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UD 6-81-2 E

# INSTRUCTION IN WINTER SERVICE PERSONAL CLOTHING

**English edition**

# UD 6-81-2 E

# Instruction in Winter Service – Personal clothing

Norwegian School of Winter Warfare
UD 6-81-2 E Instruction in Winter service
– Personal clothing is appoved for use for
The Norwegian Armed Forces

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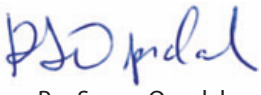

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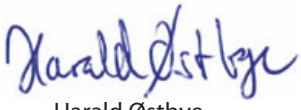

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# 1 INTRODUCTION

## 1.1 ADMINISTRATIVE REGULATIONS

### 1.1.1 OBJECTIVE

The objective of Part 2 – Clothing is to provide instruction in the appropriate use of clothing so that a soldier is able to carry out his/her mission in winter conditions.



This section provides theoretical knowledge in the use of military clothing. However, it is only through proper training under field conditions that a soldier will acquire the necessary skills and routines in order to use the clothing appropriately in all conditions.

This section only deals with clothing that is directly related to winter service.

### 1.1.2 ENTRY INTO FORCE

UD 6-81-2 Instruction in Winter Service – Personal Clothing came into force on 20th November 2009. At the same time, UD 6-81-2 Personal clothing of 1st December 1987 was withdrawn.

### 1.1.3 GENERAL

One of the first conditions necessary to maintaining a division's battle capability is appropriate clothing and the correct use of same. Today, the standard of winter clothing used by the Norwegian Armed Forces is very high. Nonetheless, it is of even greater significance that the individual soldier, and especially an officer, has been trained in the appropriate use of his/her clothing under diverse conditions. An officer has a particular responsibility to train and follow-up his soldiers in the appropriate use of clothing.

All materiel supplied to and used by the Norwegian Armed Forces has been tested and has satisfied requirements in respect of wear and tear, hygiene, flame-retardant properties, etc. Civilian items, which may appear to be similar, have not been subject to the same degree of testing. Civilian clothing may provide equally good protection from the elements, but in all probability is unable to withstand flames or chemicals. It is therefore of the greatest importance that only supplied materiel is used and that the soldier learns how to use such materiel appropriately.

#### Heat loss from the body

Heat loss from the body primarily occurs in four different ways:

- During circulation The heated air layer closest to the skin flows away and is replaced by cold air. This is particularly noticeable in cold wind.
- During contact Contact between the body and the surface that an individual is lying or sitting on, for example. The cold soles of shoes 'steal' the body's heat.

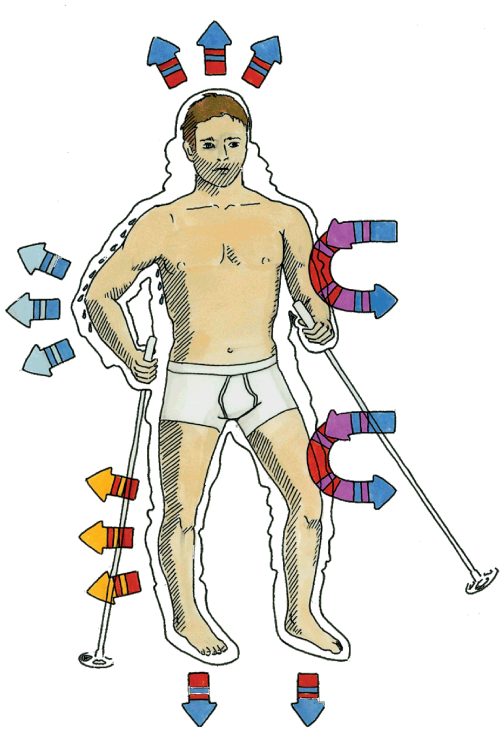
**NB!** Civilian clothes have not been tested for use in the Norwegian Armed Forces.

- During radiation

The body will release heat into its surroundings when these are colder than the body. This has little significance to a fully clothed person during the winter.

- During evaporation

When body sweat and sweat in clothing evaporates, as well as during exhalation.



*Heat loss from the body*

One half of heat loss from the body is in the head and neck region.

The head and neck are the parts of the body that lose the most heat. Up to one half of heat loss from the body is from the uncovered head and neck region. In other words, these are vitally important parts of the body in terms of both the ventilation of surplus heat (bare head, unbuttoned neck) as well as the conservation of body heat (caps and balaclavas).

It is the so-called extremities (hands, feet) as well as the ears, nose and genitals that are most vulnerable to the cold. Small, cylindrical parts of the body such as fingers also lose a lot of heat as they have a large surface area in relation to their volume. In addition, the extremities will not be prioritised by the body when its core temperature is about to diminish. The body will re-direct warm blood to vital organs and blood flow to the capillaries in the extremities and to the ears, nose and genitals will be

considerably reduced. Women tend to freeze more than men in their extremities as they possess a greater amount of subcutaneous fat. Fatty tissue contains a substantially smaller amount of capillaries than muscles, which means that there is minimal blood flow in subcutaneous fat.

# 2 CLOTHING

## 2.1 THE PRINCIPLE OF CLOTHING

### 2.1.1 GENERAL

It is not possible for clothing to provide 100% protection from the effects of cold. It is the body that produces heat, not clothing itself. The air layer in clothing and the air layer between individual garments are what is heated by the body's surplus heat. The more air there is in the garment itself, as well as the more layers of air, the better the insulation.

The purpose of clothing is to ensure that the proper body temperature is maintained according to the intensity of the work that is being carried out. This is known as 'working temperature'. Clothing should insulate from the cold and offer protection against wind, rain and snow. It should also provide the possibility for ventilation so that, if required, surplus heat may be released, together with moisture from sweat. Dry air has very little heat conducting properties. Several thin layers of clothing provide several layers of insulation and therefore better heat insulation than just one thick layer. Wind protection is achieved through the use of windproof fabrics worn on the outside. Waterproof or impregnated external clothing offers protection from wet conditions. The greatest challenge during the winter is heat regulation.

### 2.1.2 THE MULTI-LAYER PRINCIPLE

Appropriate clothing and the correct use of clothing is a prerequisite to the battle and survival capability of divisions and soldiers in winter conditions. However, a single item of clothing will not meet all the requirements and necessary properties for appropriate clothing. By using a combination of several items of clothing – the multi-layer principle – the requirements for heat and protection can be adapted to individual conditions. Clothing can be divided into three layers: an inner layer, middle layer and outer layer.

In addition, a supplementary layer may be worn when there is a greater need for insulation during breaks, sleep, and on sentry duty, for example, or other activities where the body is unable to produce sufficient amounts of heat to maintain the correct body temperature.

*Figure 2 - Multi-layer principle*

Multi-layer principle:

1. Inner layer – moisture transport
2. Middle layer – insulation
3. Outer layer – protection from extreme weather and wind

Supplementary layer – extra insulation

**Inner layer**

This is underwear that is worn directly against the skin. The function of this layer is to create an insulating air layer closest to the body and transport moisture away from the skin's surface. Suitable materials for this layer are synthetic fibres, wool or a mixture of wool and synthetic fibres. A weakness of synthetic fibre is that it has poor heating qualities in wet conditions. It is, however, durable and transports moisture well. Wool is not as durable as synthetic fibre but has the advantage of being able to absorb a lot of moisture without the garment appearing to be wet. Even when wet,

wool will provide good heat insulation.

Garments that contain a mixture of wool and synthetic fibre have both the advantages and disadvantages of both types of material.

It is advisable not to wear cotton underwear during cold weather. Cotton absorbs and retains sweat close to the skin and when such moisture evaporates the body cools down. Cotton garments also inhibit the further transport of moisture through middle and outer layers.

NB!

- Cotton must not be used as an inner layer in field conditions during the cold season.

Garments used as an inner layer should have the following properties:

- Heating properties when damp
- The ability to transport moisture
- Rapid drying time on the body
- Durability and comfort

**Middle layer**

The function of this layer is to provide insulation at low or moderate levels of work, as well as transporting moisture from the inner layer to the outer layer. Suitable materials for this layer are wool, a mixture of wool and synthetic fibre, or synthetic fibre. The same principles for the inner layer apply here. Synthetic garments such as fleece have both insulating and moisture transporting properties, as well as low net weight. However, they do not heat well when damp. Wool is a little heavier but is also able to insulate when the garment becomes wet.

Garments used as a middle layer should have the following properties:

- Heating properties when damp
- The ability to transport moisture
- Rapid drying time on the body
- Durability and comfort
- Low weight and volume

**Outer layer**

The outer layer should be a shell that provides protection from extreme weather, maintains body temperature by inhibiting air circulation and ventilates moisture from within. Suitable materials for this layer are thick woven cotton, mixtures of cotton and synthetic fibres or membrane-based fabrics.

Garments used as an outer layer should have the following properties:

- Completely windproof and virtually waterproof/water resistant
- Spacious with sufficient room for a middle layer of clothing, as well as an insulating air layer
- The ability to transport moisture/breathe

- The ability to ventilate surplus heat
- Durability
- Rapid drying time
- Suitable technical features (e.g. hoods, pockets)

**Supplementary layer**

This layer of clothing should maintain heat when the body is unable to produce sufficient heat through activity. The function of this layer is to provide extra protection from the cold by conserving heat that the body has produced through activity. Suitable materials for this layer are wool, synthetic fibre and synthetic fibre filled with synthetic fibre or down.

A garment used as a supplementary layer should have the following properties:

- Good insulation
- Windproof and water-resistant

Wool insulates even when damp.



NB! The outer layer must be:

- Windproof
- Spacious
- Easy to take on and off
- Compact packing volume and low weight

A supplementary layer must only be used when personnel are stationary and not during activity. It is as important to avoid sweating as it is to avoid freezing.

### 2.1.3 HEADGEAR

As previously mentioned in the section on loss of body heat, one half of heat loss from the body is in the uncovered head and neck regions. This heat loss may constitute over 50% of the body's total heat loss. The appropriate use of headgear is therefore vital in order to regulate body temperature.

