Marine Survival Handbook For Cold Regions

Canada

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INTRODUCTION

Ship evacuation in cold regions may expose you to a hostile envrionment. Survival may depend on the available equipment and your knowledge of survival techniques.

This handbook contains a condensed version of the information in the Cold Weather Marine Survival Guide. The intent is to provide basic and practical advice on cold weather survival in a marine environment. Please refer to the Guide for more details and for a list of recommended reading.

DISCLAIMER

The information contained in this Handbook is provided in good faith as advice to mariners. The contents reflect the views of the authors and not necessarily the official views or policies of the Canadian Coast Guard who accept no liability for any consequences that may result from accepting the advice offered. Nothing that is written here will have precedence over the Canada Shipping Act and the Arctic Waters Pollution Prevention Act, nor should the following material be quoted as representing them.

Advance Preparations

When the order comes to evacuate the ship there will be very little time to think about what items of personal clothing or equipement you should take with you. Think about this well ahead of time. Make sure your personal Arctic survival kit (PASK) is stowed in your cabin and well maintained. Do not use any of these items for everyday duties.

Equipment	S-PASK	U-PASK
SHIP OPERATING SEASON	**SUMMER**	**UNLIMITED**
Clothing		
Toque	1	1
Scarf	1	1
Arctic Mitts	-	1 Pair
Gloves	1 Pair	1 Pair
Heavy Socks	1 Pair	1 Pair
Mukluks	-	1 Pair
Cold Weather Pants	1	-
Cold Weather Parka	1	-
Extreme Cold Weather Pants	-	1
Extreme Cold Weather Parka	-	1
Thermal Underwear	-	1 Set
Miscellaneous		
Handwarmers	-	240 hours
Sunglasses	-	1 Pair
Survival Candle	1	1
Matches	2 boxes	2 boxes
Whistle	-	1
Drinking Mug	-	1
Pen Knife	1	1
Handbook (Arctic Survival)	1	1
Carrying Bag	1	1

Personal Arctic Survival Kits (PASKs) for Summer and Unlimited Operating Seasons.

Ship Evacuation

MAYDAY

Canadian Coast Guard radio stations keep a watch on the international distress and calling frequencies of 500 and 2182 kHz (MF), and port radio stations maintain a watch on the safety and calling frequency of 156.8 Mhz (VHF). In an emergency, international procedures and designated frequencies must be used. Should this be impossible, any other frequency may be used.

PREPARATIONS FOR EVACUATION

When notified that the ship is to be evacuated, proceed to your cabin, put on warm clothing and collect your immersion suit, if it is there, and any other personal effects which may assist survival. These may include your Personal Arctic Survival Kit, if you have one, or such items as extra warm clothing, flashlights, handwarmers, and chocolate bars.

TAKE ANYTHING THAT
MAY ENHANCE YOUR CHANCE
OF SURVIVAL

PORTABLE RADIO EQUIPMENT

An Emergency Position Indicating Radio Beacon (EPIRB) is located on top of the wheelhouse and will float free if the ship sinks. Two portable EPIRBs are also located in or near the life boats and must be carried off the ship. these EPIRBs will emit radio signals which will be relayed to the search and rescue system. The ship may also have a portable life boat radio, usually located in the wheelhouse, which should be placed in a life boat or lowered to the ice surface. All walkie-talkies should be brought to the mustering stations and distributed between the boat and raft parties.

MAKE SURE THE PORTABLE EPIRBS,
PORTABLE RADIO AND WALKIE-TALKIES
ARE CARRIED OFF THE SHIP

LAUNCHING

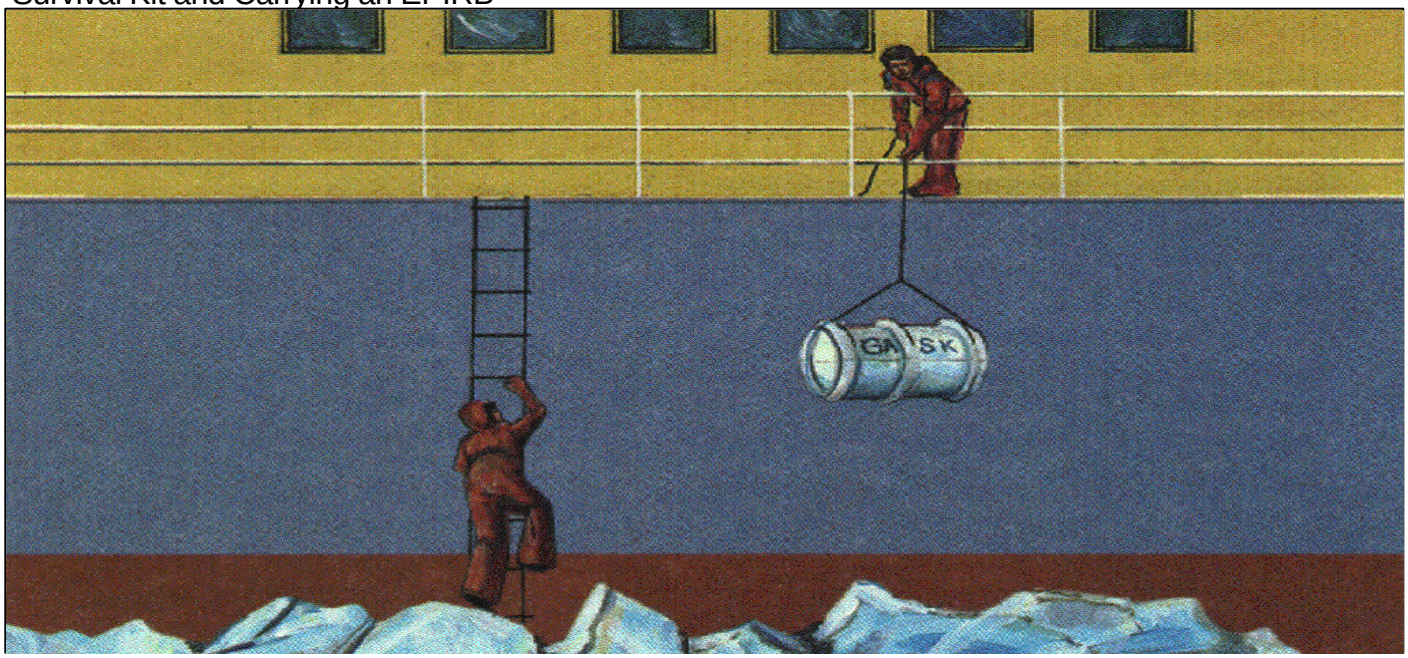
LIFE BOATS

Life boats may be launched conventionally into open water, open pack or thin ice. The boats should be used to marchal life rafts away from the ship. If the ice is thin, it may be sufficiently fractured to allow the life boat to progress. In pack ice, use the

Lowering a Group Arctic Survival Kit onto the ice

About 7 cm of ice will support a person's weight but will not support a life boat and will prevent its movement in the water

Person With Their Personal Arctic Survival Kit and Carrying an EPIRB



boathook to fend off any ice floes. If the ice is thick and close to the ship's side, it may prevent launching of life boats. In this case, you should rely on the life rafts.

