



Ministry
of Defence

A Commander's Guide to Climatic Injury

Extracted from JSP 539: Climatic Illness and Injury in the Armed Forces v2.1

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If more heat is gained than lost, core temperature rises too much, which may lead to heat illness

Members of the Armed Forces are more at risk from heat illness resulting from:

- High intensity physical training
- Exposure to hot climates
- Having to wear protective clothing (e.g. Body armour, CBRN, fire retardant or impermeable clothing)

**HEAT STORAGE =
HEAT GAINED - HEAT LOST**

Risk Factors

Key to the prevention of heat illness is an awareness of the risk factors and a thorough risk assessment by commanders. This risk assessment should consider the following:

- **Individual factors.** Personnel are at greater risk of heat illness if they are:
 - Tired
 - Hungry
 - Thirsty (dehydrated)
 - Unfit
 - Overweight
 - A smoker
 - Hung-over
- **Clothing, equipment and additional load.**
- **Acclimatisation.** Continuous exposure to heat and exercise in hot conditions will result in physiological adaptations to improve heat loss, particularly increased sweat rate and earlier onset of sweating.



Heat Illness

Most heat illness is preventable. Greater awareness by commanders at all levels, clearer recognition of heat illness symptoms and better planning of higher risk activities can significantly reduce the risk of heat illnesses. Giving the right first aid and getting a quick evacuation to medical care can be the difference between life and death.

Heat illness happens in the UK as well as in warm climates. The weather doesn't have to be hot if personnel are: exercising hard, carrying heavy loads or wearing protective clothing.

Heat illness can lead to individuals being downgraded and medically discharged.

Commanders have a duty to ensure risk is as low as reasonably practicable (ALARP)

Definition

Heat illness is a condition in those individuals who become unwell as a result of a rise in core body temperature.

How does it happen?

Heat illness occurs due to a rise in core temperature that is not matched by heat loss.

Body temperature rises when running, or marching carrying heavy loads or wearing protective clothing. Bodies also get hot from high air temperature, direct sunshine or heat reflecting off buildings and other surfaces.

Heat is lost mainly through sweating. Usually, this helps the body to cool down and continue to function efficiently. In humid conditions, sweating is ineffective in dissipating heat and if too many clothes (or the wrong sort of clothes) are worn the body may retain more heat than it should.



• Casualty evacuation chain and availability of first aid responders

Commanders at all levels must be familiar with the Armed Forces Policy on Climatic Illness and Injury (JSP 539)

Recognition and response

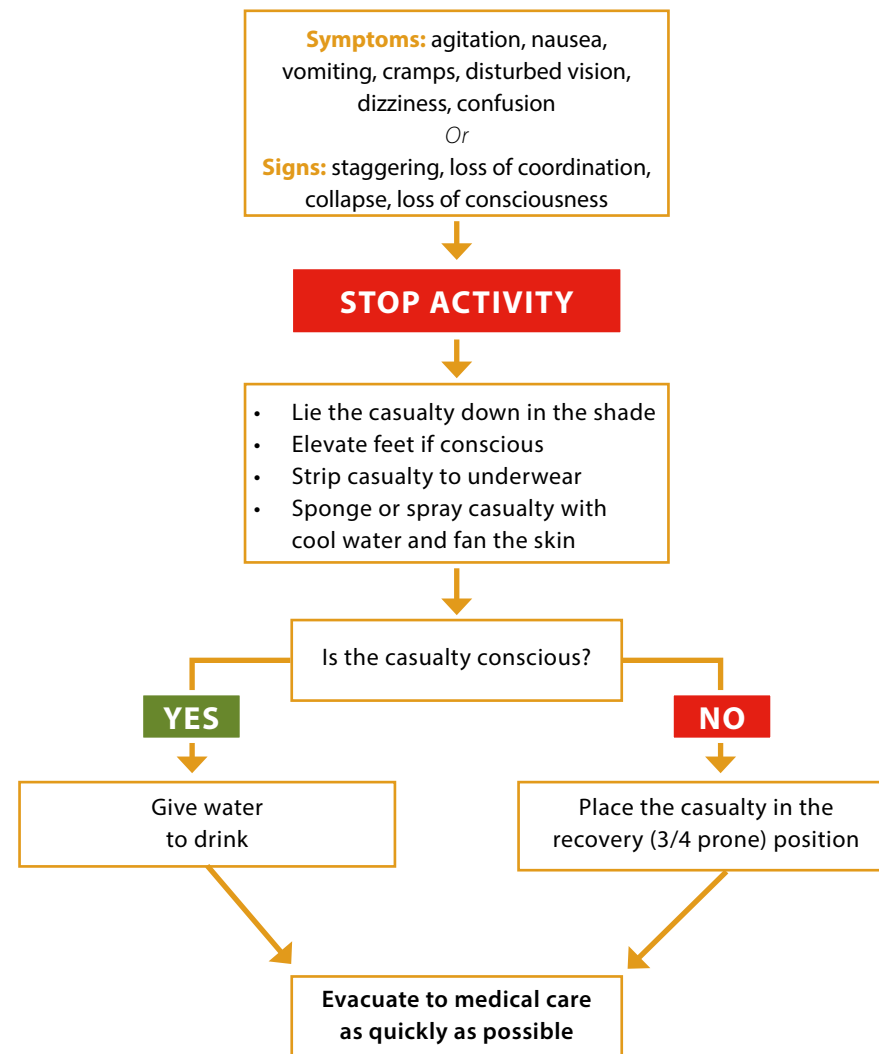
When in a hot environment; or whilst wearing protective clothing (or any combination of these) an individual should be presumed to have heat illness if they experience or show any of the following:

- Agitation
- Nausea or vomiting
- Staggering or loss of coordination
- Cramps
- Disturbed vision
- Confusion
- Collapse or loss of consciousness
- Dizziness

Particular responsibilities for Commanders are:

- Conduct a risk assessment and continually review this
- Allow for acclimatisation, even in the UK
- Monitor WBGT Index
- Keep individuals in the shade where possible
- Observe work/rest cycles
- Identify high risk groups/individuals
- Monitor, encourage and supervise: food and fluid intake
- Teach early recognition of heat illness symptoms
- Encourage individuals to speak up if feeling unwell
- Recognise the cumulative effect of dehydration and exercising on sequential hot days
- Have a contingency plan for emergencies, including cooling and evacuation
- Consider re-timing or cancelling events if conditions warrant it.

Immediate Treatment Action:



WBGT index threshold values.

The threshold values indicate the maximum permitted continuous work intensity for Service personnel at a given environmental temperature (WBGT).

They are valid for one hour exposures with a minimum of 30 minutes rest after the activity. They apply to personnel wearing a single layer uniform with sleeves rolled up and without helmets.

For personnel who cannot pass their mandatory fitness tests the WBGT threshold values should be lowered. There is little difference in heat

tolerance between men and women of equal physical fitness. Adherence to the guidance will minimise the risk of heat illness to 95% of normal, healthy personnel. Despite preventive measures, heat illness can still occur, and all personnel should remain vigilant to this risk.

Acclimatisation.

The table below is divided into un-acclimatised and acclimatised groups. An individual is considered to be partially acclimatised (by approximately 75%) if they have undertaken regular exercise for longer than 8 days in the same

WBGT Index Threshold (Max) Values (JSP 539: Table 2A.1)	Maximum Work Rate (not to be exceeded)	WBGT Index Threshold Values	
		Acclimatised	Unacclimatised
1	Low. For example, lying, guard duty.	34	32
2	Medium. For example, marching 3.6 kph (2.3 mph) with a 30 kg load.	30	26
3	High. For example, marching 5.6 kph (3.5 mph) with a 20 kg load, patrolling, digging, field assaults.	27	24
4	Very High. For example, marching 8kph (5 mph) with no load, marching 5.6 kph (3.5 mph) with a 30 kg load. This equates to the Army Basic Combat Fitness Test.	25	20
5	Extreme. For example, running in sports kit; speed marching at 9.7 kph (6mph) with a 15kg load	20	Max 30 mins at 20



environmental conditions as the proposed activity. Full acclimatisation will require 15 days or longer. All UK based activities are classed as unacclimatised.

The time taken to partially and fully acclimatise is extended if arrival in the hot climate has included a substantial period of travel or crossing multiple

time-zones. Living or working in air-conditioned accommodation also slows the development of acclimatisation. Individuals returning to a hot climate from cooler environments (other areas of operation within same theatre, courses or leave including R&R) will have lost acclimatisation.