Personnel should always be in possession of at least two types of headgear: one for activity and the other as a supplementary layer. Light/thin headgear such as a field cap/balaclava should be worn during activity. When activity diminishes, thick, warm headgear, such as a balaclava, membrane cap or mountain cap should be worn. Personnel should always ensure that warm headgear does not become wet. It should be protected from dampness by being kept in a pocket or waterproof cover that is easily accessible. Warm headgear should be removed when activity increases so that it does not become damp through sweat.

*Figure 3 - Headgear during activity*

*Figure 4 - Headgear in wind*



*Figure 5 - Headgear for use when personnel are stationary*

Even though the body produces a lot of surplus heat during activity, the ears and exposed facial skin will be vulnerable to the cold, especially the cheeks. These areas require protection, particularly during extremely windy conditions. Field caps have ear flaps that cover the ears well and continue down to the cheeks. Field caps must be loose-fitting enough to fold down the ear flaps. The hood of a field and winter camouflage uniform is an extremely effective tool to protect the face and ears from cold and wind when activity is too intense to use warm headgear. The hood creates a warm air layer around the head and in front of the face.

The hood should be actively used for rapid protection of the head against cold and wind, as well as easy regulation of heat. Combining a hood with a cap or a hood with a bare head will provide degrees of variation, based on the intensity of the activity, as well as protection from the wind. By actively wearing and removing the hood, based on the prevailing conditions, warm headgear will be saved until activity diminishes/ceases. When stationary or during light activity, it is important to use dry and warm headgear to prevent heat loss from the head.

When using a helmet during the winter, it is important that the helmet is sufficiently large enough to contain headgear, based on the prevailing conditions and type of activity. Norwegian Armed Force's balaclavas are well suited in combination with battle helmets, as well as vehicle crash helmets.

The face should be protected against extreme cold and wind, or the effects of wind when being towed on skis or driving an ATV, in order to prevent frostbite. Face masks are well suited to this purpose. Be aware that face masks are a 'double-edged sword' because of interior icing caused by moisture from exhalation and sweat. The sealed air vents and the mask may freeze to the face. Face masks should therefore be ventilated at frequent intervals during use and personnel should inspect each other's faces to check for signs of frostbite.

- Personnel should always be in possession of two types of headgear, one thick and one thin
- Headgear should be adjusted according to the level of activity
- A hood is an effective tool to protect the head against heat loss resulting from extreme weather

The body will always sacrifice the extremities such as the hands and feet in order to maintain its core temperature. If fingers or toes become cold, this has not necessarily been caused by poor quality boots or mittens. It could equally be the result of an inappropriate choice of cap, or that a cap was not used at all.

### 2.1.4 HANDGEAR

As previously described in this section, hands are also vulnerable to the cold. The hands are the body's most important tools for accomplishing fine motor skills and must therefore be well protected. The inability to use the hands during the wintertime will create major problems. Work involving the exposure of fingers in low temperatures should be kept to the minimum. If, however, it is necessary to carry out tasks that require finger dexterity, e.g. the use of telecommunication equipment, the hands should be protected with gloves. Metal objects should never be touched during cold weather without first protecting the hands, otherwise personnel may suffer from local superficial frostbite.

Handwear should not be so large that heat from the hands is unable to warm the air pocket inside the mittens. Mittens heat better than gloves because they have less total surface area, so it easier to keep the hands warm. Norwegian Armed Force's handwear is made in accordance with the multi-layer principle with insulating, windproof and water-resistant layers. The insulating layer comprises woollen mittens and finger gloves. Windproof and water-resistant layers comprise wind mittens.

NB!

When using face masks, personnel should inspect each other's faces to check for signs of frostbite.

Cold metal objects should never be touched without first protecting the hands.

Gloves are primarily used to protect the hands against scratches and cuts. However, in cold weather gloves will also offer protection from the effects of cold, e.g. touching metal. The use of handwear must be adapted to the prevailing conditions.

Personnel should take good care of their mittens and never leave them anywhere. Loss of mittens during the winter could have disastrous consequences. When mittens are not being used they should be placed in a pocket or inside a jacket.



Mittens must be carefully safeguarded. Loss of mittens in cold weather can have disastrous consequences and may quickly result in frostbite. Personnel should never leave mittens on the ground, or in any other location, or they will become wet and dirty. In the worst cases, mittens could be blown away by a strong wind. When mittens are not being used they should be placed in a pocket or inside a jacket in order to keep them warm and dry. Under no circumstances must woollen mittens be used separately without being covered by wind mittens. Woollen mittens quickly become damp and dirty when they are used separately. This also considerably reduces the wool's heat-insulating properties.

### 2.1.5 FOOTGEAR

Contact between the body and the surface that an individual is standing on will 'steal' heat from the body (contact). It is therefore vital that footgear provides adequate insulation. Reliable cold weather footgear, which can be adapted to all areas of use such as ski marching, snowshoes, stationary personnel, extreme cold, frozen bare ground and slushy snow, does not exist. However, there are certain principles that should be adhered to in respect of choice of cold weather footgear.

The multi-layer principle also applies to footgear. The boot is the shell that should protect the foot from various types of strain and dampness. During winter, this should be a simple, high quality leather shell, preferably re-enforced with a waterproof material in the last, e.g. cellular rubber.

The most important function of footgear is to prevent loss of heat to the ground and to protect against dampness.

A simple shell without an integrated lining is easier to dry. M/77 and Lundhags Husky boots, which are used by some divisions, are examples of such simple shell boots. In addition, a boot with a thick lining attracts moisture in the lining. This may freeze to ice and chill the foot. If the boots are lined, it should be possible to remove the lining. A good alternative is an inner boot made of felted wool. The inner boot may be removed in order to be dried (Lundhags Husky). Air in and between the shell and the lining creates insulation.

Personnel should use woollen socks or socks that are a mixture of wool and synthetic fibre. These have good moisture transporting and insulating properties. During

winter, two pairs of socks should be used inside the boots, a thin pair on the inside against the skin and a thick pair on the outside. This will provide several insulating air layers, as well as reducing skin friction and preventing blisters from forming.

There are several vital prerequisites to keeping the feet warm in cold weather. Two of the most important prerequisites are to prevent heat loss to the ground and ensure that there is a sufficient amount of air inside the boots. The air is heated by the feet. Boots should be spacious enough to permit movement of the feet without problems. A good, thick sole of felt, wool, or felted wool provides a proper level of insulation from the ground. In order for there to be adequate room for the sole, as well as two pairs of socks and sufficient air, it is recommended that the shoe size is increased by at least one size. An increase in shoe size is one of the most vital winter measures relating to personal clothing! Several investigating committees have concluded that the main cause of frostbite is boots that are too tight.

NB!

- Never use cotton socks during field conditions in cold weather. Cotton easily attracts moisture, which can lead to frostbite.
- In order that personnel have sufficient room for socks and soles, the shoe size should be increased by at least one size during the cold season.

During winter, boots on their own are often not adequate enough and there may be a requirement for further protection and insulation. Foot muffs and leggings are items of footgear that provide a supplementary layer. The Norwegian Armed Force's foot muffs protect the boot from dampness, as well has having extremely good insulating properties when required. In order to further increase the insulating properties of foot muffs, it is recommended that a pair of soles, made from pieces of discarded sleeping mats, is placed at the bottom of the foot muffs. Many different types of footgear have been tested by the Norwegian Armed Forces and it has been shown that foot muffs combined with M/77 boots is a footgear principle that is difficult to surpass. Leggings do not have the same insulating properties as foot muffs. However, as an extra layer, they will serve to increase the level of insulation. The most beneficial effect of leggings is that they protect boots from the dampness in snow and ice. Leggings used during the winter should completely cover the whole boot. An example of such leggings are Berghaus Yeti leggings, which are used by some divisions of the Norwegian Armed Forces.

Moreover, bivouac shoes are a supplement to footgear and can be used in a bivouac, a tent, a snow hole or on sentry duty/OP. Bivouac shoes can comprise felted wool socks and foot muffs with soles made from pieces of discarded sleeping mats. On the commercial market there is also a range of bivouac shoes made of synthetic fibre with light fillings. These are light and extremely compressible and are used by some divisions of the Norwegian Armed Forces.

It is not recommended that membrane boots are used during several consecutive days of cold weather in the field, without the option of drying them. The breathing properties of the membrane are significantly reduced in the cold. This may result in the boots being completely air-resistant. Thus, most of the dampness from the foot will be absorbed by the lining. Such dampness is extremely difficult to get rid off

without adequate drying options. This dampness is capable of freezing, turning the boots into a 'cold store'.

### 2.1.6 USE OF SLEEPING BAGS/CLOTHING DURING SLEEP

The amount of cold that a sleeping bag can tolerate is governed by four factors: the sleeping bag, the sleeping mat, the surroundings and the individual in the sleeping bag. A sleeping bag, together with the sleeping mat, should insulate the body from its surroundings. Most of the heat will disappear through contact with the ground. Thus, a good, thick sleeping mat is a prerequisite to preventing personnel from freezing at night. In extremely cold conditions, the supplied sleeping mat may be strengthened with reindeer skin by adding some supplementary layers beneath the sleeping mat or by using a double sleeping mat.

Twigs may also be placed beneath the sleeping mat in order to raise it a little from the ground.



'Plenty below, plenty on top and not much inside' are the basic principles for optimal use of a sleeping bag. It will not always be possible to sleep without clothing but, if circumstances permit, personnel should avoid wearing an excessive amount of clothing inside a sleeping bag. As with any other type of clothing, a sleeping bag does not produce heat; it insulates and maintains heat produced by the body itself. If too much clothing is worn, the sleeping bag's effectiveness will be reduced. Therefore, pullovers, cold weather jackets and field jackets should be placed outside the sleeping bag.

**Sleeping**

Principles of achieving an agreeable level of sleep:

- Use much insulation underneath, minimal clothing on the body and much insulation on top of the body
- Personnel should eat a warm meal before retiring
- Personnel should wear dry underwear and socks
- Personnel should use a balaclava or cap

*Figure 6- Headgear effectively reduces heat loss from the head during sleep*

Before the soldier lies down in the sleeping bag, he/she should consume a hot meal in order to increase the body's heat production. The sleeping bag should be shaken in order to fill it with air. Fibres in the sleeping bag become compressed in the compression bag and need time to straighten and accumulate air for insulation. Personnel should change into dry socks and underwear. If it is extremely cold in a bivouac that does not contain any heating apparatus, a balaclava/cap should be worn in order to reduce heat loss from the head and neck. Finger gloves will also help reduce the amount of heat that the body loses. Personnel should fill a canteen with hot water and use it in the sleeping bag as a hot water bottle. This will provide heat for many hours.