LIFE RAFTS

Life rafts may also be launched conventionally into open water or open pack ice. The rafts should be moved quickly away from the ship. In pack ice, use the paddles to fend off any ice floes. If there is no open water, life raft containers should be lowered to the ice surface and moved to a safe distance from the ship.

GROUP SURVIVAL EQUIPMENT

If the ship is equipped with group Arctic survival kits (GASK), packed in containers, they should be lowered over the side.

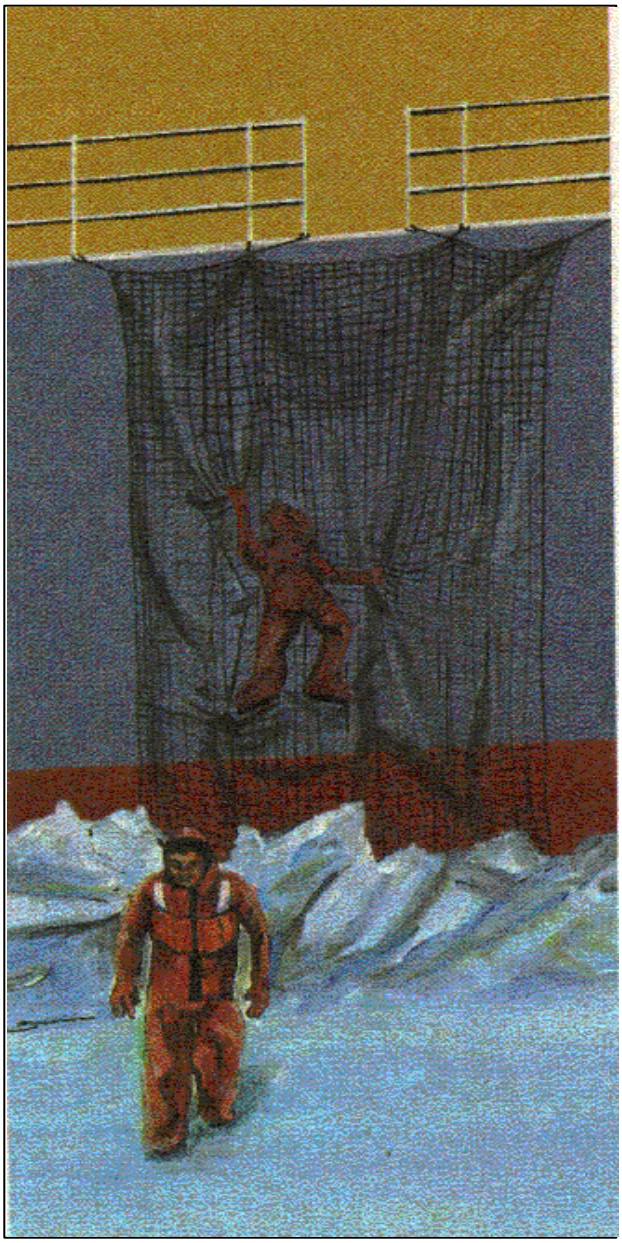
These kits contain many items which may be important to survival, such as tents, sleeping bags, stoves and fuel

EQUIPMENT	GASK
Group Equipment	**Quantity**
Tents	1 per 6 persons
Air Mattresses	1 per 2 persons
Sleeping Bags	1 per 2 persons
Stove	1 per tent
Stove Fuel	0.25 litres per person
Fuel Paste	2 tubes per stove
Matches	2 boxes per tent
Pan (with sealing lid)	1 per stove
Health Drink Mixes	5 packets per person
Flashlights	1 per tent
Candles and Holders	5 per tent
Snow Shovel	1 per tent
Snow Saw and Machete	1 per tent
Tarpaulin	1 per tent
Handbook (Arctic Survival)	1 per tent
Hunting Rifle	1 per ship
Spare Personal Equipment	
Toque	1
Scarf	1
Arctic Mitts	1 pair
Gloves	1 pair
Heavy Socks	1 pair
Bootees	1 pair
Extreme Cold Weather Pants	1
Extreme Cold Weather Parka	1
Thermal Underwear	1 pair
Handwarmers	1 set
Sunglasses	1
Whistle	1
Drinking Mug	1

Contents of the Group Arctic Survival Kits (GASKs)

SCRAMBLE NETS

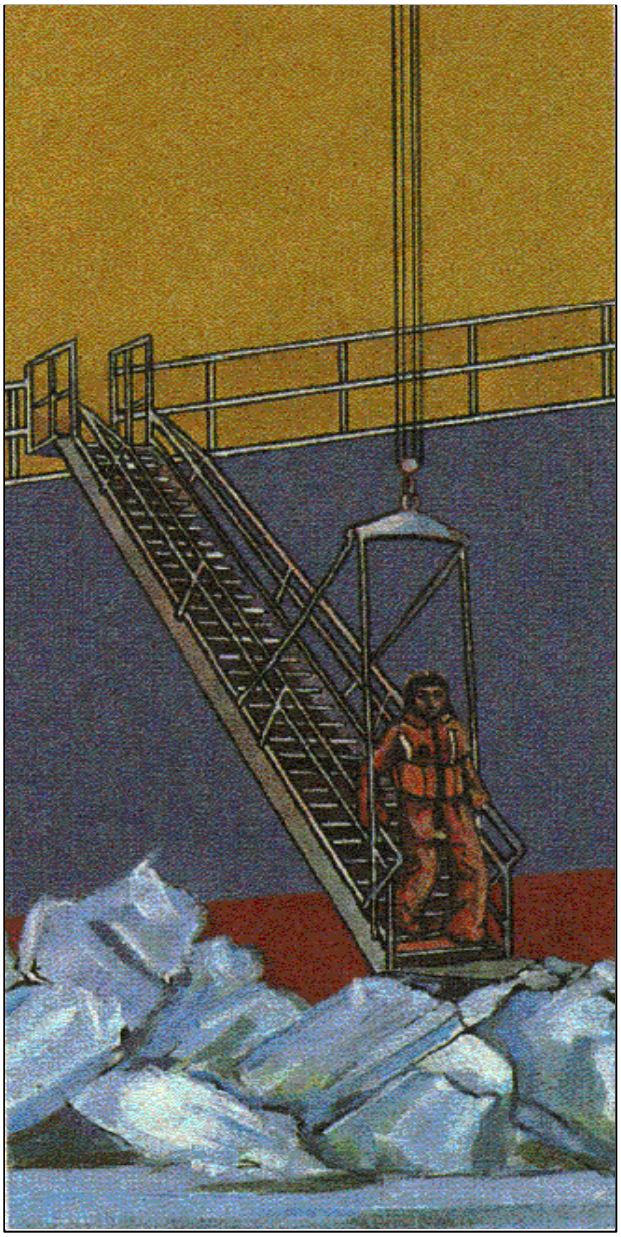
Where scramble nets are available they should be rigged for evacuation purposes.



