IRATA International code of practice for industrial rope access

Part 3: Informative annexes

Annex O: Protecting rope access technicians against environmental conditions

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Contents

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Annex O (informative)
Protecting rope access technicians against environmental conditions

Introduction

Annex O is one of a number of informative annexes in Part 3 of this code of practice. Previous editions of Annex O dealt solely with the effect of wind and height on working times. This edition is a major revision and has a change of title. Annex O now gives information and advice on protecting rope access technicians against four types of environmental conditions, covered in four sections: **O.2**, Protecting against windy conditions, **O.3**, Protecting against wet and cold conditions, **O.4**, Protecting against hot conditions and **O.5**, Protecting against ultra-violet radiation. The information contained in these four sections has been gathered from various sources. Some general advice applicable to all the types is given in **O.1**.

Annex O is intended for rope access managers, rope access safety supervisors and rope access technicians who may be called upon to plan and carry out work in any or all of the environmental conditions covered by this document.

Three of the sections, **O.3**, **O.4** and **O.5**, describe some medical problems that can affect rope access technicians while working in the relevant environment. Signs and symptoms of such medical conditions are given as well as advice on initial treatment and prevention. For clarification, signs are what someone observes in a person, while symptoms are what the person experiences. It should be noted that some of these signs and symptoms may not be exclusive to the medical problem being covered, i.e. they could relate to an unassociated medical condition.

It should also be noted that Annex O deals only with the potential effect of the relevant environmental condition on the rope access technician themselves, and not on the equipment he/she is using. Information on equipment can be found in Part 2 of this code of practice.

Annex O should be read in conjunction with other parts of this code of practice, should not be used in isolation and is not intended to be exhaustive. For further information, readers should refer to relevant specialist publications.

O.1 General advice

O.1.1 Working in any of the environmental conditions covered by Annex O can be hazardous. Before starting work in any of these conditions, and during the work, consideration should be given as to whether it is really necessary to do so such work or whether it could be delayed until more appropriate conditions prevail. Consulting weather forecasts and on-site monitoring equipment is recommended.

O.1.2 Adverse weather should be considered when carrying out a risk assessment for a given task. There should be a risk assessment that specifically takes the relevant environmental conditions into account, as well as the nature of the task and the nature of the site – see Part 3, Annex B for information on risk assessments. Risk assessment should be ongoing as well as initial and should take account of changing environmental conditions. Rope access work should not be undertaken when the environmental conditions are such that they would pose an unacceptable risk to the personnel involved.

O.1.3 There should be a rescue plan, and appropriate emergency equipment and resources should be in place or readily accessible.

O.1.4 The environmental conditions covered in Annex O can affect the number of consecutive hours that a rope access technician could be expected to work safely. Employers should be aware that, in such conditions, periods of consecutive working might need to be reduced.

O.1.5 The rope access safety supervisor should be the person to determine whether any given condition at the worksite is compromising or is likely to compromise safety for the rope access technicians. He/she should have the authority to instruct the rope access team to cease work and vacate the immediate work site in such circumstances. The rope access safety supervisor should act on his/her own authority or as a result of a request by any rope access technician or involved third party (e.g. site manager; standby boat) that feels the environmental conditions are unsafe. In addition, a rope access technician should be allowed to make his/her own decision to cease work if he/she considers the conditions to be unsafe.

O.1.6 Wearable technology could help to improve the safety of rope access technicians by monitoring vital signs and other important information to help them be aware of how their body is responding to the environment, e.g. by tracking heart rate, temperature, UV index, perspiration and activity levels.

O.2 Protecting against windy conditions

O.2.1 Overview

O.2.1.1 The information and guidance contained in this section of Annex O (**O.2**) covers taking steps to combat the wind; provides the Beaufort wind force scale; gives wind speed measurement units and conversion factors, and other specific guidance. For some general guidance on working in the environmental conditions covered by Annex O, see **O.1**.

O.2.1.2 Wind speeds, working height and inclement weather such as rain and cold are likely to affect working times when working at height. Winds in excess of 37 km/h; 23 mph; 20 knots; 10.3 m/s (conversions are approximate) are likely to affect a person's balance, with an increased risk of a fall from a height. Cold winds can contribute to the onset of fatigue and hypothermia: see **O.3**.

O.2.1.3 High winds can cause large quantities of grit to become airborne, e.g. as in a sandstorm, which can cause eye injuries and damage to safety equipment.

O.2.1.4 High winds can cause unsecured rope ends to blow around and potentially become entangled, e.g. with moving machinery or vehicles.

O.2.1.5 Nearby objects such as trees and overhead power lines can become dangerous in windy conditions and potentially affect the safety of the working area.

O.2.1.6 Without careful attention, high winds can dislodge unsecured tools from working platforms and materials such as roofing; cladding; signage can be blown away, with the risk of injury to people in the working area and even to those outside of existing exclusion zones below.

O.2.1.7 High winds, particularly gusting high winds, can affect the stability of a rope access technician when suspended from the anchor lines such that he/she could be blown into the side of buildings, structures or natural features (e.g. a rock face) with the possibility of serious injury.

O.2.1.8 Weather forecasts usually give mean wind speeds. While this is useful information, it is very important to take predicted gust speeds into consideration when deciding whether work at height should go ahead or continue. If gust speeds are not known, the approximation *gust speed equals twice mean speed* may be used as a general guide for all heights up to 35 m. Twice the wind speed means four times the pressure. When comparing speeds quoted in forecasts, a general rule is that 10 m/s = 36 km/h = 20 knots = 23 mph.