In cold bivouacs such as snow holes, or in a tent that does not contain heating apparatus, boots should be placed inside the sleeping bag or placed beneath the hollow of the knees, between the sleeping bag and the sleeping mat. If this is not done, the boots will become frozen solid during the course of the night. If boots are taken into the sleeping bag, they must be brushed free of snow and external moisture. If boots with inner boots – felt boots – are being used, the felt boots should be taken into the sleeping bag and the outer boots should be placed beneath the hollow of the knees between the sleeping bag and the sleeping mat. If underwear is wet and the body is likely to produce a sufficient amount of surplus heat, underwear may be left on/taken into the sleeping bag. Personnel should not take too much wet clothing into the sleeping bag or it will become wet and cold.

NB!
If boots are to be taken into the sleeping bag, they must be brushed completely free of snow, ice and external moisture.

# 2.2 CLOTHING IN SPECIAL CONDITIONS

## 2.2.1 SPECIAL CONDITIONS - ATV (WINTER) / ATV (SUMMER)

The combined effects of the wind and cold increase substantially for ATV personnel. Both driver and passenger must pay particular attention to protecting themselves against such conditions. The same applies to the use of an ATV (summer) during the autumn. The face will be vulnerable to local frostbite if it is not covered, especially the most prominent parts. The face will be well protected if a face mask and scooter goggles are used. However, personnel should ensure that no bare skin is exposed between the goggles and mask.



The ATV driver is usually more active than the passenger and any personnel being conveyed on the sledge. For this reason, passengers are more vulnerable to frostbite and hypothermia. Good communication is therefore vital between members of the ATV team. Regular stops should also be made where personnel carry out inspections by checking each other's faces for signs of local frostbite.


*Figure 7 - ATV clothing*

ATV clothing is protective gear necessary to personnel using a vehicle as part of their daily service. ATV clothing comprises scooter mittens, face mask, goggles, felted wool socks, soles made from pieces of discarded sleeping mats, and an ATV helmet.

Scooter mittens comprise an inner and outer mitten. These mittens are suitable for use on an ATV in conditions in which regular mittens are not sufficient. Scooter mittens will provide better protection against extreme weather than wind mittens. However, it should be noted that it is not possible to operate a weapon when wearing scooter mittens.

Felted wool socks are intended to be an extra layer of insulation for the feet. When using felted wool socks in foot muffs, pieces of discarded sleeping mats, or similar, must be used as an insole. A foot muff on its own will not provide adequate surface insulation. The disadvantage of foot muffs and felted wool socks is that the foot becomes a little less stable and is not protected against blows and strikes.

The main function of a snowmobile helmet is to protect the head. However, the helmet also provides relatively good insulation for the head, depending on its shape. For additional insulation, a balaclava should be worn under the helmet.

NB! An ATV travelling at 40 km/h will impact heavily upon the effective temperature:

- 0° C corresponds to an effective temperature of -17° C
- -10° C corresponds to an effective temperature of -30° C
- -20° C corresponds to an effective temperature of -44° C

*Figure 8 - Bare skin should be covered during ATV manoeuvres*

### 2.2.2 SPECIAL CONDITIONS - COASTAL AREAS

During operations in coastal areas and transfer to/from an open vessel, personnel will be exposed to a combination of dampness, the effects of wind, as well as the cold. Personnel must be especially alert in such situations. A waterproof and windproof outer layer, handwear and footgear must be worn. Personnel operating under such conditions have special garments at their disposal, such as dry suits, as a supplement to ordinary clothing. Wool has good insulating properties in damp conditions, which will be a distinct advantage during such operations.

For operations in and around salt water, it is the effect of salt crystals upon clothing that is a particular problem. Clothing that has been made damp by salt water becomes ‘saturated’ by salt crystals (absorbs and conserves moisture). Therefore, in practice, clothing that has been affected by salt water will never dry properly until

the salt water has been washed/rinsed out.

*Figure 9 - Boat Patrol Border Guard Garrison in the county of Sør-Varanger during October*

Due to the issue of salt in clothing, cotton is not a suitable choice as an outer layer. Membrane-based garments are slightly more suitable. However, salt crystals will still be present in clothing. It is easier to dry a membrane uniform than a cotton uniform. This is an important detail as the salt water must be rinsed out of clothing before the clothing will function optimally again.

A dry suit will prevent the ingress of dampness and sea spray but dampness/sweat will not escape. It is also a challenge to remain sufficiently warm in a dry suit over an extended period of time. The dry suit should therefore be large and spacious enough to provide adequate room for insulating clothing to be worn underneath (wool).

NB!

Clothing that has been made wet by salt water will not dry. Clothing to be used on missions ashore should be packed in a waterproof bag.

Every opportunity should be taken to release surplus heat and moisture. A boat suit is also a supplement to the outer layer but this will become wet and will not offer the same level of protection as a dry suit.

There will almost always be water in an open vessel. In such conditions, the feet are particularly vulnerable to frostbite (trench foot/immersion foot) and it is recommended that personnel wear completely waterproof footgear with removable wool felt inner boots. Mittens also become quickly wet in an open vessel. However, a woollen inner mitten will provide insulation even if outer mittens are wet.

Personnel will always become wet in an open vessel, to a greater or lesser extent, whether this is externally as a result of sea spray or internally from sweat. In addition, there are few or no options to mobilise personnel in order to keep them warm. Therefore, proper routines should be established, i.e. personnel should inspect each other for signs of frostbite, etc. Also, forays should be undertaken in order to create activity. Uniforms and additional clothing to be used on missions ashore should be packed in a waterproof bag. A change of clothing should take place at the first available opportunity once the unit has reached a safe area away from the beach zone.



### 2.2.3 SPECIAL CONDITIONS - VEHICLE PERSONNEL

An environment that fluctuates between hot and cold represents a special challenge to personnel being conveyed in vehicles. Sudden changes such as being in a heated vehicle and then alighting into a cold environment, only to board the vehicle again, present major challenges in terms of clothing. Personnel are often conveyed with full combat gear in confined spaces with no option to adjust/remove any articles of clothing.

NB!

Vehicle personnel must have established proper routines for the adjustment of clothing, based on the rapid change between a warm interior climate and a cold external environment.

*Figure 10 - CV 90 under winter conditions*

Vehicle personnel must also have established proper routines and discipline to ensure that surplus heat is ventilated and clothing adjusted. The uniform's many options for ventilation must be fully utilised when personnel are being conveyed in a vehicle. It is particularly important that footgear is loosened, especially foot muffs. There is documentary evidence indicating that feet can suffer frostbite in a vehicle as a result of personnel not loosening foot muffs.

Snow and ice that has formed on uniforms and clothing melts when changing from a cold environment to a warm one. A snow brush should be actively used to remove as much ice and snow as possible before boarding the vehicle. The snow brush should always be easily accessible and ready for use.

In the case of turret personnel, the issue of a cold upper body and a warm lower body is a common problem. If possible, clothing should be adjusted accordingly. Personnel should wear windproof and insulating clothing on the upper body, while reducing the amount of insulating layers worn on the lower body. In addition, turret personnel are exposed to the effects of wind in the face. The face should therefore be well protected with goggles and face mask.

# 2.3 TEMPERATURE ADJUSTMENT / CORRECT WORKING TEMPERATURE

## 2.3.1 HOW IS HEAT RETAINED AND HOW IS SURPLUS HEAT RELEASED?

Keeping warm is always a challenge; however not becoming too warm is equally a challenge. It is impossible to completely avoid freezing or sweating during military activity. There are, however, certain measures that will, to a large extent, ensure that body temperature is kept at the correct working temperature.



*Figure 11 - It is not possible to avoid getting damp during military activity. It is therefore vital to have appropriate clothing routines.*

In order for the body to be kept at the correct working temperature, heat loss and heat production must be balanced at all times. The correct working temperature is achieved when clothing is adjusted to the level of activity in such a way that personnel neither freeze nor sweat too much. Poor heat regulation will result in an increase in sweat production and an increase in the amount of calories that are burned in order to maintain heat production.

The adjustment of working temperature and the ventilation of moisture is necessary to maintain comfort during any activity and in all types of weather conditions. It is important to vary clothing and the number of layers being worn during activity so that personnel do not become too hot. It is in such situations that the multi-layer

principle plays an important role. Several thin layers offer the option of adjusting and varying clothing, based on the prevailing conditions and intensity of activity. To prevent unnecessary sweat production during activity, as well as preventing personnel from freezing during tasks involving less activity, personnel should practice the active adjustment and varying of clothing, based on the given situation.

The most common error is to use too much clothing because of a fear of freezing. If, for example, personnel are ready to set off on a march and are sufficiently warm whilst waiting for the rest of the unit to make themselves ready, they will undoubtedly be far too warm as soon as the march commences. The colder and more demanding the weather conditions, the more important it becomes, paradoxically, to avoid becoming too warm during movement or intense activity. It matters not if personnel sweat while erecting a bivouac on a warm summer's day, but on a freezing, windy winter's day this may be critical. Consideration should also be made if the route of the march commences in a mountain forest and then ascends to bare, rocky terrain. Windy conditions may be tolerable in a forest but can become considerably tougher in bare, rocky terrain. Personnel who are sweating profusely as they enter mountainous terrain will become cold very quickly.

By using as little clothing as possible, personnel will reduce sweat production. Carrying out physical activity in warm clothing will result in personnel freezing when they become stationary because of inner dampness. By being correctly dressed during activity, personnel will quickly become cold when activity ceases as a result of sweat evaporating from the body. This is immediately noticeable and clothing should therefore be adjusted when activity ceases. The number of layers of middle clothing should be increased or a supplementary layer should be added. Personnel should also wear a warm cap.

One option during shorter breaks e.g. a ten minute rest during a march, is attempting to conserve surplus heat.

NB!

The colder and more demanding the weather conditions, the more important it becomes to avoid becoming too warm during activity. Sweat will cause personnel to become cold when activity ceases.