Commanders Heat Illness Risk Assessment Checklist

Key Reference - (JSP 539 - Annex 2A Appx 1)

Ser	Risk Factor	Question	Results	Remarks
1	Activity (Work rate) <i>Ensure all personnel are rested and recovered. see Table page 8,</i>	What is the intensity of activity?	Low <input type="checkbox"/> Medium <input type="checkbox"/> High <input type="checkbox"/> Very High <input type="checkbox"/> Extreme <input type="checkbox"/>	The work intensity should take account of the available time, loads carried and previous activity. The higher the work rate the greater the risk.
2	Duration of activity	What is the planned duration of the activity?	<30 mins <input type="checkbox"/> <1 hr <input type="checkbox"/> <2 hrs <input type="checkbox"/> >4 hrs <input type="checkbox"/>	Environmental conditions (including consideration of time of day) may change over the duration of the activity. Extension of the planned activity requires a review. Longer duration activities have increased risk.
3	Environmental conditions <i>Establish WBGT threshold value for the personnel undertaking the task. see Table page 8,</i>	Does the WBGT threshold value exceed the advised value?	Yes <input type="checkbox"/> No <input type="checkbox"/>	The WBGT index takes account of site specific climatic conditions. Consideration must be given to differences between the WBGT reading site and the topography and geography where the activity is planned.
4	Dress for activity	Is PPE or equipment that may significantly reduce heat loss being worn or used?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Can the dress state be modified to prevent heat gain and improve heat loss? Where this is not possible then the WBGT threshold value should be reduced by 5°C
5	Individual Risk Factors	Are any of the participants in the activity subject to the individual risk factors detailed in JSP 539 Para 209?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Consider these risk factors on an individual basis and across the group as a whole.
6	Preparatory education	Are participants sufficiently briefed on heat illness?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Knowledge of risk factors, signs an symptoms will encourage early identification.
7	Water intake	Has sufficient drinking water been planned for?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Dehydration can occur rapidly and will increase the risk of heat illness.
8	Acclimatisation	Are the participants acclimatised?	Yes <input type="checkbox"/> No <input type="checkbox"/> Mixed <input type="checkbox"/>	Un-acclimatised participants are at greater risk.
9	Casualty response	Is there adequate medical support and a robust evacuation plan for the activity?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Time is critical in the response to heat illness.





Cold Injuries

Cold environments represent a serious hazard to the unprepared.

Each year significant numbers of Service personnel are medically discharged as a result of cold injury. Hypothermia can and does kill.

Military personnel are at increased risk from cold-related injuries due to unavoidable need to expose them to adverse environmental conditions on operations and exercises both in the UK and abroad.

Commanders have a duty to ensure risk of cold exposure is as low as reasonably practicable (ALARP)

Classification.

Cold injuries occur as a result of the exposure of cold/wet and cold/dry conditions on the body and are classified as follows:

Hypothermia occurs due to low core body temperature. This may be mild, moderate or severe and can be due to:

- **Immersion.** Caused by severe cold stress; often rapid. *e.g. a sailor washed overboard.*
- **Exhaustion.** Caused by a combination of wind and wet conditions with moderately low temperature. *e.g. usually found in mountaineers or hill walkers.*
- **Urban.** Where the cold is relatively mild but prolonged. *e.g. most common in the elderly and malnourished.*

Non-Freezing Cold Injury (NFCI) is the most common cold injury in land operations and exercise. It is a serious

injury and is neither an illness nor a weakness. It can lead to serious disability for the sufferer and could lead to a medical discharge.

It can also affect the immediate operational effectiveness of your unit and yet it is entirely preventable. The main cause is allowing feet or hands to remain wet and cold for long periods.

NFCI causes numbness which does not go away; persistent numbness on rewarming following exposure to the cold is NOT normal and must be addressed. Other symptoms are pain and pins and needles.

Freezing Cold Injury (FCI) is a significant cause of disability. Parts of the body most prone to freezing are the extremities and exposed areas - face, fingers, toes, heels and soles of the feet.

There are two types of FCI:

- **Frost nip.** Where people recover fully within 30 mins of re-warming of the injured part.
- **Frost bite.** Which goes deeper and causes longer lasting damage.

How does it happen?

Control of human body temperature is dependent on the balance of heat production and the rate of heat loss. The rate of heat loss through convection and conduction depends on the temperature difference between skin and the environment.

Air movement over the body known as 'wind chill' increases both types of heat loss.

HEAT STORAGE = HEAT GAINED - HEAT LOST

Risk Factors.

The key to the prevention of cold injuries is the commander's awareness of the risk that their personnel are being exposed to.