O.2.1.9 Even when the wind speed is considered acceptable to work in, it is likely to be windier higher up, as wind speed normally increases with height. In addition, various factors, e.g. building shape, can affect localized wind speed and direction, which can vary throughout a worksite. Wind speed can also be increased by being funnelled through gaps between high buildings, hills or other surrounding features.

O.2.1.10 **Table O.2.1** gives the Beaufort wind force scale (generally referred to as the Beaufort scale), which is an empirical measure that relates wind speed to observed conditions at sea or on land. In fact, the Beaufort wind force scale is a measure of wind speed and not of force in the scientific sense. The scale is given up to Force 12. Higher forces exist but are considered irrelevant for this annex.

O.2.1.11 Observed conditions can be very useful in judging wind speed if there is no anemometer available. The wind speeds in the table are given in kilometres per hour (km/h); miles per hour (mph); knots and metres per second (m/s). **Table O.2.2** gives conversion factors for these wind speed

measurement units. It should be noted that in **Table O.2.1**, the wave heights given are for the open sea and not along the shoreline.

O.2.1.12 The Beaufort wind force scale is based on a ten-minute mean wind speed, in knots, and measured 10 m above the ground. (At 2 m above the ground, the wind speed is likely to be around 30 % to 50 % less than the figures quoted.)

O.2.2 Taking steps to combat the wind

O.2.2.1 It is important to access a local weather forecast prior to starting a rope access task and to get regular updates, so that an understanding can be gained of how the weather behaves in the given area when comparing to the initial forecast, e.g. occurrences of sudden turbulence. Local knowledge may also provide useful information when assessing this.

O.2.2.2 There is no definitive maximum wind speed at which rope access work should be stopped, as this depends on many factors, e.g. place of work; company policy; nature of the task. In other trades, recommendations vary for maximum wind speeds at which work should be stopped. The recommendation for falsework is that a maximum working wind force during operations is Force 6 on the Beaufort scale. This equates to 10.8 to 13.9 m/s. For roofing work, e.g. laying or handling profiled single-skin sheets at roof level, it is recommended that work should stop when the mean wind speed reaches 23 mph, gusting to 35 mph or over (10.3 m/s or Force 5 on the Beaufort scale). For lightweight materials, e.g. insulation boards, this is lowered to 17 mph, gusting to 26 mph or over (7.6 m/s or Force 4 on the Beaufort scale).

O.2.2.3 Bearing in mind the wind speed limit examples given in **O.2.2.2**, for rope access technicians, a limit for direct exposure to wind of benign temperature from the Beaufort scale 4 to 5 (8.0 to 10.8 m/s; 28.7 to 38.9 km/h; 15.5 to 21 knots; 18 to 24.2 mph) could be appropriate. These values seem to be within the limits of other industry guidance and are reasonably conformable if work periods are taken into consideration and modified where thought necessary. When working at the upper end of these values, suitable measures may be required, such as more frequent breaks and additional or more appropriate protective equipment, e.g. clothing.

O.2.2.4 Some points to consider during a risk assessment for working in windy conditions are:

a) effective communications, e.g. by using radios; pre-planned hand signals;

b) regular monitoring of wind speed and variability;

c) whether access and egress can be affected by the wind, including any emergency and rescue procedures;

d) whether steps can be taken to minimize or eliminate the risk and potential consequences of rope access technicians being dislodged and blown into the building, structure or natural feature during high or gusting wind conditions, e.g. by rigging short drops or limiting the drop by the use of re-anchors, lateral restraint or other temporary work-positioning aids;

e) whether high winds are likely to affect the well-being of the rope access technician. High winds in cold conditions can cause both physical and mental fatigue. Wind chill can add to the risk of hypothermia and frostbite (see **O.3.2**). Regular buddy checking and frequent breaks are recommended in these conditions.

NOTE *The list is non-exhaustive.*

O.2.2.5 Steps can sometimes be taken to combat the effects of the wind by the use, for example, of containment sheeting, containment netting or other types of barrier, or by working on the lee side of a building, structure or natural feature, rather than in an exposed area.

O.2.2.6 Different wind speeds can affect continuous working times when working at height. For rope access, these times are likely to vary considerably, depending on factors such as the ambient air temperature, the height above ground and the precise nature of the worksite, e.g. working in suspension or on an inclined surface such as a pitched roof or an embankment.

O.2.3 Additional guidance

O.2.3.1 In windy conditions, care should be taken to protect against various hazards, such as:

a) foreign objects blowing into the eyes, e.g. grit, which can be addressed by the use of safety goggles;

b) rope entanglement (see **Part 2, 2.11.3.1**);

c) sandstorms, which can injure rope access technicians and cause damage to equipment;

c) flying debris, e.g. sheeting panels; scaffold boards; roofing tiles, which could injure rope access technicians;

d) excessive slack in the safety line caused by the wind blowing it through the back-up device, which could compromise safety by increasing the potential fall distance;

e) combined swell and wave height when working over water.

O.2.3.2 In addition to the standard contents, first-aid kits should include equipment specific to the hazards likely to be encountered, e.g. eye wash; emergency thermal blanket.