EVACUATION USING A SCRAMBLE NET

ACCOMMODATION LADDER

During evacuation onto ice, accommodation ladders may offer the quickest and safest way of getting to the ice surface.



Evacuation onto the Ice Using the Accomodation Ladder

Survival Afloat

MARSHALLING THE BOATS AND RAFTS

Life boats and life rafts should be manoeuvred into open water and kept together if possible. No contact should be allowed with ice floes. Although rafts may be pulled onto larger ice floes, ther is a danger that smaller floes may capsize.

Search and Rescue will find you more quickly if you stay near the ship

SHELTER

Life Rafts and fully enclosed life boats are not comfortable shelters but are the only ones available. doors or hatches should be kept closed to retain warm air inside but special attention must be paid to the vents since adequate ventilation is vital. Keep the vents open. In open or partially open life boats, cover the opening with a tarpaulin.

Adequate ventilation is very important

Marshalling the Life Rafts

STAYING WARM

In a motorized life boat the area around the engine will be warmer. This area should be reserved for those who are most affected by the cold.

CLOTHING

Wear the warmest available clothing. Insulated outer wear, mitts and boots should be worn when practical. If the interior of the life boat or life raft is wet, your immersion suit should be worn over warm clothing.

SLEEPING GEAR

It will probably be impractical to use sleeping bags in life boats and life rafts when afloat. Conditions will be too cramped and the bags will be useless if wet.

HANDWARMERS

If available, chemically activated handwarmers should be used inside mitts, gloves and boots to keep the hands and feet warm. To activate the handwarmer, shake the sachet vigorously until the chemicals mix and start to give off heat.

FOOD AND WATER

Every effort should be made to warm food and water before ingestion. If taken cold the body's core temperature may be lowered, inducing or aggravating hypothermia. Due to the motion of life boats and life rafts it is unlikely that stoves or survival candles may be used safely as a source of heat. It may be possible, with great care, to use them outside on lthe life boat canopy or in open or partially open life boats.

Food and water should be heated before ingestion

RATIONS

Standard survival rations consist of biscuits, glucose candies and, in life boats only, condensed milk. These may be supplemented by any food brought off the ship during evacuation, including the high energy drinks provided in the group Arctic survival kits. The rations should be distributed on the basis that it will take five days to be rescued. To preserve rations and reduce the possibility of seasickness you should not eat during the first twenty four hours after evacuation.

WATER

Sea water should not be consumed, since it will increase thirst and may cause diarrhoea and vomiting. The drinking water supply will be contained in individual plastic sachets or plastic jerry cans and will probably be frozen. Heat from the life boat engine may melt the frozen fresh water sachets but may not be useful if the water is contained in jerry cans

Consuming sea water will increase thirst and may cause diarrhea and vomitting

SIGNALLING

The portable EPIRBs should be activated and a constant watch maintained for aircraft. Make yourself familiar with the pyrotechnics on board. Red flares will stand out better than white in a winter landscape or seascape. Morse code may also be used with a suitable reflector (heliograph) or light source

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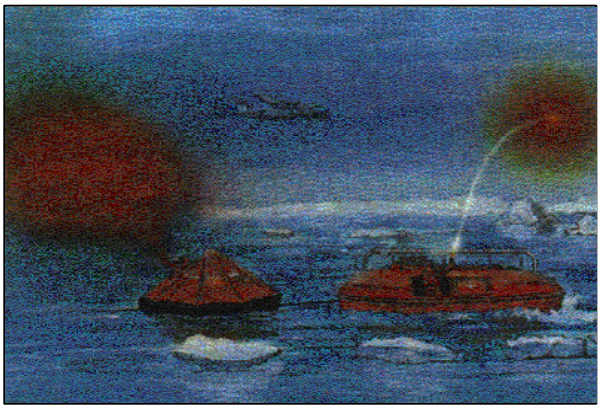


Setting off Flares

MORSE CODE

A – —	N — –	1 – — — — —
B — – – –	O — — —	2 – – — —
C — – — –	P – — — –	3 – – – — —
D — – –	Q — — – —	4 – – – —
E –	R – — –	5 – – – – –
F – – — –	S – – –	6 — – – – –
G — — –	T —	7 — — – – –
H – – – –	U – – —	8 — — — – –
I – –	V – – – —	9 — — — — –
J – — — —	W – — —	0 — — — — —
K — – —	X — – – —	
L – — – –	Y — – — —	
M — —	Z — — – –	

SENDING SIGNALS

AAAAA* etc.	Call sign *I have a message*
AAA*	End of sentence. *More follows.*
Pause	End of Word. *More follows.*
EEEEE* etc.	Error. *Start from last correct word*
AR	End of Message.

RECEIVING SIGNALS

TTTTT* etc.	I am receiving you.
K	I am ready. *Start message.*
T	Word received.
IMI*	Repeat sign. *I do not understand.*
R	Message received.

* Send as one word. No pauses.

Survival on the ice

THE BASICS

Survival depends on having the right equipment, knowing how to operate it and how to cope with equipment failure. The survival party leader or leaders must take control of the situation immediately. Action must be taken to care for the injured, establish communications, set up camp and establish a routine.