The objective is to prevent the onset of hypothermia as a result of the evaporation of moisture in clothes and from the body. As soon as the air in clothing becomes saturated by water vapour, evaporation will stop and heat loss will diminish. A well-known first aid technique to counter the onset of hypothermia is the use of a canvas section covered in silver foil or bubble wrap. The conservation of surplus heat is achieved by closing all openings in outer clothing, as well as tightening the cord at the neck and wrists. Personnel should wear a warm cap and mittens. These should be easily accessible. In most cases, this will maintain body heat over shorter periods.

The ventilation of surplus heat and dampness during activity is vital to avoid becoming wet through sweat and consequently cold when activity ceases. Heat loss from the head and the temperature regulating effects of this – as well as the use of headgear and adjustment of working temperature through the use of a hood – has

been previously described under Headgear. In addition, it is important to use the uniform's own ventilating options. The cotton fabric of the M/75 Field Uniform has relatively good ventilation and moisture transporting properties. However, in most cases, a polyester winter camouflage uniform will be worn outside of the field uniform. This will prevent moisture transport. Personnel should ventilate surplus heat by unbuttoning the neck, loosening the wrists and unzipping the front of a jacket, as well as the trouser fly. Personnel should ensure that clothing is roomy and not tight-fitting; braces should be used on a field uniform rather than a belt. A belt will prevent effective ventilation.

### 2.3.2 PRINCIPLES OF TEMPERATURE REGULATION

- Personnel should actively adjust the number of layers based on the level of activity
- A thin cap should be worn during activity and a thick cap should be worn when stationary
- Personnel should use as little clothing as possible during activity and wear thick clothing and a cap when activity ceases
- Personnel should familiarise themselves with the uniform's ventilation options
- The head, neck and major arteries are effective in regulating the working temperature
- Clothing that is too tight-fighting should be avoided. Braces should be worn
- Personnel should practice proper routines for temperature regulation and be disciplined enough to maintain such routines regardless of the weather conditions



The M/02 membrane Field Uniform is, first and foremost, a completely windproof garment but, in addition, the membrane possesses properties that, in theory, should ventilate internal moisture in the form of vapour and prevent external moisture in the form of droplets. In practice, however, the membrane's moisture transporting properties are extremely restricted. During work activity, so much moisture is produced that the membrane is unable to ventilate all of it. In addition, a winter camouflage uniform, as well as combat and carrying equipment will usually be worn. All of this contributes to significantly reducing the membrane's function. It is therefore of the greatest importance that all ventilation options are fully utilised when using this uniform. Beyond the ventilation options provided by a cotton uniform, a membrane uniform also has zips under the arms, at the hips and along the legs. By combining all of these ventilation points, it is possible to achieve a reasonable ventilation solution. Nonetheless, personnel will still become damp in a membrane uniform. It is therefore important to have established proper routines for the variation and adaptation of clothing, based on whether personnel are active or stationary.

Personnel should be particularly careful to adjust clothing when changing from a cold to a warm environment such as a tent or a vehicle, for example. Clothing should be removed, opened up and ventilated when entering a tent or a vehicle, for example. Clothing and footgear will insulate against external cold but, at the same time, it

conserves the cold air in clothing when personnel enter a warmer environment. Thus, the effect of too much clothing will be quite the opposite and will act as a cold store that traps the cold within clothing. There is documentary evidence indicating that feet can suffer frostbite as a result of soldiers not removing foot muffs in the vehicle transporting them home after an exercise.

NB!

- Personnel should loosen clothing and footgear when they enter a warm environment.

It is inevitable that personnel will become wet and damp with sweat during military activity. In order to remain comfortable, personnel must be disciplined in the active variation and adjustment of clothing, even though it might feel uncomfortable, in the moment, to remove warm clothing and a warm cap before setting off on a march.

*Figure 12 - Adjustment of clothing*

## 2.4 DAMPNESS, SNOW AND ICING

### 2.4.1 GENERAL

Situations in which temperatures change from cold to warm (e.g. boarding and alighting a vehicle) and intense activity followed by a rest period is typical of military activity. Clothing will become wet, either through sweat from the inside or

from the ambient environment. Weather conditions will arise in which it is virtually impossible to avoid getting wet. Wet clothes do not warm well.

If personnel are wet or damp they will become cold – in any event, as soon as they stop moving. Water has a range of properties that will result in an individual feeling uncomfortable when wet. Firstly, water has great thermal conductivity. This means that heat is drawn out of the body. Secondly, a considerable amount of energy is required to heat water. This energy is taken from the body. However, in respect of clothing, it is water's significant evaporating energy that cools the body the most. It requires an extreme amount of energy to transform water from a liquid into a gas – which must occur if wet clothing is to dry.

NB!
Dampness will cause personnel to become cold and must be actively countered. Wet clothes do not warm well.



### 2.4.2 ACTION

During winter, clothing will absorb the major part of moisture from sweat, with the exception of a membrane uniform where moisture will form on the inside of the garment. If this moisture is prevented from escaping through ventilation, frost or ice will form on the inside of external clothing. In addition, personnel will become wet on the outside through precipitation or through direct contact with the snow on the ground. Dampness is therefore one of the most major challenges when it is cold, not just from the outside, but also from within.

Dampness from within is best handled through active adjustment and variation of clothing based on the prevailing conditions and the intensity of the activity being undertaken. Personnel should use as little clothing as possible and utilise all ventilation options during activity.

When stationary, warm clothing should be worn or surplus heat should be conserved.

External dampness cannot be avoided during military activity. It will snow and it will be necessary for personnel to be in direct contact with snow on the ground during an advance, attack, or similar. If it is cold and the snow is dry, it is easy to get rid of snow on uniforms and equipment with a snow brush. It is particularly important to remove all snow and ice before leaving any cold surroundings in order to prevent it from melting.

A snow brush is the most important tool to keep uniforms and equipment free of snow. Personnel should ensure that a snow brush is always easily accessible in a pocket. It should be used at every available opportunity! In addition to a personal snow brush, a unit or patrol should also possess a larger snow brush (e.g. a car brush) to be used for the unit's materiel, weapons, as well as for the removal of snow prior to personnel entering a tent.

*Figure 13 - A snow brush should be used to remove snow and ice from clothing*

Winter conditions in which the temperature is around zero degrees – with wet snow both on the ground and falling from the sky – are challenging. It is virtually impossible to stay dry under such conditions during military activity, even with the best type of clothing. Even when using rainwear, personnel will still be damp on the inside. Under such conditions, personnel must be disciplined enough to vary and adjust clothing actively and often. Personnel must accept that there will be periods when they will be wet. It is vital that personnel do not use up all of their clothing so that everything becomes wet. For example, personnel must possess supplementary garments, wool terry cloth underwear, warm headgear and a pair of socks that are always dry. These should be packed in a waterproof bag. Personnel should use as little underwear as possible while active and change to dry underwear when there is no longer a risk of getting wet. Personnel should work in wet clothes and rest in dry clothes. Personnel should change to dry clothing when stationary and wear wet clothing during activity, even though this may be uncomfortable at the time. Use every available opportunity, as well as breaks in combat, to dry wet garments.

NB!

- Personnel must accept that there will be periods when they will be wet. They should work in wet clothes and rest in dry clothes.

### 2.4.3 DRYING UNDER FIELD CONDITIONS

It is often difficult to dry clothes under field conditions. This problem can be

resolved through well-prepared routines, as well as personnel demonstrating the discipline to adhere to routines even in difficult conditions.

## Drying clothing through use of the body's own heat production

In conditions where no heat source is available or a heat source cannot be used due to enemy presence, clothing may be dried by using the body's own heat production. The body's heat will cause dampness in clothing to evaporate. As previously stated in this section, such evaporation of dampness will result in personnel cooling down. Personnel must therefore be alert to such situations.

It is impossible to become dry through a high level of activity! On the contrary, in order to dry clothing on the body, activity must be reduced to the point that personnel no longer produce sweat. The middle and outer layers of clothing are the most difficult to dry. Personnel should prioritise the inner layer – their underwear. Net underwear dries relatively quickly and personnel may find that such underwear will dry in the course of erecting a bivouac, for example.



- It is impossible to become dry through a high level of activity. On the contrary, to dry clothing on the body, activity must be reduced to the point that personnel no longer produce sweat
- Personnel should ventilate moisture and dampness in clothing when taking a break
- Dry clothing should not be completely used up
- Personnel should always be in possession of some dry clothing – a set of underwear, a pair of socks, a supplementary garment and a dry cap. These should packed in a waterproof bag

When activity ceases, personnel should immediately open up clothing and ventilate well in order to remove as much dampness and moisture as possible. After this has been accomplished, a warm garment should be worn outside of damp underwear so that personnel do not cool down as a result of evaporation.

This will also cause the evaporation process to take longer, thus reducing the cooling effect.

Clothing may be dried, or at least warmed up, by taking it into the sleeping bag or by placing it on the body in the sleeping bag. Clothing should not be too wet if it is to be dried inside the sleeping bag, but damp and sweaty clothing may, to a certain extent, be dried. Soles and socks should be placed on the body and boots should be placed beneath the hollow of the knees under the sleeping bag. Personnel should be aware that moisture in clothing will disappear into the sleeping bag. The sleeping bag should therefore be turned inside out and ventilated well on the following morning. Clothing will not be completely dry. However, it will be warmer and more comfortable to wear. Field uniforms should be placed on top of sleeping bags.

It is always a fine balance choosing between whether personnel should change to dry clothing when stationary or attempt to dry wet clothing in a sleeping bag or against the body. Personnel should remember not to use up all their warm garments or their sleeping bags. Personnel should be disciplined enough to ensure that they are warm and dry when they rest. Thereafter, dry clothing should be removed and damp

clothing should be worn when activity is about to re-commence.

## Drying clothing in a bivouac

Depending on the situation, personnel should dry clothing in a bivouac at the first available opportunity. As a rule, there is limited space in a bivouac, regardless of whether it is a tent or an improvised solution. Nonetheless, personnel must prioritise which layers should be dried first. Socks, underwear, boots and mittens should be prioritised before uniforms. Uniforms may be hung up, if possible, or placed on top of sleeping bags. The fire watch may be given the task of turning uniforms during the course of the rest period. When clothing is being dried, personnel should pay particular attention to the risk of fire and should not be over-zealous. Drying clothing takes time. Burn holes may appear on clothing that is placed too near an open heat source. This is much worse than a whole, wet garment.