Table O.2.1 – The Beaufort wind force scale

Beaufort Force	Description	Signs	Wind speed	Wave height
0	**Calm**	Land: calm. Smoke rises vertically Sea: flat	<1 km/h <0.7 mph <0.6 knots <0.3 m/s	0 m 0 ft
1	**Light air**	Land: wind direction is shown by smoke drift but not by wind vane Sea: ripples without crests	1.1 to 5.5 km/h 07 to 3.4 mph 0.6 to 3 knots 0.3 to 1.5 m/s	0 m to 0.2 m 0 ft to 1 ft
2	**Light breeze**	Land: wind is felt on the face; leaves rustle; wind vanes move Sea: small wavelets; crests of glassy appearance, not breaking	5.5 to 11.9 km/h 3.4 to 7.4 mph 3 to 6.4 knots 1.5 to 3.3 m/s	0.2 m to 0.5 m 1 ft to 2 ft
3	**Gentle breeze**	Land: leaves and small twigs move steadily; small flags extend Sea: large wavelets; crests starting to break; scattered whitecaps	11.9 to 19.7 km/h 7.4 to 12.2 mph 6.4 to 10.6 knots 3.3 to 5.5 m/s	0.5 m to 1 m 2 ft to 3.5 ft
4	**Moderate breeze**	Land: wind raises dust and loose paper; small branches move Sea: small waves with breaking crests; fairly frequent whitecaps	19.7 to 28.7 km/h 12.2 to 17.9 mph 10.6 to 15.5 knots 5.5 to 8 m/s	1 m to 2 m 3.5 ft to 6 ft
5	**Fresh breeze**	Land: small trees in leaf sway; moderate size branches move Sea: moderate waves; many whitecaps; small amounts of spray	28.7 to 38.8 km/h 17.9 to 24.1 mph 15.5 to 21 knots 8 to 10.8 m/s	2 m to 3 m 6 ft to 9 ft
6	**Strong breeze**	Land: large branches move; wires whistle; umbrella use difficult Sea: long waves form; frequent white foam crests; some airborne spray	38.8 to 49.9 km/h 24.1 to 31 mph 21 to 26.9 knots 10.8 to 13.9 m/s	3 m to 4 m 9 ft to 13 ft
7	**High wind/Moderate gale**	Land: whole trees are in motion; walking against the wind is difficult Sea: sea heaps up; foam blown from breaking waves; moderate spray	49.9 to 61.8 km/h 31 to 38.4 mph 26.9 to 33.4 knots 13.9 to 17.2 m/s	4 m to 5.5 m 13 ft to 19 ft
8	**Gale/Fresh gale**	Land: twigs break from trees; difficult to walk against the wind; Sea: high waves with breaking crests; streaks of foam; considerable spray	61.8 to 74.6 km/h 38.4 to 46.3 mph 33.4 to 40.3knots 17.2 to 20.7 m/s	5.5 m to 7.5 m 18 ft to 25 ft
9	**Strong gale**	Sea: high waves; crests sometimes roll over; dense foam; much airborne spray	74.6 to 88.1 km/h 46.3 to 54.8 mph 40.3 to 47.6 knots 20.7 to 24.5 m/s	7 m to 10 m 23 ft to 32 ft
10	**Storm/Whole gale**	Land: trees are broken or uprooted; structural damage likely Sea: very high, tumbling waves; overhanging crests; much foam and spray	88.1 to 102.4 km/h 54.8 to 63.6 mph 47.6 to 55.3 knots 24.5 to 28.4 m/s	9 m to 12.5 m 29 ft to 41 ft
11	**Violent storm**	Land: widespread damage likely Sea: exceptionally high waves; foam-covered sea; very large spray; bad visibility	102.4 to 117.4 km/h 63.6 to 72.9 mph 55.3 to 63.4 knots 28.4 to 32.6 m/s	11.5 m to 16 m 37 ft to 52 ft
12	**Hurricane**	Land: widespread destruction; unsecured objects hurled about Sea: huge waves; sea completely white with foam; driving spray; bad visibility	>117.4 km/h >72.9 mph >63.4 knots >32.6 m/s	>14m >46 ft

Table O.2.2 – Wind speed measurement units and conversion factors

Wind speed measurement unit		Conversion factor
1 kilometre per hour (km/h or kph)[1]	=	0.621 miles per hour (mph)
1 kilometre per hour (km/h or kph)	=	0.540 knots (kn or kt)[2]
1 kilometre per hour (km/h or kph)	=	0.278 metres per second (m/s)
1 mile per hour (mph)	=	1.61 kilometres per hour (km/h or kph)
1 mile per hour (mph)	=	0.869 knots (kn or kt) [3]
1 mile per hour (mph)	=	0.447 metres per second (m/s)
1 knot (kn or kt)	=	1.852 kilometres per hour (km/h or kph)
1 knot (kn or kt)	=	1.152 miles per hour (mph)
1 knot (kn or kt)	=	0.514 metres per second (m/s)
1 metre per second (m/s)	=	3.60 kilometres per hour (km/h or kph)
1 metre per second (m/s)	=	2.237 miles per hour (mph)
1 metre per second (m/s)	=	1.944 knots (kn or kt)

NOTE 1 *km/h and kph are two recognized symbols for kilometres per hour.*

NOTE 2 *The abbreviations for knots kn and kt are interchangeable.*

NOTE 3 *There are two different types of knots. A knot is defined as a nautical-mile per hour. In the UK, a nautical mile is defined as 6080 feet, whereas internationally a knot is defined as 1.852 km (or 6076.12 feet). This means that 0.0639 % should be added to UK knots to get international knots. International knots are used in this table. The small difference is usually not significant.*

O.3 Protecting against wet and cold conditions

O.3.1 Overview

O.3.1.1 Information in this section of Annex O (**O.3**) is provided on wind chill, hypothermia and frostbite, which are risks associated with working in wet or cold conditions, and advice is given on how to deal with them. There is also advice on choosing a clothing system to protect against the cold and wet. For some general guidance on working in the environmental conditions covered by Annex O, see **O.1**.