Tasks should be assigned to people to make the best use of their skills. Those who beome panic stricken or depressed must be comforted immediately. At least one survivor should be on watch for polar bears and resuers. Use common sense, take no unnecessary risks, and stay alert.

Although the ship's command structure will still apply in this survival situation, it may be that less senior personnel are more knowledgable of survival techniques. Their knowledge should be used to its maximum potential.

Ingenuity is your greatest survival asset

Person Being Pulled from the Water

ARRANGING SHELTER

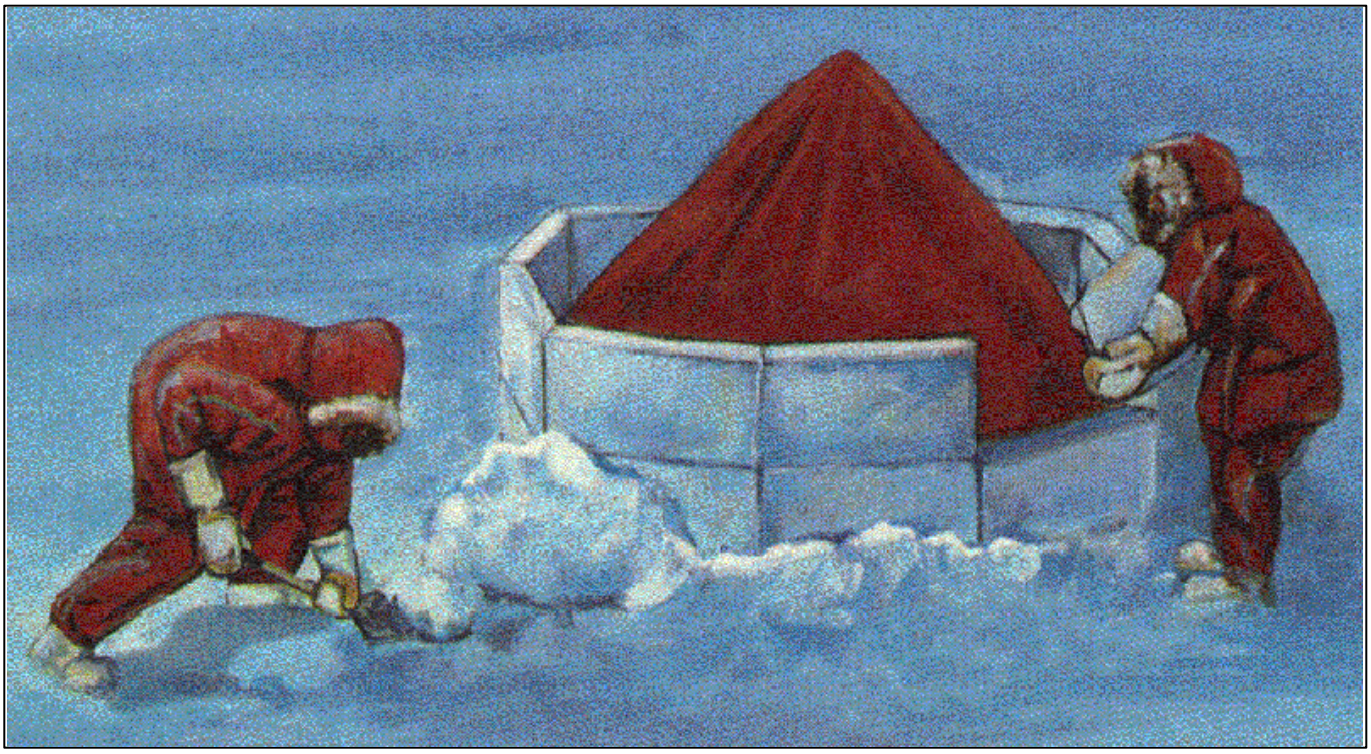
You should move to a safe distance from the ship, carrying, pulling or pushing all available equipment. Travel on the ice should be in single file. The person in front should carry a boathook to provide support if they fall through the ice. A rope should be tied around the waist of the first person and held by the second person in line to ensure the first person can be pulled from the water.

The camp site should be protected from the wind and there should be hard packed snow for cutting snow blocks. The site should be located on a thick snow base, not directly on the ice surface.

Get out of the wind as quickly as possible

LIFE RAFTS

Life rafts may be the easiest to use on-ice shelters since, once in position, the painter needs only to be pulled to inflate the raft. If the raft does not fully inflate, the hand pump supplied with the raft should be used to complete the inflation. A snow wall should be built around the life raft to deflect the wind. The wall should be as high or higher than the life raft, chinked and banked with snow to prevent erosion. If a tarpaulin is available, it may be secured on top of the snow wall to form a roof, creating a dead-air space around the life raft. Clothing and footwear should be brushed free of loose snow before entering the raft. The group may sleep in shifts to provide more space for those sleeping and to ensure a continuous watch.



Life Raft with a Snow Wall

TENTS

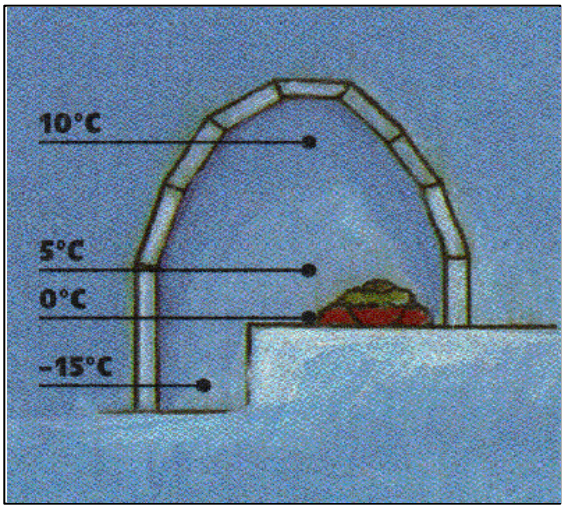
If tents are available they should be erected and protected with a snow wall in the same way as the life rafts.