- **Individual factors.** Personnel are at greater risk of cold injury if they are:
 - Of an African-Caribbean ethnicity
 - Unwell or Unfit
 - Inactive or static
 - Dehydrated - cold weather increases respiratory and urine fluid loss
 - Poorly fed - i.e. in a negative energy balance e.g. resting adult male energy requirements increase from 2500 kcl (at room temp) to 5000 kcal at -20°C
 - Have a past history of cold-related problems
 - Current smoker

- **Environmental conditions.**

Particular care is needed during outdoor training when the still air temperature (SAT) is less than 5°C. **Great care required below -5°C.**



- **Wind chill index.** Skin temperature can be affected by even moderate wind speeds and the index shown

helps calculate the equivalent still air temperature in terms of its effect on the rate of cooling:

Wind Chill Chart (JSP 539 - Fig 3A-1)

		Equivalent chill temperature (°C)									
SAT (°C)		4	-1	-7	-12	-18	-23	-29	-34	-40	-46
Measured wind speed (mph)											
0		4	-1	-7	-12	-18	-23	-29	-34	-40	-46
5		2	-4	-12	-15	-21	-26	-32	-37	-43	-48
10		-1	-9	-15	-23	-29	-37	-34	-51	-57	-62
15		-4	-12	-21	-29	-34	-43	-51	-57	-65	-73
20		-7	-15	-23	-32	-37	-46	-54	-62	-71	-79
25		-9	-18	-26	-34	-43	-51	-59	-68	-76	-84
30		-12	-18	-29	-34	-46	-54	-62	-71	-79	-87
35		-12	-21	-29	-37	-46	-54	-62	-73	-82	-90
40		-12	-21	-29	-37	-48	-57	-65	-73	-82	-90
		Danger - risk of cold injury		Increasing danger, flesh may freeze within one minute.			Greater danger, flesh may freeze within 30 seconds				



- **Work intensity.** Inactivity in open areas exposed to the wind may make an individual vulnerable. Additionally, the sweating produced after periods of exertion and the diversion of blood to the muscles and skin, away from the body core, may lead to excessive cooling thus predisposing further to cold related problems.
- **Footwear.**
 - Boots should not be laced tightly in cold conditions.
 - Socks should be changed when wet.
 - Dirty old or compressed socks don't work well.
 - Feet should be inspected regularly.
- **Hand protection.** Hand protection should be available when SAT falls below +5°C, and mandatory below -5°C. Spare gloves should be carried as wet hand wear may result in injury.
- **Sleeping systems.** Sleeping bags (suitably rated for the temperature range to be encountered) must be kept dry and insulated matting used as insulation.

Particular responsibilities for Commanders are:

- Prevention of immersion hypothermia depends on wearing adequate waterproof clothing which stops the ingress of water.
- Prevention of exhaustion hypothermia requires the correct use of clothing and equipment.
- **Headwear.** Specialist headwear must be worn when SAT is below -10°C. Helmets and berets offer no protection against frostbite and do not significantly reduce heat loss from the head.
- **Layered Clothing.** The layering principle should be adopted in cold conditions. Layers of clothing should be removed immediately prior to, and during, physical exercise in order to allow adequate ventilation, limit sweating and the danger of wet clothing.
- Conduct a risk assessment and continually review this
- Ensure all personnel are adequately briefed and prepared
- Ensure adequate shelter
- Ensure adequate food and water intake, warm where possible
- Ensure standing orders and instructions regarding training restrictions are well understood by all
- Ensure the activity has an appropriate level of medical cover, and that a clear and efficient means of evacuation is agreed in the event of an emergency
- Consider retiming, amending or cancelling if conditions warrant it

Recognition and response

Hypothermia.

Hypothermia occurs when the core body temperature drops below 35°C, a fall below 32°C is a life threatening emergency. (Normal core body temperature is 37°C). It is a high risk in **cold and wet** conditions.

- **Initial signs:**

Feeling very cold
Stiffness, tiredness
Violent shivering
Increased heart rate
Irrational behaviour

- **Later signs: (core temp <32°C)**

Probably not shivering
Stiff limbs - rigid joints
Confusion or loss of consciousness

Immediate actions.

The most important immediate action is to get the person under cover, stop them getting any colder and replace wet clothing with dry. Once under cover:

- Start to re-warm SLOWLY
- Add layers
- Give warming food and drink (but NOT alcohol)
- Place the casualty in a sleeping bag and treat as a stretcher case
- Urgently evacuate (concurrent discussions with medical staff)

Non-Freezing Cold Injury (NFCI).