O.3.1.2 While **O.3** focuses on work outdoors, much of the information and guidance would also apply to working indoors in wet or cold conditions, e.g. cold stores.

O.3.1.3 Water conducts heat away from the body 25 times faster than air. Consequently, being wet can soon lead to hypothermia, especially in cool or cold conditions. In cold conditions, hypothermia can lead to frostbite. Wind can exacerbate the cooling effect by what is known as wind chill. Hypothermia can occur even in warm or hot weather if the water is cold, e.g. when becoming drenched by water from a cold river or sea. It is essential, therefore, to stay warm and dry.

O.3.2 Wind chill

O.3.2.1 In addition to the ambient temperature, the cooling effect of the wind needs to be taken into account when protecting against the cold. The greater the speed of the wind, the more rapidly unprotected parts of the body lose heat, causing the temperature of the skin and the core temperature of the body to drop. This can lead to hypothermia (see **O.3.3**) and frostbite (see **O.3.4**). For guidance on the prevention of hypothermia and frostbite, see **O.3.5** and for staying warm and dry, see **O.3.6**.

O.3.2.2 The wind chill chart shown in **Table O.3.1** is taken from work done by the US National Weather Service and is designed to show how cold air feels on the skin. It is based on the results of tests on heat loss from the exposed skin of human volunteers. As an example, **Table O.3.1** shows that when the temperature is 15 °F and the wind speed is 30 miles per hour, the wind chill effectively reduces the temperature to -5 °F. The information in **Table O.3.1** is presented in degrees Fahrenheit (°F) and miles per hour (mph). **Table O.3.2** shows the same information as **Table O.3.1** but has been converted from the original table to degrees Celsius (°C). **Table O.3.3** shows the same information as **Table O.3.2** but with miles per hour (mph) converted to kilometres per hour (km/h or kph).

O.3.2.3 **Tables O.3.1**, **O.3.2** and **O.3.3** also include a frostbite indicator, showing the points at which the combination of temperature, wind speed and exposure time produces frostbite in humans. The unshaded area and the two shaded areas show how long a person can be exposed before frostbite develops. For example, a temperature of -17 °C/0 °F and a wind speed of 24 km/h/15 mph are shown to produce a wind-chill temperature of -28 °C/-19 °F. Under these conditions, exposed skin can freeze in 30 minutes.

Table O.3.1 – The effect of wind chill in degrees Fahrenheit and miles per hour

Wind speed mph	Temperature °F														
0	**35**	**30**	**25**	**20**	**15**	**10**	**5**	**0**	**-5**	**-10**	**-15**	**-20**	**-25**	**-30**	**-35**
5	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52
10	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59
15	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64
20	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68
25	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71
30	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73
35	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76
40	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78
45	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
50	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81
55	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82
60	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84

Key

Non-bold numbers		Temperature with wind-chill effect
Unshaded area		Frostbite occurs in 30 minutes
Lightly shaded area		Frostbite occurs in 10 minutes
Darker shaded area		Frostbite occurs in 5 minutes

Source: United States National Weather Service

Table O.3.2 – The effect of wind chill in degrees Celsius and miles per hour

Wind speed mph	Temperature °C (Converted from °F to nearest whole degree Celsius)														
0	**2**	**-1**	**-4**	**-7**	**-9**	**-12**	**-15**	**-18**	**-21**	**-23**	**-26**	**-29**	**-32**	**-34**	**-37**
5	1	-4	-7	-11	-14	-17	-21	-24	-27	-30	-33	-37	-40	-43	-47
10	-3	-6	-9	-13	-16	-20	-23	-27	-30	-33	-37	-41	-44	-47	-51
15	-4	-7	-10	-14	-18	-22	-25	-28	-32	-36	-39	-43	-46	-50	-53
20	-4	-8	-12	-16	-19	-23	-26	-30	-34	-37	-41	-44	-48	-52	-56
25	-5	-9	-13	-16	-20	-24	-27	-31	-35	-38	-42	-46	-50	-53	-57
30	-6	-9	-13	-17	-21	-24	-28	-32	-36	-39	-43	-47	-51	-55	-58
35	-6	-10	-14	-18	-22	-26	-29	-33	-37	-41	-44	-48	-52	-56	-60
40	-7	-11	-14	-18	-22	-26	-30	-34	-38	-42	-46	-49	-53	-57	-61
45	-7	-11	-15	-19	-23	-27	-31	-34	-38	-42	-46	-50	-54	-58	-62
50	-7	-11	-16	-19	-23	-27	-31	-35	-39	-43	-47	-51	-55	-59	-63
55	-8	-12	-16	-19	-24	-28	-32	-36	-39	-43	-48	-52	-56	-59	-63
60	-8	-12	-16	-20	-24	-28	-32	-36	-40	-44	-48	-52	-56	-60	-64

Key

Non-bold numbers		Temperature with wind-chill effect
Unshaded area		Frostbite occurs in 30 minutes
Lightly shaded area		Frostbite occurs in 10 minutes
Darker shaded area		Frostbite occurs in 5 minutes

Table O.3.3 – The effect of wind chill in degrees Celsius and kilometres per hour