*Figure 14 - Drying clothing in a tent*

NB! Personnel should be aware of the risk of fire.

Boots dry best at room temperature. Boot leather must not be exposed to temperatures above 50 degrees. A rule of thumb is that leather will be ruined at the same temperature that would burn an individual. The most effective method is to stuff the boots with newspaper when they have been removed. The newspaper will absorb much of the moisture in the boots. When drying boots, the soles must always

be removed.

NB! Leather boots will be ruined at temperatures above 50° C. Dry at room temperature.

## Freeze-drying of clothing

At temperatures below minus 10 degrees it is possible to freeze-dry items of clothing. This is accomplished by removing the garments and allowing moisture on/in them to freeze to ice and frost, e.g. hanging a jacket on poles. The garment should be shaken and brushed with a snow brush in order to remove ice and frost. It will not be completely dry but this method will result in the removal of much of the moisture in the garment.

The outer layer of a winter camouflage uniform, cotton uniform, membrane field uniform, membrane cap and wind mittens are the easiest items to freeze-dry. Of all these, the membrane uniform is best suited to freeze-drying because moisture will not be absorbed by the fabric but will remain either on the outside or the inside of the membrane. Thus, frost is easier to brush off.



It is also possible to freeze-dry some other items of clothing, particularly clothing made from synthetic fibre. Moisture will remain on the outside of synthetic fibres and will not be absorbed by the fibres, as would be the case with woollen and cotton garments. An example of this is the lining in a membrane cap. If this becomes damp as a result of sweat the cap may be turned inside out and the moisture will freeze and can then be brushed off. The lining will then be virtually dry.

*Figure 15 - Freeze-drying*

# 3 FABRICS USED IN MILITARY CLOTHING

## 3.1 THE NORWEGIAN ARMED FORCE'S FIELD CLOTHING

### 3.1.1 GENERAL

Contemporary field clothing is characterised by traditional values, modifications and new developments. Cost/utility assessments indicate that our forefathers developed many excellent products that continue to do their job. However, new demands and technological developments, etc, have led to a need for change. Even though new items are bound to appear in the future, the clothing described in this section will be used by soldiers for many years to come.

There are a lot of factors that influence field clothing in the Norwegian Armed Forces. The solutions found will often be a compromise between many desirable characteristics. Some desirable characteristics are, for example:

- user comfort, durability and minimal noise from clothing friction
- colour and multispectral camouflage
- water-resistance and ventilation/moisture transportation
- insulation, low weight and flame-retardant properties
- reasonable biological and chemical protection
- good washing/dry cleaning qualities
- storage durability and easy handling

Beyond this, the Norwegian Armed Forces places great demands in respect of the quality of manufacturing and the quality of clothing.

### 3.1.2 NATURAL FIBRE

#### Cotton

Over the last 30-40 years, the Norwegian Armed Forces has used the natural fibre (vegetable fibre) cotton in its clothing. This tendency changed somewhat with the introduction of the 'Soldat 2000' programme. Cotton has many properties that render it a suitable fabric for clothing. However, it also has many disadvantages, particularly in respect of moisture. In military clothing, cotton is used in the M/75 field uniform, M/51 field cap, mountain cap, M/93 wind mittens, foot muffs, as well in field shirts.

**Cotton**

+ Durability
+ May be boiled
+ Flame-resistant
– Absorbs moisture
– Retains moisture

– Does not insulate when wet

Cotton is a comfortable material that very few people react allergically to. The fibres are very durable, permit the efficient passage of air and condense very little in variable temperatures. Cotton has excellent insulating properties when it is dry, as well as providing good wind-resistance when tightly woven.

In a military context, cotton also possesses positive properties insofar as it makes little noise, is relatively flame-resistant, can be boiled and may therefore be re-used again by several different people. Cotton is a reasonably-priced and cost-effective fabric.

On the negative side, cotton is a fibre that easily absorbs moisture and requires impregnation in order to withstand the damp. Cotton absorbs and accumulates moisture, which results in its insulating properties being lost even with a small degree of damp. When a cotton garment is wet it becomes heavy and takes a relatively long time to dry.

In respect of military garments made of cotton, personnel require an appropriate degree of training and experience in order to use such garments effectively in damp and demanding field conditions. Cotton is not very dirt resistant and has poor BC protection properties.



## Wool

For many years, wool has been known for the excellent insulating properties of its natural fibre (animal fibre), even when wet. The many different ways of producing wool also allow it to be used in a great diversity of garments. In recent years, the Norwegian Armed Forces has used wool for insulation and protection, especially for the extremities.

In military clothing, wool is used in socks, M/93 woollen mittens, M/93 finger gloves, hunting caps, balaclavas, woollen pullovers and wool terry cloth underwear.

Wool is capable of repelling water drops and absorbing water vapour. Wool is also very dirt resistant. The reason for this is the fibre's frizzy shape and its surface with layers of shell. These shells contain natural Lanolin that repels dirt. The wool's excellent insulating properties are due to its frizzy shape, insofar as the surface creates a lot of tiny air pockets and each individual wool fibre can contain up to 80% air. The frizzy surface means that wool does not feel particularly damp against the body when it is wet because only a small part of each fibre comes into contact with the skin.

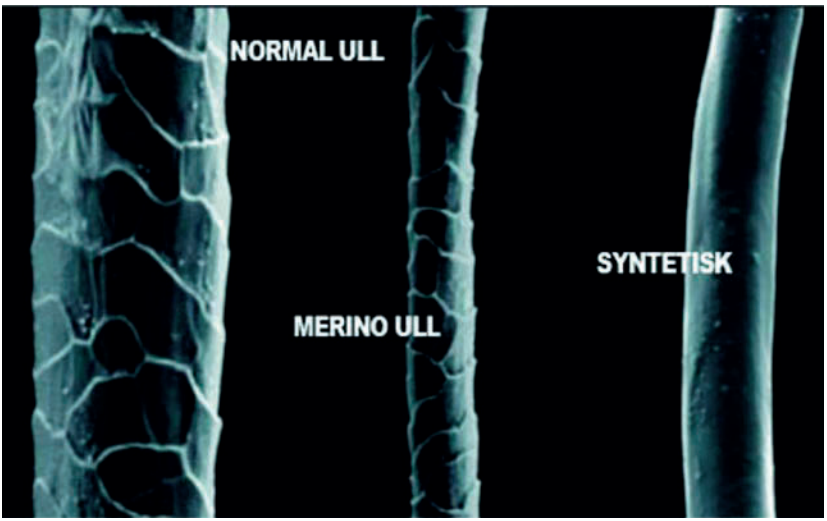



*Figure 16 - The structure of different fibres*

Wool fibre comprises, among other things, proteins. It is the chemical construction of these proteins that gives wool its elasticity, stretchability and lightness. The fibre contains a large amount of air that insulates against both the warm and the cold. When the proteins in the fibre come into contact with moisture, they also produce heat.

**Wool**

+ Insulates in damp conditions
+ Does not feel wet before it has absorbed a great deal of moisture
+ Flame-resistant
+ Dirt resistant and odour resistant
– Not very durable
– May cause an allergic reaction

The core of wool fibre is hydrophilic. Heat released by the body in the form of water vapour is absorbed by the fibre's core. When dry, the fibre is able to retain fluid corresponding to 30% of its own weight, without feeling wet.

Merino wool, which is used in the Norwegian Armed Force's field underwear for women (brassieres and panties) is obtained from a range of suppliers in Australia and New Zealand. The wool from sheep in these regions contains longer and thinner wool fibres than the fibres found in Norwegian sheep. Resin and synthetic fibre are added to garments made from Merino wool during processing. This means that the garments do not itch and almost never shrink when washed. The garments are a

mixture of Merino wool and synthetic fibre.

### Wool terry cloth

A characteristic of wool terry cloth is that it is comfortable to wear and does not itch. Wool terry cloth may be washed at temperatures of up to 60 degrees, making it suitable for military use. However, this is still not sufficient for a garment to be re-used by several different persons. Therefore, a single garment should be issued to each member of personnel.

Wool terry cloth used by the Norwegian Armed Forces contains a mixture of 70% wool and 30% polyester. The polyester should improve the underwear's durability and elasticity. However, polyester is an oil-based synthetic fibre that can easily melt. Therefore, tight-fitting clothing should not contain more than 30% synthetic fibre. Synthetic fibres contribute to increasing the garment's moisture transporting properties. A mixture of wool and polyester ensures good insulation as well as transporting moisture away from the skin. The material is not flame-retardant although it does possess strong flame and heat-resistant properties. (Wool terry cloth is self-extinguishing and difficult to ignite.)



Wool terry cloth fabric contains up to 80% air that is retained by the frizzy wool fibre. The air forms an insulating layer outside of the skin and prevents heat from evaporating. In addition, wool terry cloth fabric is woven in such a way that each individual thread of wool is looped. The air retained in all of the loops in the terry cloth provides an increased level of heat in the form of more air.

In the case of wool terry cloth, moisture is transported away from the skin and the fabric allows particles of vapour through without losing its heating function. The ability to transport moisture away eases heat emission during physical activity and keeps the body dry, while also maintaining heat balance. It is this very effect that may be fully exploited by using net underwear beneath woollen underwear. Moisture from the body is transported through the net underwear and out through the wool terry cloth.

## 3.1.3 SYNTHETIC FIBRES

Synthetic fibre is a collective term often used for regenerated and synthetic fibres. Regenerated fibres are made from wood pulp or cellulose such as Modal and viscose. The majority of synthetic fibres are extracted from oil. In military clothing, a range of synthetic fibres are used such as Rhovyl, polyester and polyamide (nylon).

All synthetic fibres display a number of common characteristics that separate them from natural and regenerated fibres. Synthetic fibre is at least as strong as natural fibre, even when wet. It is water-resistant and will therefore dry quickly. Synthetic fibre does not absorb sweat very well because of poor moisture-absorbing properties. On the minus side, synthetic fibres melt very easily unless a flame-retardant has been added.