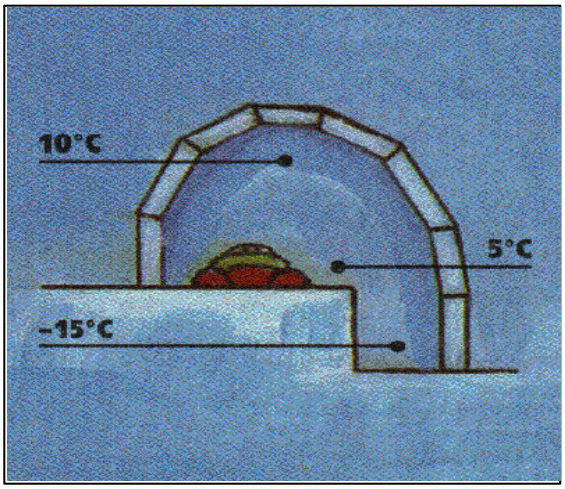
SNOW SHELTERS

Shelters made from hard packed snow blocks provide good insulation and may be warmer and more confortable than life rafts or tents. A saw is needed for cutting snow blocks and an axe or machete for cutting ice to produce drinking water. A snow shovel is also useful for digging snow caves and trenches. These tools should be brushed free of snow and taken inside the shelter after use. When making any kind of snow shelter such as caves or igloos, a cold well should be arranged to make the sleeping platform warmer. High structures result in colder temperatures at the level of the sleeping platform.

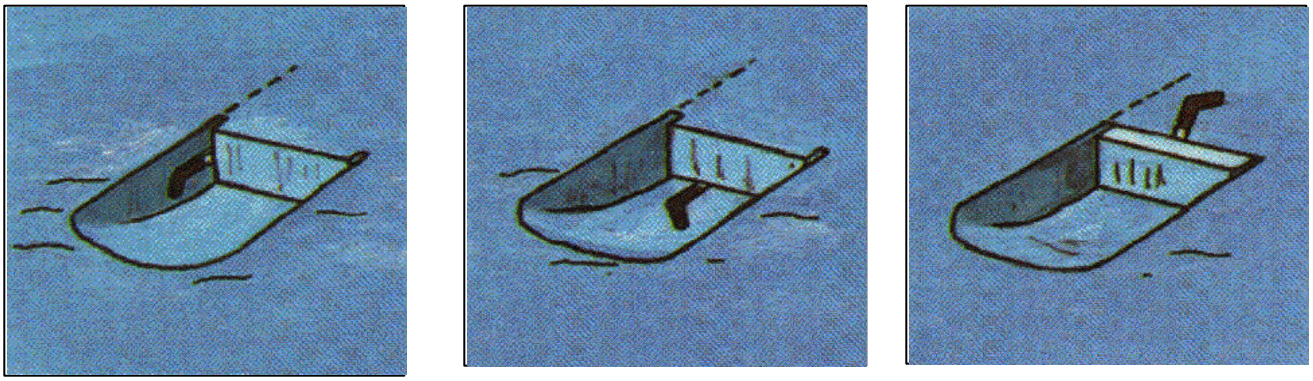
Snow Trenches

A snow trench is easy to build and requires little effort. A one person trench should be slightly wider than