Wind speed km/h (kph)	Temperature °C (Converted from °F to nearest whole degree Celsius)														
0	**2**	**-1**	**-4**	**-7**	**-9**	**-12**	**-15**	**-18**	**-21**	**-23**	**-26**	**-29**	**-32**	**-34**	**-37**
8	1	-4	-7	-11	-14	-17	-21	-24	-27	-30	-33	-37	-40	-43	-47
16	-3	-6	-9	-13	-16	-20	-23	-27	-30	-33	-37	-41	-44	-47	-51
24	-4	-7	-10	-14	-18	-22	-25	-28	-32	-36	-39	-43	-46	-50	-53
32	-4	-8	-12	-16	-19	-23	-26	-30	-34	-37	-41	-44	-48	-52	-56
40	-5	-9	-13	-16	-20	-24	-27	-31	-35	-38	-42	-46	-50	-53	-57
48	-6	-9	-13	-17	-21	-24	-28	-32	-36	-39	-43	-47	-51	-55	-58
56	-6	-10	-14	-18	-22	-26	-29	-33	-37	-41	-44	-48	-52	-56	-60
64	-7	-11	-14	-18	-22	-26	-30	-34	-38	-42	-46	-49	-53	-57	-61
72	-7	-11	-15	-19	-23	-27	-31	-34	-38	-42	-46	-50	-54	-58	-62
80	-7	-11	-16	-19	-23	-27	-31	-35	-39	-43	-47	-51	-55	-59	-63
89	-8	-12	-16	-19	-24	-28	-32	-36	-39	-43	-48	-52	-56	-59	-63
97	-8	-12	-16	-20	-24	-28	-32	-36	-40	-44	-48	-52	-56	-60	-64

Key

Non-bold numbers		Temperature with wind-chill effect
Unshaded area		Frostbite occurs in 30 minutes
Lightly shaded area		Frostbite occurs in 10 minutes
Darker shaded area		Frostbite occurs in 5 minutes

O.3.3 Hypothermia

O.3.3.1 Overview

O.3.3.1.1 Hypothermia is a condition which occurs when the core temperature of the body drops below that required for it to function normally. This is generally considered to be anything less than 35 °C (95 °F). Hypothermia often leads to a state of confusion, which increases the possibility of making serious errors of safety. Severe hypothermia can be fatal.

O.3.3.1.2 Body temperature is usually maintained naturally near a constant level of 36.5 °C to 37.5 °C (97.7 °F to 99.5 °F). However, if a person is exposed to cold and the body is unable to replenish the heat that is being lost, the body's core temperature falls. This can occur due to excessive cold but also due to health problems that decrease a person's ability to generate heat. Examples of such health problems are diabetes; thyroid conditions; severe trauma; the use of drugs or alcohol. When the body's core temperature falls below the normal temperature range for a prolonged period, hypothermia can occur.

O.3.3.2 Signs and symptoms

O.3.3.2.1 General

O.3.3.2.1.1 An early sign of hypothermia is constant shivering. Shivering itself is actually a good sign, as it shows that a person's heat control system is still working. The shivering may be enough to counter the hypothermia to some extent. Uncontrollable shivering, disorientation and incoherence, i.e. a state of confusion, are signs of hypothermia and action to combat these conditions should be taken immediately they are recognized in someone. People with a body temperature of 32 ˚C or lower

usually stop shivering completely. This is a sign that their condition is deteriorating and emergency medical help is required. There is a risk of death from heart failure.

O.3.3.2.1.2 The level of confusion a person suffering from hypothermia can experience can increase dramatically. For example, it is not uncommon for casualties to be so confused that, despite the cold, they start to remove their clothing (known as paradoxical undressing).

O.3.3.2.2 Mild hypothermia

Mild cases of hypothermia (body temperature generally between of 32 ˚C and 35 ˚C/90 ˚F and 95 ˚F) include symptoms such as:

a) constant shivering;

b) tiredness;

c) low energy;

d) cold or pale skin;

e) fast breathing (hyperventilation).

O.3.3.2.3 Moderate hypothermia

Moderate cases of hypothermia (body temperature generally between 28 ˚C and 32 ˚C/82 ˚F and 90 ˚F) include signs and symptoms such as:

a) being unable to think or pay attention;

b) confusion and memory loss;

c) loss of judgement and reasoning;

d) difficulty moving around and loss of co-ordination, e.g. clumsy movements;

e) drowsiness;

f) slurred speech;

g) exhaustion;

h) slow, shallow breathing (hypoventilation).

O.3.3.2.4 Severe hypothermia

The signs of severe hypothermia (body temperature below 28 ˚C/82 ˚F) include:

a) unconsciousness;

b) shallow or no breathing;

c) weak, irregular or no pulse;

d) dilated pupils.

O.3.3.3 Treatment

O.3.3.3.1 General

O.3.3.3.1.1 Prevention is better than cure, see **O.3.5**, but if hypothermia does occur, the guidance in **O.3.3.3** should be helpful.

O.3.3.3.1.2 Consideration should be given to standard first aid protocols for other medical conditions, e.g. injuries. Treatment should be carried out in a safe area.

O.3.3.3.1.3 Hypothermia is treated by preventing further body heat being lost and by gently rewarming the casualty. For mild hypothermia, some physical exercise by the casualty can be helpful in rewarming the body. Immediate medical attention should be sought if it is suspected that someone has more than mild hypothermia, because of its potential threat to life.

O.3.3.3.1.4 There are several methods of rewarming the casualty: passive external rewarming, active external rewarming and active internal rewarming. For anything other than passive external rewarming for mild hypothermia, treatment should only be by a competent medical professional.

O.3.3.3.1.5 ***Passive external rewarming*** is suitable for cases of mild hypothermia. It involves using body heat or ambient room temperature to aid the casualty's body in rewarming itself. This includes moving to a warmer environment, the use of insulated dry clothing and wrapping in blankets or any other non-toxic insulating material available.