Synthetic fibres are also used in Norwegian Armed Force's clothing in combination with natural fibres in order to improve a garment's durability, among other things. Wool/polyamide cotton/polyester are examples of such combinations.

### Rhovyl

Rhovyl is a synthetic fibre used in Norwegian Armed Force's net underwear. During

the manufacturing process, flame-retardant and anti-bacterial agents are added. When the fibre comes into contact with a heat source, it will carbonize instead of melting, which is normal for other types of synthetic fibre.

15% of the regenerated fibre Modal is added to Rhovyl used by the Norwegian Armed forces, in order to make the garment feel softer. Modal is a cellulose fibre, often made from the spruce tree. Modal has properties that are similar to cotton.

### Cordura

Cordura is a registered brand name. Cordura fabric is a nylon-based product (Polyamide fibre) that has been developed/woven to be especially robust and long-lasting. Cordura is used in virtually all carrying equipment. Cordura is extremely durable. However, one disadvantage is that Cordura is less heat and melt-resistant than many other fabrics. The factor that makes Cordura acceptable is that carrying equipment does not come into direct contact with the skin. It is, however, important to be aware of this characteristic.

### Polyester

Polyester is a synthetic fibre that is strong, dries quickly, is water-resistant and is one of the fibres that absorbs the least amount of moisture. Polyester has a high melting point and will contract under flame rather than melt.

Polyester may be mixed with wool and cotton to make garments more durable, water-resistant and quick-drying. In military clothing, polyester is found in various proportions in wool terry cloth (30%), winter camouflage uniform, cold weather middle trousers (Anna), M/93 wind mittens (50%) and foot muffs (50%).

### Polyamide (nylon)

Polyamide is a synthetic fibre that is extremely strong, water-resistant and elastic. The fibre absorbs little water and cannot rot.

Polyamide may be mixed together with wool and cotton to make garments more durable, easy to maintain and quick-drying. In military clothing, polyamide is found in the M/02 membrane uniform, rainwear, grey socks (18%), green socks (40%) and in the padded material used in cold weather middle trousers (Anna).

### Microfibre

Microfibre is a fibre that can be manufactured to extremely fine tolerances, as well as with cavities, which makes microfibre material exceptionally light. In military clothing, microfibre is found in winter camouflage uniforms.

## 3.1.4 FLEECE

Fleece has been on the market for a long time and in recent years has been implemented in Norwegian Armed Force's clothing. Some divisions have also procured various fleece products themselves. Fleece is often described as if it were a separate type of textile fibre comparable to wool and polyester, for example. Fleece is a collective term for a fabric with a distinct look and specific characteristics with materials comprising a floss base on one or both sides. It contains a lot of air and volume, which allows fleece to retain heat. Fleece also weighs very little and dries quickly. Beyond this, fleece retains the characteristics of the fibres from which it was made. There are several ways of making fleece and it may comprise many different fibres such as polyester, viscose, acrylic and wool. Polyester, the synthetic fibre, is

the most common type of fibre used in fleece. The insulating properties of a fleece garment are dependent on the length and thickness of the fibres, as well as the weave and knit

Polartec and Windstopper are terms that are used in connection with fleece. Polartec is a microfibre made of polyester/polyamide and possibly other fibres. Windstopper is a commercial name and a registered trade mark. It is a 3-layer product, in which the middle layer constitutes a windproof and breathing functional layer of Teflon. On the outer and inner side, a range of qualities may be used, both woven and knitted. Windstopper is soft and elastic, and has a high degree of durability against heat, cold and acids. It also dries quickly. Windstopper fleece is not a middle layer. If it is used beneath a membrane uniform this will result in a membrane to membrane effect and both garments will lose much of their intended functions. As a rule, a Windstopper garment is often tightly woven with short fibres and may be used as a typical ‘soft shell’ outer garment, where suitable.

# 4 MILITARY CLOTHING - DESCRIPTION, USE AND MAINTENANCE

## 4.1 BODY CLOTHING

### 4.1.1 INNER LAYER

#### Net underwear

**Fabric**

85% Rhovyl/15% Modal

**Properties/use**

Inner layer directly against the skin. The net construction creates a dry, insulating air pocket in the ‘holes’. The ‘holes’ also make the garment feel less damp against the body. The Rhovyl fibre transports moisture to the next layer. During light work, net underwear dries quickly on the body. Net underwear should never be combined with cotton as this will prevent the further transport of moisture. Personnel should be aware that the rapid moisture transporting properties of the garment means that skin surface evaporation happens more quickly, resulting in a faster cooling of the body than with woollen garments. Unlike woollen underwear, net underwear does not feel warm when it is damp. This is particularly noticeable when net underwear only is worn beneath a membrane field uniform.

**Maintenance**

Wash at 60 degrees. During several days’ use in field conditions, the garment should be turned inside out and shaken in order to remove dirt and skin residue. In addition, if the net underwear is worn inside out, the outer garment will wear away dirt from the underwear.

*Figure 17 - Net underwear*

### Woollen underwear for women, brassieres and panties

**Fabric**

65% Merino wool/20% polyamide/15% polyester

**Properties/use**

Inner layer directly against the skin. The underwear has the properties of wool. It becomes more durable and moisture transporting when mixed with synthetic fibre.

**Maintenance**

Wash at 60 degrees. A suitable wool detergent should be used.

*Figure 18 - Woollen underwear for women, brassieres and panties*

## 4.1.2 MIDDLE LAYER

### Wool terry cloth underwear

**Fabric**

70% wool and 30% polyester

**Properties/use**

The underwear is worn outside of net underwear. It may also be worn directly against the skin as an inner layer. Net underwear transports moisture to woollen underwear in such a way that moisture does not remain on the skin. Woollen underwear also insulates well as an inner layer but moisture is not transported as quickly away from the body as it is with net underwear. Wool terry cloth insulates well when damp and transports moisture further to the next layer. It is well suited to wearing beneath a membrane uniform. The vest has a polo neck with a zip for ventilation.

**Maintenance**

Wash at 60 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres. Wool fibres wear more quickly than polyester. This means that garments that are worn/washed many times will lose much of their insulating properties.

*Figure 19 - Wool terry cloth underwear*

## Cotton field shirts

**Fabric**

Pure cotton. Knitted terry cloth.

**Properties/use**

A field shirt has the properties of cotton and will insulate well as long as it remains dry. However, it will lose almost all of its insulating properties when it becomes damp. When used in field conditions, it is important to open the shirt at the neck and arms during activity. When stationary or when bivouacking, a damp field shirt should be exchanged for a dry one in order to prevent rapid cooling.

**Maintenance**

The garment may be boiled

*Figure 20 - Cotton field shirts*

## Woollen pullovers

**Fabric**

80% wool and 20% polyamide

**Properties/use**

The pullover is meant to be worn beneath a field jacket as an insulating garment during light activity or when stationary. It has the properties of wool and insulates well, even in damp conditions. The arms are extra long with holes for the thumbs that function as wrist warmers. There is an option to ventilate at the neck. Careful consideration should be given to the use of a woollen pullover. Personnel will become rapidly overheated during strenuous physical activity. The pullover is very suitable to wear beneath a membrane uniform.

**Maintenance**

Wash at 30 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres.

*Figure 21 - Woollen pullovers*

### 4.1.3 OUTER LAYER

## M/75 cotton field uniform

**Fabric**

50% cotton/50% polyester

**Properties/use**

The material is impregnated against dampness and the distance between the woven threads does not permit precipitation to penetrate, while also allowing body moisture to escape. A newly-impregnated field uniform can tolerate a relatively high degree of moisture. When working in snow, a certain degree of moisture will penetrate the uniform. It is therefore important to keep the uniform free of snow with a clothes brush.

In 2001, the previous version of the field uniform in 100% cotton was replaced by a new version containing a mixture of 50% cotton and 50% polyester. This has made the uniform more durable and a little more water-resistant. The uniform is hard-wearing and should be worn on top of a membrane uniform during activities that place great demands on the uniform, such as SIBO (combat training in built-up areas) and patrol firing.

The field jacket may be tightened at the waist by using the waist cord. The bottom edge of the jacket may be tightened by pulling the elastic cord from the cord channel at the rear, which is fastened to the strap with a stud button in the front or by tying a knot in the cord. The field hood is buttoned to the field jacket. There are ventilation options through adjustment of buttons on the arms, as well as many adjustment options on the front and crotch straps. The back pockets have a large storage capacity. The hood is well suited for use in extreme weather.

The trousers can be adjusted at the waistband on either side and have buttons at the front and rear suitable for braces. In order to achieve the best ventilation, braces should be worn with field trousers.

**Maintenance**

The garment may be boiled. It must be impregnated after being washed.

*Figure 22 - M/75 cotton field uniform*

## M/02 Membrane field uniform

**Fabric**

3-layer membrane laminate

**Properties/use**

The uniform provides protection from dampness and wind but has restricted breathing properties. The uniform is best suited for use in the autumn, winter and spring. The uniform is less durable than a cotton uniform and should not be used in activities in which the garment is subject to great wear and tear, e.g. SIBO and patrol drills. The uniform offers many ventilation options, as well as pockets and a spacious hood. During use in intense activity, the uniform's ventilation options must be fully utilised. Net underwear in combination with a membrane uniform is recommended as an inner garment and wool terry cloth as a middle garment. It is recommended that a woollen pullover is worn as an extra layer of insulation. It is not recommended that cotton garments are used in combination with M/02 as this will inhibit the transport of moisture. During intense activity in a cold climate, ice may form on the inside of the garment. The garment should be removed and shaken/brushed in order to remove the ice. The garment is not flame-retardant.

**Maintenance**

The garment may be washed at 60 degrees and can then be tumble dried at a medium warm setting. The water-resistant fluorocarbon treatment (impregnation in outer material) diminishes during machine washing but is reactivated in the heat. The uniform should therefore be ironed at a medium temperature after it has been washed in order to prevent wet-out. Every uniform is provided with a repair kit.

