necessary. On icy snow the skis may chatter in a turn. To correct this, body weight is kept well forward and the edging of the skis carefully controlled as the turn is made. Crusty snow which will not support the skier's weight (breakable crust) is the most difficult to cope with. Speed is kept slower while making all turns. It may become necessary to use the step turn in motion or a kick turn to change direction.

d. Forest. Due to the limited skiing room in wooded terrain, movements for changing direction must be rapid and of shorter radius than in open terrain, especially during downhill movement. In addition, the skier must be more alert so that obstacles may be quickly overcome with a minimum of delay. The step turn in motion is a very useful technique for changing direction in this type of terrain, but speed must be reduced to use this technique. In descending narrow trails in wooded terrain or during night movements, the half snowplow or pole riding are useful for control of speed. During unit movement in wooded terrain, one man falling can block the progress of all personnel behind him. If an individual falls he should remove himself from the track in the fastest way possible, even if this results in losing his original position in the column. The baskets of ski poles have a tendency to snag branches during movement in wooded terrain, resulting in loss of balance. To avoid this as much as possible, the shafts of the ski poles should be pointed directly to the rear.

4-41. Obstacles

a. General. Snow-covered terrain will contain many small obstacles such as fences, tree windfalls, and small streams or ditches. The individual must be skilled enough to cross them easily to save time and energy. Crossing obstacles can be very time consuming for a unit. Wherever possible, the men should be dispersed so as to enable them to cross on a broad front. In some cases the overall time needed can be reduced if skis are removed while overcoming the obstacles.

b. Fences and Windfalls. Low fences and windfalls 30 to 60 cm high (1'to 2') are crossed by skiing or snowshoeing beside the obstacle so that the skis or snowshoes are parallel and alongside it, then stepping over first with one foot then the other, or a kick turn may be made over the obstacle. In the case of rail fences or large diameter windfalls it may sometimes be easier to sit on the obstacle and swing both feet simultaneously to the other side. High barbed wire fences can be crossed by removing pack and rifle and crawling underneath (fig. 4-35).

c. Ditches or Small Streams. These are crossed by stepping over them sideways, using the ski poles for support (fig. 4-35). If the ditches are deep and wide it is better to descend to the bottom either by sidestepping or sideslipping and then climb the other side by sidestepping. However, care must be taken to avoid rocks or other obstacles which might damage the skis or snowshoes.

d. Steep Slopes. When it is necessary for troops to descend or ascend slopes which are too steep for their ability, or where traversing is not practical, the sidestep should be used or the skis should be removed and the slope negotiated on foot whenever snow depth will permit.

4-42. Skiing With Pack and Weapon

a. General. When skiing with pack and weapon the same techniques apply. However, the added weight carried, changes the center of gravity and will affect the manner in which movements are made.

b. Effects on Movements.

(1) Lunges are shorter and pushes with poles less powerful.

(2) To aid in maintaining balance when skiing downhill over rough terrain, the leading ski is advanced farther and the knees kept more flexible than when skiing without a load.

(3) Speed of descent is reduced and techniques are applied more cautiously.

(4) Rotation of arms and shoulders is

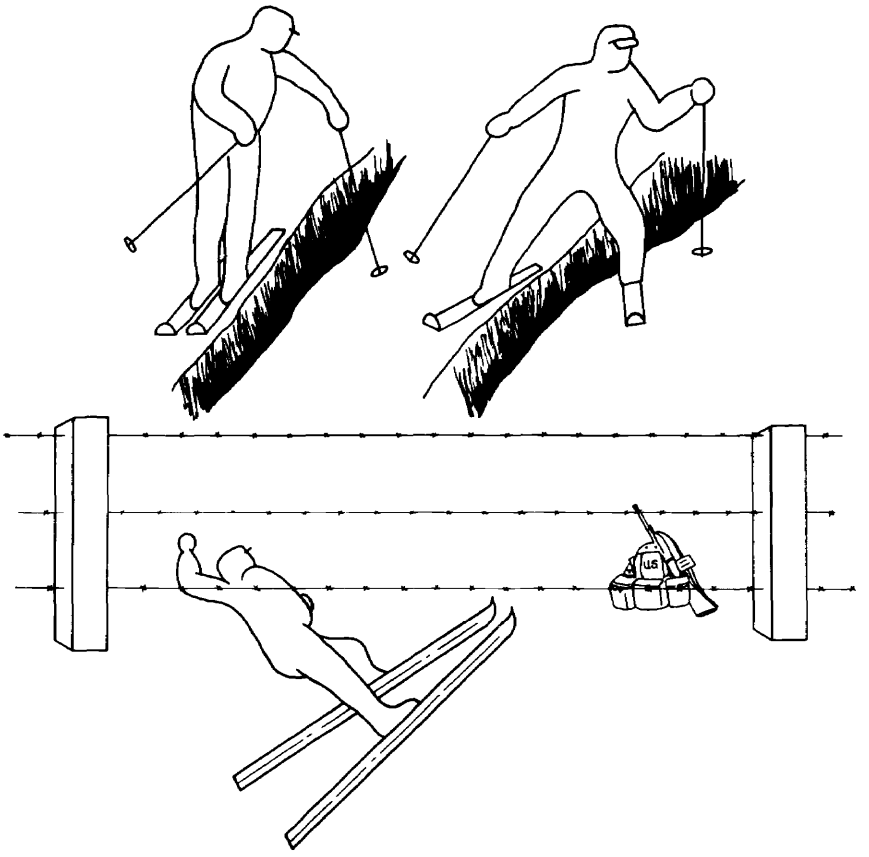


Figure 4–35. Crossing obstacles.

made with less vigor and emphasis.

(5) Slopes are climbed with a more gradual traverse.

(6) When skiing through woods or in brushy terrain, care must be exercised in order to prevent any protruding parts of the weapon from catching on branches, causing loss of balance.

(7) In the event of a fall it is sometimes more efficient to remove the pack and weapon before attempting to regain footing.

4-43. Sled Pulling

a. General. Pulling a sled is hard work, but it will be easier if proper techniques are used, The movements and techniques used should be within the ability of all members of the team, and, where possible, teams should be formed with this in mind. Generally speaking, the methods of hauling sleds apply to both skiers and snowshoes.

b. Preparation for Sled Pulling.

(1) The tow ropes must be of the proper length and also properly laid out and fastened by snap buckles in tandem system (fig. 4-36). The sled harnesses are adjusted to fit loosely on the individuals.

(2) If skis are to be used for pulling, they must be properly waxed. More emphasis must be placed on insuring good holding capacity of the wax on the snow. However, sliding capacity should not be entirely forfeited.

(3) Proper loading and lashing of sled must be checked before moving out.

c. Pulling on Varied Terrain. When pulling a sled over comparatively flat terrain, skiers normally use the one step ski technique. When