O.3.3.3.1.6 ***Active external rewarming***, which is suitable for moderate cases of hypothermia, involves applying warming devices externally, such as a heating blanket, a warm water bottle placed on the chest, neck, under the arms or in the groin or a warm water bath, all which should be within the temperature range 38 °C to 42 °C (100 °F to 108 °F) but see **O.3.3.3.3.2**.

O.3.3.3.1.7 ***Active internal rewarming*** is sometimes used in cases of severe hypothermia. Active internal warming is hazardous and should only be done in hospital. The process involves procedures such as intravenously applied warmed fluids; irrigation of body cavities with warmed fluids; inhalation of warm, humidified air; extracorporeal rewarming, which means the blood is warmed outside the body before being returned to it. Extracorporeal rewarming is the fastest method for those with severe hypothermia.

O.3.3.3.2 Caring for a casualty while awaiting professional medical help

O.3.3.3.2.1 While waiting for professional medical help to arrive, some actions, such as the ones listed in a) to k), can be taken to help a casualty that is suffering from hypothermia.

a) Remember that it is important to handle anyone with hypothermia gently and carefully.

b) Protect the casualty against further heat loss. Use coats, blankets, a colleague's own body heat to help keep the casualty warm and, in particular, insulated from the ground. Provide extra clothes or blankets. Cover the casualty's head and neck.

c) Move the casualty gently to a warm, dry shelter as soon as possible.

d) Once the casualty is in a warm environment (but not until then), remove any wet clothing, dry the person and redress in dry clothing.

e) It is very important that any rewarming is carried out slowly.

f) Begin rewarming the casualty by covering with warm blankets, coats, other clothes, towels etc. (whatever is available). Priority should be given to the torso and head.

g) Gently hugging the casualty, thereby using one's own body heat, can help the warming process.

h) Take the casualty's temperature if a thermometer is available.

i) Offer warm liquids or high-energy foods, such as chocolate, to help warm up the casualty but avoid alcohol and caffeine (e.g. coffee), which speed up heat loss. However, it is important only to offer food and drink if they can swallow normally. (Use a small quantity of water to test.)

j) Do not try to give fluids or food to an unconscious person.

k) Continue to keep the casualty warm and dry after body temperature has increased.

O.3.3.3.2.2 The casualty should be evacuated as soon as possible after initial attempts to reverse heat loss, as it is difficult and dangerous to try and adequately rewarm a severely hypothermic person in the field.

O.3.3.3.2.3 If the hypothermic person has no pulse or signs of breathing, cardiopulmonary resuscitation (CPR) should be started immediately after calling for emergency help. CPR should be continued, even when there are no signs of breathing or a pulse, until paramedics arrive or the casualty is taken to a hospital. This is because severe hypothermia causes the body to shut down in such a way as to make it appear that an unconscious person is dead. They might not be. Most hospital emergency departments have a specialized thermometer which can detect very low core body temperatures and confirm a diagnosis. It is sometimes possible to resuscitate people with severe hypothermia, although often the condition is fatal.

O.3.3.3.3 Actions to be avoided

O.3.3.3.3.1 Unless carried out by someone who is medically competent, there are certain things that should not be done when helping someone with hypothermia, because they may make the condition worse:

a) do not put the cold person into a hot bath;

b) do not massage their limbs;

c) do not use heating pads and lamps;

d) do not give alcohol to drink;

e) do not give drinks containing caffeine.

O.3.3.3.3.2 Trying to warm someone up with hot water, massages, heat pads and heat lamps can cause the blood vessels in the arms and legs to open up (dilate) too quickly. If this happens, it can lead to a fall in blood pressure to vital organs such as the brain, heart, lungs and kidneys, potentially resulting in cardiac arrest and death.

O.3.3.3.4 Hospital treatment for severe hypothermia

If someone is admitted to hospital with severe hypothermia, advanced medical treatment can be used to warm them (e.g. active internal warming, see **O.3.3.3.1.7**). However, the techniques employed are usually only available in major hospitals that have appropriate specialist emergency services or units, e.g. those that regularly perform heart surgery. A person with severe hypothermia is likely to stand a better chance of surviving if they are taken directly by ambulance to one of these hospitals, even if it means bypassing a smaller hospital on the way.

O.3.4 Frostbite

O.3.4.1 Overview

O.3.4.1.1 Frostbite is a medical condition in which localized damage is caused to skin and other tissues due to freezing. Frostbite is most likely to happen in extremities of the body such as the fingers, hands, toes, feet, the nose, ear lobes and cheeks, but can occur on any exposed area of unprotected skin. In cold conditions, if there is a loss of feeling in any of these areas or they are turning pale or white, shelter should be sought immediately, as should medical attention. For the prevention of frostbite, see **O.3.5**.

O.3.4.1.2 At or below 0 °C (32 °F), the body automatically takes action to preserve its core temperature and to combat hypothermia. Blood vessels close to the skin start to constrict and blood is shifted away from the extremities. In extreme cold, or when the body is exposed to cold for long periods, this protective strategy can reduce blood flow in some areas of the body to dangerously low levels. This lack of blood can lead to the eventual freezing and death of skin tissue in the affected areas.

O.3.4.1.3 The same factors that can lead to hypothermia (e.g. long exposure to cold; extreme cold; inadequate clothing; wet clothes; wind chill) can also contribute to frostbite, as can inadequate blood circulation caused by factors such as tightly fitting clothing, gloves or boots; cramped positions; fatigue; certain medications; smoking; alcohol use; or diseases that affect the blood vessels, such as diabetes and Raynaud's disease.