If an individual has numbness, pain and or pins and needles in hands or feet, ensure they report it at the earliest opportunity. NFCI can occur in temperatures that are not particularly cold if there are other risk factors such as: damp / wet conditions or immobility are present.

Immediate actions.

If individuals get hands or feet wet. Make sure they:

- Dry them as soon as they can
- Change into any dry socks and / or gloves
- Use foot powder
- Wiggle their toes and fingers to keep them warm

Commanders should conduct foot inspections at regular intervals during exercises.

If they have to stand still for long periods:

- Order 10 mins of step ups or marching on the spot to keep the circulation going

If exercise is not possible (with help if required):

- Remove wet boots and socks and / or gloves
- Gently re-warm their feet/hands
- Try to get their feet into a dry sleeping bag - they should then massage them gently
- Change into dry kit as soon as possible
- Check for symptoms in others



For FCI and NFCI: DO NOT use any artificial heat, hot water or stoves. This will make the injury worse.



Freezing cold injury (FCI).

• Early signs (frost nip):

The affected part feels cold and is painful to touch

A tingling sensation followed by numbness

No feeling when the affected part is moved

Skin looks mottled – white and pink

• Later signs (frost bite):

No feeling in the affected part

Skin white and waxy-looking

A clear line between white and pink skin

After re-warming, skin may appear bruised and blistered

Immediate actions.

- Get into shelter
- Remain sheltered until evacuation can be arranged
- Protect the affected part
- Do NOT re-warm if there is any danger of re-freezing
- Do NOT apply direct heat (heater), or rub the frozen part in an attempt to thaw
- Do NOT allow the casualty to smoke or take alcohol
- Do NOT use skin ointments (e.g. Deep Heat)
- Do NOT allow the casualty to use the limb when re-warmed

Once frostbite is suspected /evident, you must treat the casualty as a case for evacuation. If the casualty is going to be re-exposed to the cold, you must not re-warm until they are in the hands of medically trained personnel.



Commanders' Cold Injury Risk Assessment Checklist

Key Reference - (JSP 539 - Annex 3B)

Ser	Risk Factor	Question	Results	Remarks
1	Activity	Is shelter available for static periods?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Risk of CI is increased when static, particularly if this follows a period of arduous activity. Immersion/ wet clothing greatly increases risk of CI.
		Can long static periods be avoided?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Can immersion be avoided?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Exhaustion increases CI risk.
		Are there plans to allow changing into dry clothes after immersion?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
2	Duration of activity	Can rest periods be incorporated (in shelter)?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
3	Environmental conditions - see Page 14	Has accurate weather forecast been obtained?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Risk of CI increases when SAT is below minus 5°C. Windy / wet conditions greatly increase risk.
		Has wind chill factor been taken into account?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Can training be carried out in warmer / more sheltered conditions?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Trainers and DS provide a vital means of preventing CI / early detection of CI.
		Are DS and training staff adequately trained and competent?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
4	Supervision	Is the medical support plan adequate?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
5	Preparation / Education	Have all troops received a presentation on CI or watched the training video?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Knowledge of risk factors, signs and symptoms should enable avoidance of CI and aid early identification.
		Have Commander's and individual guides been issued?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
6	Water Intake	Is there adequate safe water available throughout the intended activity?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Dehydration can occur rapidly in cold conditions.
7	Food intake	Have increased calorific needs been considered?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Energy requirements increase in cold conditions.
8	Alcohol	Has alcohol been avoided for 48 hours prior to activity?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Alcohol increases susceptibility to CI.
9	Dress & Equipment	Is correct clothing/sleeping system issued?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Correct clothing and equipment will reduce CI risk.
		Do all troops have spare dry clothes?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
10	Predisposing Factors	Can the activity be postponed until personnel have rested?	Yes <input type="checkbox"/> No <input type="checkbox"/>	Lack of sleep; food; fluids; poor fitness; and illness all predispose to CI. Those with previous CI are at greater risk.
		Have personnel been provided with food and water prior to undertaking the activity?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Have unfit/ill people been excluded from the activity?	Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Have previous Cold Injuries been declared to, and investigated by, medical staff?	Yes <input type="checkbox"/> No <input type="checkbox"/>	



Commander's Notes





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