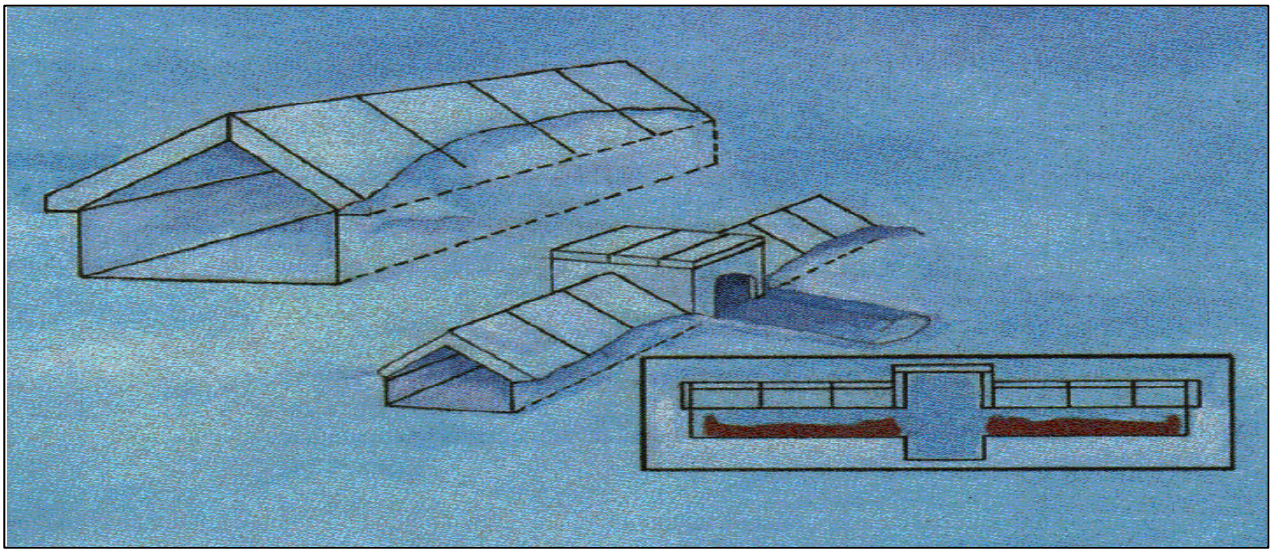




Temperature Gradient in a Snow Shelter



Cutting Snow Blocks



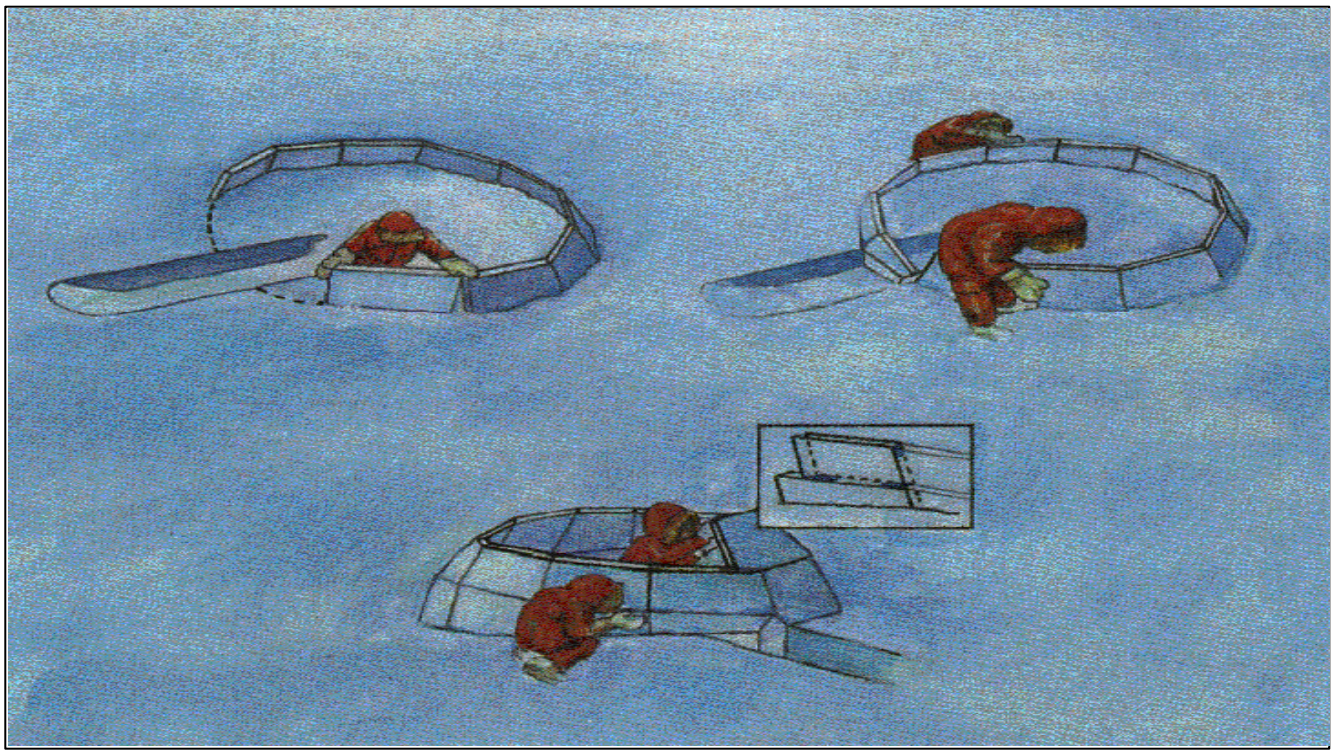
One and Two Person Snow Trenches

a sleeping bag and long enough to accommodate survival equipment. After first cutting blocks from a trench and excavating a cold well to below the level of the sleeping platform, the roof is constructed by laying blocks on edge to form a triangular structure. Once the roof is complete it should be chinked and covered with loose snow. A block is required to close the downwind end and a ventilation hole bored through the roof

Igloos

The most important igloo construction principle is to understand the way snow blocks support each other. The edges must be shaped to create three bearing surfaces at the corners. The vertical edges must be radial to the igloo centre and the top and bottom edges must be horizontal.

Approximately 30 blocks of 120cm long by 50cm high by 20cm thick are required for a two person igloo



Igloo Construction Process

The diameter of a one person igloo is about 2.5m and for each additional person the diameter should be increased by about 25cm. The igloo should be positioned to take advantage of the trench created by block cutting. A spiral building technique is effective and easy to use.

Once the outside and inside are chinked, loose snow should be piled outside to protect against wind erosion. A ventilation hole should be located about two thirds of the dome height above the snow surface pointing away from the sleeping platform.

The entrance tunnel should be located below the surrounding snow level, placing the sleeping platform above the entrance, creating a cold well and trapping the warm air inside.

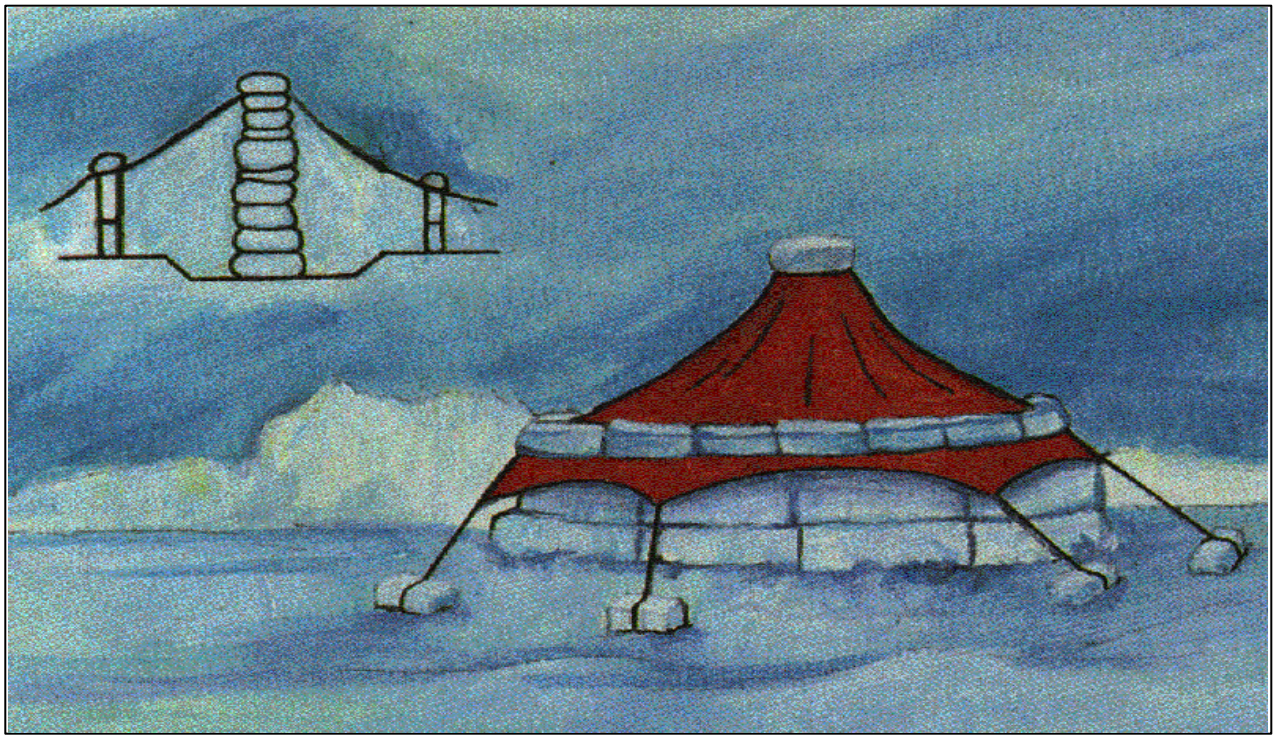
Improvised Igloo

An improvised igloo may be built of a circular wall of snow blocks with a centre pillar of snow blocks and a tarpaulin roof. The roof insulation may be improved by adding another layer of blocks and a second tarpaulin to create a dead air space.