O.3.4.2 Signs and symptoms

O.3.4.2.1 General

Frostbite is categorized by severity as first, second, third or fourth degree, with fourth degree being the most serious. Depending on the severity of the condition, frostbitten areas may feel numb, hard and frozen, and may appear waxy, white or grey. Symptoms such as sensitivity to cold, numbness, or chronic pain may last for years. In extreme cases, the frostbitten tissue may have been permanently damaged and may need to be amputated.

O.3.4.2.2 First degree frostbite

O.3.4.2.2.1 The initial stages of frostbite are sometimes called frostnip. Frostnip affects only the outer layers of the skin, which has frozen. An early symptom is a whitening of the skin and a sensation of 'pins and needles'. Other symptoms include numbness, swelling, itching, burning, and deep pain as the area is warmed. Usually, these symptoms disappear as warming occurs, but the skin may appear red for several hours.

O.3.4.2.2.2 The area of skin suffering from frostnip does not usually become permanently damaged, as only the top layers of the skin are affected, although there can sometimes be a long-term altered sensation of cold and heat.

O.3.4.2.3 Second degree frostbite

If freezing continues past the initial (first degree) stages, the skin may freeze and harden. However, the deep tissues are not affected and stay soft and normal. Second-degree frostbite usually results in blisters one to two days after becoming frozen. The blisters may become hard and blackened, but often appear worse than they actually are. Most of the injuries heal in approximately a month but the area may become permanently insensitive to both cold and heat.

O.3.4.2.4 Third degree frostbite

If the area continues to freeze, the frostbite deepens. In third degree frostbite, this means the skin and underlying tissues have frozen. The symptoms are similar to second-degree frostbite. The skin is hard, may appear bluish-grey or yellowish-grey in colour and feel wooden to touch. Use of the area is lost temporarily. In severe cases, the loss of use is permanent.

O.3.4.2.5 Fourth degree frostbite

In fourth degree frostbite, the muscles, tendons, blood vessels, and nerves all freeze. Deep frostbite like this results in areas of purplish blisters which turn black and which are generally blood-filled but may be filled with clear or milky-coloured liquid. Nerve damage in the area can result in a loss of feeling. This extreme and very serious frostbite may result in amputation of the affected parts, e.g. fingers and toes, if the area becomes infected with gangrene. The extent of the damage can take several months to assess, and this often delays surgery to remove the dead tissue.

O.3.4.3 Treatment

O.3.4.3.1 General

O.3.4.3.1.1 Prevention is better than cure, see **O.3.5**, but if frostbite does occur, the guidance in **O.3.4.3** should be helpful.

O.3.4.3.1.2 Consideration should be given to standard first aid protocols for other medical conditions, e.g. injuries. Treatment should be carried out in a safe area and only by someone who is medically competent.

O.3.4.3.1.3 The casualty may be suffering from hypothermia as well as frostbite. Check for hypothermia and treat for this condition first, see **O.3.3**.

O.3.4.3.1.4 The decision when to start the thawing process of frostbitten parts depends on the availability of a long-term warm environment and medical expertise. If rewarmed tissue becomes refrozen, there is a high risk of more damage to the tissue. Excessive movement of frostbitten tissue should be avoided as ice crystals that have formed in the tissue can cause further damage. For the same reason, applying physical force to frostbitten tissues, e.g. massaging, as a means to rewarm them can be harmful and should not be carried out. Splinting and/or wrapping frostbitten extremities are recommended to prevent movement of them.

O.3.4.3.1.5 Various ways of rewarming a casualty suffering from hypothermia are described in **O.3.3.3**. In addition to this advice, there are other points to be made relating to active external rewarming, specific to cases of frostbite.

O.3.4.3.1.6 Active external rewarming is the direct addition of heat to a person, usually in addition to the treatments included in passive external rewarming. Active external rewarming requires more equipment and skill and, therefore, may be difficult to perform unless the casualty is in an appropriate medical environment, e.g. a hospital, and under expert medical care. Active external rewarming seeks to warm the injured tissue as quickly as possible without burning. This is desirable, because the faster tissue is thawed, the less tissue damage occurs. Active rewarming is usually achieved by immersing the injured tissue in a water-bath held within the temperature range 38 °C to 42 °C (100 °F to 108 °F) for 30 to 45 minutes. Warming of peripheral tissues can increase blood flow from these areas back to the body's core. It is possible that this may produce a decrease in the body's core temperature and increase the risk of cardiac dysrhythmias.

O.3.4.3.2 Caring for a casualty while awaiting professional medical help

O.3.4.3.2.1 While waiting for professional medical help to arrive, some actions can be taken to help a casualty that is suffering from frostbite:

a) get to safe place;

b) summon urgent medical assistance;

c) get the casualty to a warm room as soon as possible. The casualty can have warm drinks, such as broth, hot chocolate or weak tea (avoid caffeine and alcohol);

d) rest the injured areas (avoid walking on frostbitten feet, for example) and elevate them slightly;

e) take off any wet or restrictive clothing;

f) leave blisters intact and cover them with a sterile or clean cloth until the casualty is seen by a medically qualified person;

g) keep the affected part(s) as clean as possible to reduce the risk of infection;

h) elevate the area above the level of the heart.

O.3.4.3.2.2 Only if professional medical help is not available and the warmth of the casualty can be maintained, the affected area may be rewarmed by immersing it in warm water within the temperature range (38 °C to 42 °C/100 °F to 108 °F) for at least 30 to 45 minutes or until the area feels warm and the skin looks a more normal colour (e.g. reddish). During warming, there may be severe pain and the injured area may swell and change colour.