*Figure 23 - M/02 membrane field uniform*

## M/97 camouflage uniform

**Fabric**

A mixture of polyester and microfibre

**Properties/use**

The uniform is windproof and water-resistant. The polyester is spun as a filament yarn. This makes the surface smooth, so that snow is unable to adhere to the uniform. The uniform is not flame-retardant, but it will not burn either. The fabric will contract under flames when melting and will not drip.

The jacket is large with wide arms and spacious pockets that are equipped with Velcro. In high working temperatures the arms may be opened so that surplus heat from the body can be released. The hood is spacious and provides good protection. The zip may be opened/closed for ventilation, according to requirements. A two-way zip enables the jacket to be opened from both above and below. The zip is a weak point and must be treated with care so that it does not break. The uniform must be in good order and should be roomy.

The trousers are roomy enough to be taken off without having to remove field boots. There are holes in the sides so that the pockets of field trousers may be used even if camouflage trousers are being worn. When using the camouflage uniform in combination with membrane trousers, braces may be threaded through these holes to prevent the trousers from sliding down or the waist requiring an excessive amount of tightening. When being used in combination with cotton field trousers, there are small loops in the waistband that can be buttoned directly to the buttons used for fastening braces. The trousers have pockets in front of the knees in which to add further insulation in the form of pieces of discarded sleeping mats, for example. The trousers may be tied at the bottom in order to prevent snow from entering.

**Maintenance**

The garment may be washed at 60 degrees. Ensure that the garment is kept clean by not using it unnecessarily, such as in a tent, during boot polishing and maintenance.

*Figure 24 - M/97 camouflage uniform*

## Rainwear

**Fabric**

A mixture of polyester and microfibre

**Properties/use**

The uniform is windproof and water-resistant. The polyester is spun as a filament yarn. This makes the surface smooth, so that snow is unable to adhere to the uniform. The uniform is not flame-retardant, but it will not burn either. The fabric will contract under flames when melting and will not drip.

The jacket is large with wide arms and spacious pockets that are equipped with Velcro. In high working temperatures the arms may be opened so that surplus heat from the body can be released. The hood is spacious and provides good protection. The zip may be opened/closed for ventilation, according to requirements. A two-way zip enables the jacket to be opened from both above and below. The zip is a weak point and must be treated with care so that it does not break. The uniform must be in good order and should be roomy.

The trousers are roomy enough to be taken off without having to remove field boots. There are holes in the sides so that the pockets of field trousers may be used even if camouflage trousers are being worn. When using the camouflage uniform in combination with membrane trousers, braces may be threaded through these holes to prevent the trousers from sliding down or the waist requiring an excessive amount of tightening. When being used in combination with cotton field trousers, there are small loops in the waistband that can be buttoned directly to the buttons used for fastening braces. The trousers have pockets in front of the knees in which to add further insulation in the form of pieces of discarded sleeping mats, for example. The trousers may be tied at the bottom in order to prevent snow from entering.

**Maintenance**

The garment may be washed at 60 degrees. Ensure that the garment is kept clean by not using it unnecessarily, such as in a tent, during boot polishing and maintenance.

*Figure 25 - Rainwear*

## 4.1.4 BODY CLOTHING - SUPPLEMENTARY GARMENTS

### Cold weather jackets and trousers

**Fabric**

Several layers of polyester and a patented filling material

**Properties/use**

This supplementary garment contains a lot of air and creates a good layer of insulation. The garment is relatively moisture-resistant and virtually windproof. The garment is light and compressible. A carrying bag is included. The garment is used when stationary or during light activity. Careful consideration should be given to the use of the garment as personnel will become rapidly overheated during strenuous physical activity. The garment may be quickly placed on top of other clothing during short breaks. When being used on top of other clothing, neither carrying equipment nor combat equipment should be used on the outside of the jacket as this will quickly form holes in the garment. During precipitation, the garment should not be worn outside of other clothing. If used beneath a field uniform/white camouflage uniform, the uniform should be large enough to not ‘squeeze together’ the air in cold weather jackets/trousers. Examples of use as an outer layer: short breaks, OP service, bivouac, snow hole. Examples of use beneath a uniform: sentry duty, ATV, vehicle turret hatch, being towed on skis, precipitation.

**Maintenance**

The garment may be washed at 50 degrees. The garment must be aired after use to preserve the fibres. In order to preserve the fibres, the garment must not be stored in a compression bag.

*Figure 26 - Cold weather jackets and trousers*

## ‘Anna’ cold weather middle trousers

**Fabric**

Padded material in polyester/polyamide

**Properties/use**

This is an insulating garment for use when stationary. Suitable for use inside field trousers, but outside long underwear. The garment may also be used outside of field trousers and beneath winter camouflage trousers so that they can easily be removed during physical activity. Careful consideration should be given to the use of the garment as personnel will become rapidly overheated during strenuous physical activity.

The trousers may be completely opened on both sides so that they can be put on/taken off without having to remove boots. The white waistband should be at the front.

**Maintenance**

The garment may be boiled.

*Figure 27 - ‘Anna’ cold weather middle trousers*

# 4.2 HEADGEAR, HANDGEAR AND FOOTGEAR

## 4.2.1 HEADGEAR

### Balaclava

**Fabric**

Wool

**Properties/use**

The balaclava has the insulating properties of wool. It has been designed to prevent heat loss from the head and neck. The garment has many areas of application. It is well suited to wearing beneath a helmet, both a battle helmet and an ATV crash helmet. If folded layer upon layer, it makes a thick woollen cap that insulates well. If folded downwards, it may be used as a neck tube. It may also be used beneath a membrane hat as an insulating supplementary layer. A balaclava is very suitable for use in a sleeping bag in cold conditions. It is not windproof or water-resistant.

**Maintenance**

Wash at 40 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres.

*Figure 28 - Balaclava*

## Stretched woollen cap (hunting cap)

**Fabric**

100% wool. Knitted elastic.

**Properties/use**

The cap has the insulating properties of wool. The cap has been primarily developed as a hunting cap and for use beneath a helmet but is also suitable for use in a bivouac and in a sleeping bag in cold conditions. The cap is neither windproof nor water-resistant.

**Maintenance**

The cap may be washed at 30 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres.

*Figure 29 - Stretched woollen cap (hunting cap)*

## M/51 Field cap

**Fabric**

Impregnated cotton

**Properties/use**

The field cap has the same properties as cotton and insulates well when dry. It is also reasonably windproof and water-resistant. The cap is very suitable for use in cold weather when physical activity is intense. A suitable size should be chosen that permits use of the fold down ear flaps. The brim in combination with the hood provides good protection from extreme weather. During longer breaks following activity, personnel should change to warmer headgear as the moisture in the garment will quickly lead to the head cooling down.

**Maintenance**

The garment may be boiled.

*Figure 30 - M/51 Field cap*

## Mountain cap

**Fabric**

Impregnated cotton. Fibre pile lining in the cheek flaps.

**Properties/use**

The cap has the same properties as cotton and insulates well when dry. It is also reasonably windproof and water-resistant. A supplementary garment suitable for use when personnel are stationary. Utilise the fold down forehead protector and cheek flaps when required. In extreme temperatures, the cap may also be used beneath a helmet.

**Maintenance**

The cap may be boiled.

*Figure 31 - Mountain cap*

## Membrane cap

**Fabric**

3-layer membrane laminate with fibre pile on the inside

**Properties/use**

Windproof and partially waterproof headgear with good insulating properties. The membrane in the cap has limited ventilation properties. The cap is therefore poorly suited to intense physical activity. It functions as a cross between a field cap and a mountain cap. The cap offers excellent options for adjustment and covers the cheeks well. The cap is also suitable for use beneath a helmet in extremely cold conditions.

**Maintenance**

The cap may be washed at 60 degrees.

*Figure 32 - Membrane cap*

## Neoprene face mask

**Fabric**

Neopren

**Properties/use**

The mask covers the face and neck well. When used in conjunction with snow goggles (snowmobile goggles) the mask provides complete protection to the whole face. Developed for use in extremely cold conditions and strong wind, or to counter the effects of wind upon ATV personnel, personnel being towed on skis or standing in the driver's hatch of a tank, etc. When using a face mask, personnel should air the mask at regular intervals, as well as checking each other's faces for signs of frostbite.

**Maintenance**

Face masks may be washed at 30 degrees.


*Figure 33 - Neoprene face mask*

## Protective goggles (snowmobile goggles)

**Properties/use**

The goggles should protect the eyes from extreme weather. The goggles also protect against UV radiation and are supplied in three colours – neutral, yellow and dark. The yellow glass is suitable for accentuating the contours of snow during overcast weather. When used in conjunction with a face mask, the goggles provide complete protection to the whole face.

**Maintenance**

The goggles should be wiped with a lukewarm cloth. They should be stored in a storage bag when not being used in order to prevent the glass from being scratched or worn.

*Figure 34 - Protective goggles (snowmobile goggles)*

## 4.2.2 HANDWEAR

### M/93 wind mittens

**Fabric**

50% cotton/50% polyester. Impregnated.

**Properties/use**

Wind mittens are the hand's outer layer and should protect against wind and dampness. The mittens are durable, windproof and water-resistant. The mittens cover the forearms well and may be tightened around the wrists. If the trigger finger is not being used it should be withdrawn into the mitten so that it does cause an obstruction. In order to avoid losing the mittens in poor weather/strong wind, a cord may be threaded through the arms of a field jacket, which is then attached to the loops inside the mittens. In order to keep the mittens dry and warm, as well as to avoid losing them, they should be placed on the chest when not in use.

**Maintenance**

The mittens must be impregnated after being washed.



*Figure 35A - M/93 wind mittens*

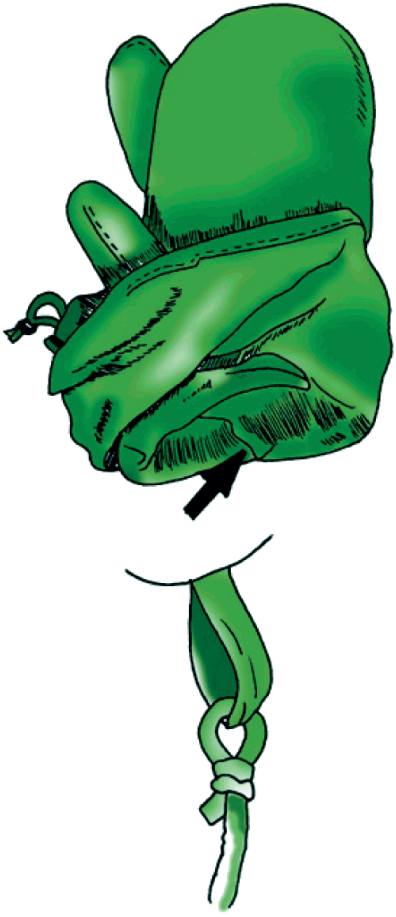


*Figure 35B - M/93 wind mittens detail*

## M/93 woollen mittens

**Fabric**

97% unbleached wool that easily felts. 3% elastic. Thick yarn knit.