Snow Caves

Snow drifts may form on the leeward side of ice ridges. If the snow is hard and the drifts large enough, a snow cave may be built. The cave should be excavated high in the drift to avoid an accumulation of blowing snow over the entrance. The cave should also be excavated from the floor up and the entrance sealed with a snow block. The roof should have a thickness of about 30cm and be arched to provide strength and prevent dripping. A ventilation hole should be bored through the roof. The sleeping bench should be about 50cm above the top of the entrance so warm air remains in the cave when the

Cross Section Through a Snow Cave



Improvised Igloo

STAYING WARM

CLOTHING

Insulated clothing is designed to maintain the body's thermal balance by reducing heat loss. The most difficult parts of the body to keep warm are the hands, feet, ears, nose and cheeks. These parts define how cold a person feels.

Temperature Regulation

By adjusting headgear, you can regulate the total body heat balance. Clothing should be worn in layers or there should be several ventilation openings. The clothing should then be adjusted so you feel cool rather than warm so that moisture build up due to sweating will be reduced and dehydration avoided.

Up to 40% of total heat loss is from the head

Parka and Pants

An insulated parka and pants provide excellent protection from the cold. There are many suitable insulating materials, synthetic and natural, but down is preferred. The clothing should be kept dry.

Avoid sweating by ventilating your clothing during physical exercise

Cold Weather Clothing

Thermal Underwear

The underwear should be of a synthetic material or a synthetic-natural blend to wick perspiration away from the skin. Wet underwear should be removed, although light exercise may generate sufficient heat, without causing sweating, to dry damp underwear

Handwear

Arctic mitts should be used if available. The best style is for the outer shell to be durable and water repellent with a wool pad on the back. The inner shell should be synthetic or a synthetic-natural blend to wick perspiration away from the skin. Gloves are preferred for tasks requiring dexterity.

Headgear

A toque provides an acceptable first layer of insulation for the head. A long cotton scarf will protect the face and neck from the wind. When the scarf becomes iced-up from your breath, rotate it and position the iced-up part inside the parka. A headover, which is a tube of material, is also useful and may be used as a hat or balaclava or pulled up over the face to protect the neck, nose and cheeks.

Footwear

Mukluks are warm, rugged and durable. Heavy socks provide excellent insulation and should be of synthetic material or a synthetic-natural blend to wick moisture away from the skin.

SLEEPING GEAR

A well insulated sleeping bag is important to preserve body heat when sleeping. To avoid moisture build up in the bag, you should:

- breathe outside the bag,
- sleep bare or in underwear,
- use an air mattress below the bag, and
- ventilate the bag whenever possible

If the sleeping bag does not have an insulated hood, you should wear a balaclava and scarf. Damp clothes can be dried by placing them between the inner liner and the bag.

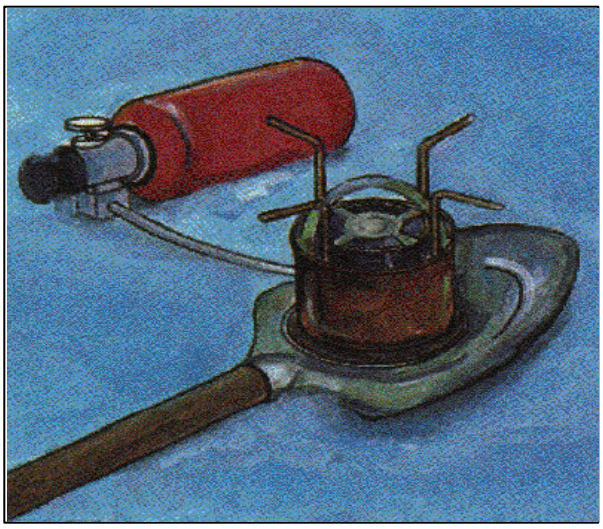
HANDWARMERS

The chemically activated handwarmers supplied with the personal and group Arctic survival kits should be placed inside mitts, gloves, boots and sleeping bags to keep your hands and feet warm. Shake the handwarmer sachet vigorously until the chemicals mix and start to give off heat.

FOOD AND WATER

PREPARATIONS

A stove and fuel may be included in the GASKs. These will probably be multi-fuel stoves designed for cold weather operation. Provided you protect the flame from the wind and cover the pan with a lid it will be quite practical to heat sufficient quantities of water to provide hot drinks for everyone in the group. As an alternative source of heat and light, beeswax survival candles may be used. Stoves should not be used inside the tents or life rafts due to the fire hazard and since the steam will condense, freeze and subsequently drip onto clothing and sleeping bags. Waterproof matches should be distributed among the group so the entire supply will not be lost if one person falls in the water.



Stove

Survival Candle

RATIONS

Standard life raft survival rations consist of biscuits and glucose candies. These may be supplemented by food brought off the ship during evacuation, including the high energy drinks provided in the Group Arctic Survival Kits. The rations should be distributed on the basis that it will take five days to be rescued.