**Properties/use**

Woollen mittens should provide good insulation for the hands and wrists. The wool should felt during use, making the mittens more durable and warm. Right hand and left hand mittens are identical and are therefore interchangeable. Woollen mittens should be used in conjunction with wind mittens to avoid wear and tear and to prevent them from becoming soiled. It is recommended that the trigger finger should not used if a weapon is not being operated. Less heat loss will occur if the fingers are close together.

**Maintenance**

Woollen mittens may be washed at 30 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres.

*Figure 36 - M/93 woollen mittens*

## M/93 finger gloves

**Fabric**

97% wool that easily felts. 3% elastic. Thick yarn knit.

**Properties/use**

Finger gloves provide good insulation for the hands and wrists. The wool should felt during use, making the finger gloves more durable and warm. The finger gloves may be used in every combination, with woollen mittens/wind mittens or on their own. The holes in the palm of the hand allow the fingertips to warm quickly. The holes also release the thumbs. Personnel should note that frostbite can easily occur on exposed fingers. It can be difficult to register cold in the fingers if personnel are not conscious of such cold.

**Maintenance**

Finger gloves may be washed at 30 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres.

*Figure 37 - M/93 finger gloves*

## Combat gloves

**Fabric**

Black Nubuk calfskin. Protex® (woven polyamide). Trevira CS® (flame-retardant).

**Properties/use**

Combat gloves will protect hands from pointed, sharp and rough objects that may cause cuts, scratches and wounds. The gloves are primarily designed to provide protection during the warm season. The gloves do not provide insulation during wintertime and should be used as a supplement to other handwear when undertaking tasks that require fine motor skills, particularly when coming into direct contact with metal.

**Maintenance**

Combat gloves should be cleaned with lukewarm, soapy water, if required. They may be washed at 30 degrees.



*Figure 38 - Combat gloves*

## Snowmobile mittens

**Fabric**

Calfskin and polyamide

**Properties/use**

Snowmobile mittens are the hand's outer layer and should protect against wind and dampness. The mittens are more durable, windproof and water-resistant than wind mittens. The mittens cover the forearms well and may be tightened around the wrists. The mittens are spacious with plenty of room for thick inner mittens. In order to keep the mittens dry and warm, as well as to avoid losing them, they should be placed on the chest when not in use.

**Maintenance**

The mittens should be cleaned with lukewarm, soapy water, if required. They may be washed at 30 degrees.

*Figure 39 - Snowmobile mittens*

### 4.2.3 FOOTGEAR - SOCKS

## Socks, black (thin socks)

**Fabric**

80% wool and 20% polyamide

**Properties/use**

The socks should insulate against the cold and transport moisture. They should be worn as an inner layer with grey socks on the outside.

**Maintenance**

The socks may be washed at 60 degrees. A suitable wool detergent should be used.

*Figure 40 - Socks, black (thin socks)*

## Socks, grey (thick socks)

**Fabric**

80% wool, 18% polyamide and 2% elastic

**Properties/use**

The socks should insulate against the cold. They should be worn as a middle layer with black socks on the inside.

**Maintenance**

The socks may be washed at 60 degrees. A suitable wool detergent should be used.

*Figure 41 - Socks, grey (thick socks)*

### 4.2.4 FOOTGEAR - BOOTS

## M/77 Field boots

**Fabric**

Outer material in fully tanned leather. Leather welt with steel shank.

**Properties/use**

The M/77 is a thin, unlined leather boot. The boot is reasonably waterproof when it has been treated with boot grease or impregnated. The boot may be worn in conjunction with ordinary NATO ski bindings and snowshoes. In the cold season, personnel should always select boots that are one size larger in order to provide sufficient room for soles and socks, as well as an insulating air layer within the boot itself. The boots should always be used with foot muffs during field conditions in the winter.

**Maintenance**

The boots should be dried at room temperature. They should be brushed free of dirt and polished with boot polish or impregnated.



*Figure 42 - M/77 Field boots*

## Alfa Jegerstøvel Gore-Tex® field boots

**Fabric**

Fully tanned leather. Lining with Gore-Tex® membrane. Vibram sole with built-in steel shank.

**Properties/use**

A thick boot offering excellent support and breathing properties, as well as being waterproof when new. The last is generous with plenty of room. In the cold season, personnel should always select boots that are one size larger in order to provide sufficient room for soles and socks, as well as an insulating air layer within the boot itself. The boots have certain weaknesses such as a tendency to bloat/lose their shape, as well as becoming loose in the seams after prolonged use. When this occurs they should be changed. During cold weather, a lot of moisture will accumulate in the lining without being released through the membrane. This moisture will freeze to ice. For this reason and also because the boots take a long time to dry under field conditions, these boots are not recommended for prolonged field exercises during the winter. Maintenance: The boots should be dried at room temperature. They should be brushed free of dirt and polished with boot polish or impregnated.

**Maintenance**

The boots should be dried at room temperature. They should be brushed free of dirt and polished with boot polish or impregnated.

*Figure 43 - Alfa Jegerstøvel Gore-Tex® field boots*

## Lundhags Husky ski boots

**Fabric**

Fully tanned leather. Lining with Gore-Tex® membrane. Vibram sole with built-in steel shank.

**Properties/use**

A thick boot offering excellent support and breathing properties, as well as being waterproof when new. The last is generous with plenty of room. In the cold season, personnel should always select boots that are one size larger in order to provide sufficient room for soles and socks, as well as an insulating air layer within the boot itself. The boots have certain weaknesses such as a tendency to bloat/lose their shape, as well as becoming loose in the seams after prolonged use. When this occurs they should be changed. During cold weather, a lot of moisture will accumulate in the lining without being released through the membrane. This moisture will freeze to ice. For this reason and also because the boots take a long time to dry under field conditions, these boots are not recommended for prolonged field exercises during the winter. Maintenance: The boots should be dried at room temperature. They should be brushed free of dirt and polished with boot polish or impregnated.

**Maintenance**

The boots should be dried at room temperature. They should be brushed free of dirt and polished with boot polish or impregnated.



*Figure 44 - Lundhags Husky ski boots 71mm tip*

*Figure 45 - Lundhags Husky ski boots 90mm tip*

*Figure 46 - Inner boot of felted wool for Lundhags Husky ski boots*

## Insoles

**Fabric**

Stiff material that does not crumple when damp. The outside is covered in fibre pile.

**Properties/use**

The insoles create an extra layer of insulation in the boots that protects against heat loss to the ground. Insulating insoles should always be used in cold weather. The fibre pile should be facing upwards.

**Maintenance**

The insoles should be changed when the fibre pile has become flattened.

*Figure 47 - Insoles*

## 4.2.5 FOOTGEAR - SUPPLEMENTARY GARMENTS

### Foot muffs

**Fabric**

The leg is 50% cotton/50% polyester. The foot section is made of fibre pile-covered polyvinyl chloride (PVC). The sole is made of polyurethane (PU) with tread pattern.

**Properties/use**

The foot muff is a supplementary garment to wear outside field boots during cold weather. The foot muff insulates well and has a waterproof bottom. Any dirt/snow should be removed from field boots before putting on the foot muffs. When felted wool socks are being used in foot muffs, soles should be made from pieces of discarded sleeping mats and placed inside the foot muffs. Personnel should take care when removing foot muffs. It is easy to make holes in the foot muffs when they are lifted over the heel. During long marches, the foot muffs should be frequently opened at the top for ventilation. This inhibits the formation of condensation and moisture. Foot muffs must be removed when personnel are assembled indoors (tents, houses, vehicles) as this inhibits heat supply to the feet.

**Maintenance**

Foot muffs may be washed at 40 degrees. They are best cleaned by rinsing/brushing with soapy water. They should be dried at a maximum temperature of 35 degrees.

*Figure 48 - Foot muffs*

## Berghaus Yeti Wilderness Leggings

**Fabric**

The leg is 50% cotton/50% polyester. The foot section is made of fibre pile-covered polyvinyl chloride (PVC). The sole is made of polyurethane (PU) with tread pattern.

**Properties/use**

The foot muff is a supplementary garment to wear outside field boots during cold weather. The foot muff insulates well and has a waterproof bottom. Any dirt/snow should be removed from field boots before putting on the foot muffs. When felted wool socks are being used in foot muffs, soles should be made from pieces of discarded sleeping mats and placed inside the foot muffs. Personnel should take care when removing foot muffs. It is easy to make holes in the foot muffs when they are lifted over the heel. During long marches, the foot muffs should be frequently opened at the top for ventilation. This inhibits the formation of condensation and moisture. Foot muffs must be removed when personnel are assembled indoors (tents, houses, vehicles) as this inhibits heat supply to the feet.

**Maintenance**

Foot muffs may be washed at 40 degrees. They are best cleaned by rinsing/brushing with soapy water. They should be dried at a maximum temperature of 35 degrees.



*Figure 49 - Berghaus Yeti Wilderness Leggings*

## Felted wool socks

**Fabric**

100% felted wool

**Properties/use**

Felted wool socks are very thick with extremely good insulating properties. They may be used inside foot muffs instead of field boots as a bivouac shoe, or when using an ATV. When felted wool socks are used in foot muffs, the foot muffs must be re-enforced with a thicker sole that does not absorb moisture. The soles may be made from pieces of discarded sleeping mats. Without such soles, foot muffs with felted wool socks will not provide sufficient ground insulation.

**Maintenance**

Felted wool socks may be washed at 30 degrees. A suitable wool detergent should be used. Ordinary detergents destroy wool fibres.

*Figure 50 - Felted wool socks*