DRINKING WATER

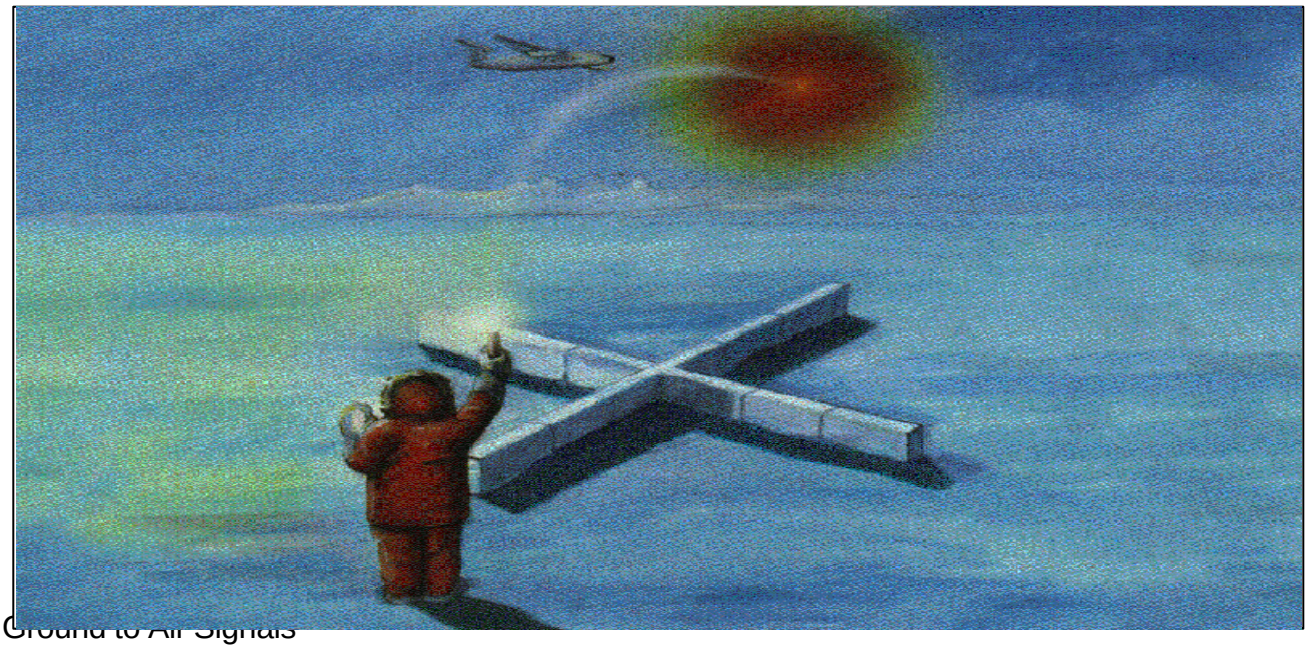
In addition to the standard drinking water supply there are two natural sources of drinking water, snow and old ice. Neither should be placed directly into the mouth as they can cause freezing damage and the body must use valuable energy to bring the snow and ice up to core temperature. For the same reason, water should be consumed warm.

Do not put ice or snow in your mouth

Ice requires approximately half as much fuel to produce a given amount of water compared to snow. If snow is used, it should first be compressed. Old-ice is clear, often contains air bubbles, usually has round edges and is virtually salt-free. The top-most layer of first-year ice will provide brackish water which should be suitable for drinking. De-salting tablets should be used if only brackish water is available. Sterilization tablets should be used if there is doubt about water purity.

LIGHT SOURCES

Candle lanterns and flashlights are sources of light. Candles also provide a heat source and the flame may provide warning of a lack of oxygen level as it will flicker and die when the oxygen level is low. Flashlights should have waterproof casings, lithium batteries and halogen bulbs. Make sure you have a flashlight in your personal Arctic survival kit.



Ground to Air Signals

SIGNALLING

The portable EPIRBs should be activated and a constant watch maintained for aircraft. Red flares should be used to attract attention if an aircraft is seen or heard. Morse code may also be used with a suitable reflector (heliograph) or light source. Snow blocks arranged in a pattern will create shadows which may be seen from the air at a great distance.

PERSONAL HYGIENE

Personal hygiene is important. You should make every effort to stay clean; your mental and physical well-being will benefit. A latrine may easily be built from snowblocks. The blocks will deflect the wind and provide some privacy. When the latrine becomes unusable a new one should be built.

PROTECTION AGAINST PREDATORS

Keep a watch for polar bears; they are a very real danger. Fully grown walrus may also be dangerous and should never be approached. Food should be stored and camp waste disposed of well away from the campsite. Polar bears may be scared off by warning shots, flares or by using the ship's Very Pistol, but once a bear decides to attack, the only practical protection is a firearm. The ship's rifle should be carried by the person who is standing watch.

Health Concerns

After evacuating a ship there may be injured people to care for. Even if there are no serious injuries, maintaining the group in reasonable health will depend on several actions:

- Find or build adequate shelter,
- Avoid sweating,
- Keep clothes dry,
- Heat food and water
- Insulate hands, feet, ears, head and neck,
- Maintain personal hygiene,
- Avoid alcohol, and
- Avoid smoking.

TRENCH FOOT OR IMMERSION FOOT

Trench foot, or immersion foot, occurs when feet are immersed in water or are damp and cold for long periods. The feet feel like they have pins and needles. Numbness sets in, but there may also be sharp pains. The feet appear purple, with swelling and blisters. To treat this injury, dry and elevate the feet and keep warm

HYPOTHERMIA

Normal body core temperature is in the range of 35°C to 37°C. Hypothermia results from low core temperature and may be caused by exposure to wind, rain and low temperatures. The major symptoms are:

- burst of energy followed by lethargy,
- loss of mental coordination,
- uncontrollable fits of shivering,
- loss of physical coordination,
- headaches, blurred vision, abdominal pains, and
- stupor or unconsciousness.

Hypothermia may be avoided by conserving body heat. Hot meals and liquids should be consumed and clothing kept dry. The core temperature should be monitored frequently. Survivors in a group should monitor each other carefully to detect the symptoms.

If someone becomes hypothermic, try to prevent further heat loss by placing them in shelter and not allowing any physical activity. The most practical method of warming is to place the hypothermic person in a sleeping bag with another person and to feed them with warm food and fluids.

FROSTBITE

Frostbite occurs as a result of frozen skin and flesh and may occur at a skin temperature of -1°C or lower. Extreme cold causes the blood vessels to contract so that insufficient blood and warmth reach the tissues. The victim should be removed from exposure and provided with warm food and fluids. The affected areas should be wrapped in a sterile dressing, covered warmly and kept as still as possible.

SNOW BLINDNESS

Snow blindness is usually caused by direct or reflected sunlight from fresh snow, ice or ice crystals in the atmosphere or from open water. Simple goggles may be made by cutting small slits in a piece of material and using it as a face mask. Glare may also be reduced by blackening the skin beneath the eyes. To treat this injury, place the patient in a dark area or cover the eyes with a blindfold.

SHOCK

Mental shock is primarily due to lack of knowledge and fear. Physical shock is caused by pain, excessive nerve stimulation and/or the loss of blood. The symptoms and signs of shock are:

- quickening of respiration,
- collapse,
- extreme paleness of the skin,
- cold sweaty skin,
- muscle tension,
- feeble but rapid pulse, and
- excitement or apprehension.

Mental shock should be treated with understanding, sympathy and reassurance. With physical shock, the injury should be treated. Pain relieving drugs should be administered if available, the loss of fluids should be stopped and fluids replenished.