O.3.4.3.3 Actions to be avoided

There are some actions that are likely to be detrimental and thus best avoided:

a) do not do anything that could further injure the frostbitten tissue;

b) do not rub the area with hands, snow, melted ice, or with anything else;

c) do not start to warm the affected area if there is any chance that it could be exposed to the cold again;

d) do not allow the injury to thaw then refreeze. This is very dangerous and can cause serious or permanent injury. It is better to delay warming;

e) do not use dry heat, such as from a heating pad, sunlamp, fire, or radiator, to try to warm the area. Because the skin is numb and may not feel the heat, it can easily be burned;

f) do not thaw the injury in melted ice;

g) do not allow the casualty to consume alcohol, nicotine, caffeine or other drugs that may affect blood flow.

O.3.5 Prevention of hypothermia and frostbite

O.3.5.1 If the temperature, including wind chill, is not below -10° C, there is only a low risk of frostbite but there is still a risk of hypothermia. To protect against hypothermia and frostbite:

a) if arrival in a cold climate from a warmer one is only very recent, give the body time to adjust before spending extended periods outside;

b) check the weather forecast before starting work outside;

c) be prepared for unexpected changes in the weather, such as high winds, snowstorms and drops in temperature;

d) ensure there is enough clothing of the right type to cope with changes in the weather;

e) keep dry and warm by wearing clothing appropriate for the conditions (see **O.3.6**);

f) avoid using cotton clothing because it does not dry quickly and does not provide good insulation;

g) carry out regular and frequent buddy checks, at least every half an hour, for signs of hypothermia, e.g. constant shivering; confusion, and for frostbite, e.g. white patches on extremities such as the nose; ears; fingers; toes. The colder it becomes, the more often the checks should be carried out;

h) at the first sign of redness, blueness, whiteness or pain in the skin (which may indicate that the body is becoming too cold), move out of the cold, warm up, and protect any exposed skin;

i) if someone gets wet, move the person inside to somewhere warm and change the wet clothing for dry clothing as quickly as possible;

j) eat well-balanced carbohydrate-rich meals and stay hydrated. Nutrition is a critical part of combating hypothermia. The body needs food to sustain its core temperature. The dry air in cold conditions can cause dehydration, which makes the body more susceptible to hypothermia, so it is important to rehydrate regularly. Drinking warm, sweet beverages, such as hot chocolate, is likely to help;

k) stay active. This keeps the blood flowing and helps to stay warm. However, the activity should not be to the point of exhaustion;

l) avoid stimulants such as caffeine (e.g. coffee unless decaffeinated or naturally without caffeine). Caffeine stimulates the heart and constricts small blood vessels in the skin;

m) avoid drinking alcohol before or during exposure to cold weather. Although alcohol may make a person feel warm, it actually causes the body to lose heat and its effect may keep a person from realizing that the body is becoming too cold;

n) avoid smoking, which can detrimentally affect circulation and increase the risk of frostbite.

O.3.5.2 As the temperature drops, the risk of frostbite increases. Cover as much exposed skin as possible. Be sure to check regularly for gaps in clothing (e.g. between glove and sleeve) that might expose bare skin to the cold. Exposed skin can freeze in just a few minutes, depending on just how cold and/or windy it is. Do not work alone. Increase the number of buddy checks for signs of hypothermia and frostbite (also see **O.3.5.1g)** and **O.3.7**). If any are observed, cease work immediately and move to a warm area.

O.3.5.3 Assess the risks of continuing the planned work activities. If in any doubt, postpone or cancel these activities. If work is to continue, ensure there is a warm shelter and medical expertise readily to hand.

O.3.6 Staying warm and dry

O.3.6.1 Protecting the torso and arms by layering

O.3.6.1.1 General

O.3.6.1.1.1 Wearing multiple layers of clothing (known as layering) is a long-established and effective way of insulating the body from the cold. The effectiveness of layering has been enhanced over the years by the development of new materials and fabrics.

O.3.6.1.1.2 The layering system is intended to keep the body warm by trapping warm air between the layers of clothing and around the fibres of the materials used in their construction and to keep the body dry by allowing excess heat and moisture (sweat) to escape to the outside. The outer part of the layering system should be windproof and keep out any wet weather.

O.3.6.1.2 Base layer

O.3.6.1.2.1 The layer of clothing worn next to the skin is known as the base layer. The objective of the base layer is to trap warm air close to the skin; to keep the surface of the skin dry and to maintain it at a consistent temperature.

O.3.6.1.2.2 There are several different materials used in the construction of the fabric used to manufacture base layers. Examples are polypropylene, polyester, merino wool, or a mixture of these. Merino wool or a merino wool/manmade fibre blend seems to provide the best insulation and is comfortable to wear, although it is the most expensive. An added advantage of merino wool is that it is naturally anti-bacterial, thus it minimizes body odour. Base layers made from cotton should be avoided because cotton does not dry quickly and does not provide good insulation.

O.3.6.1.2.3 In addition to providing insulation, a key requirement of a base layer is that it draws moisture (sweat) away from the body towards the next layer. This is known as wicking. All the materials named have good wicking attributes.

O.3.6.1.2.4 Base layers come in different thicknesses or densities, giving varying amounts of insulation. Usually the thicker the fabric, the better the insulation and the warmer the garment is. In choosing the base layer, the type of activity to be undertaken needs to be considered. For example, if the work planned in cold conditions is likely to be very physical, a thinner base layer may be more appropriate than one chosen for less active work in those conditions.

O.3.6.1.2.5 Base layers should be a worn with a relatively snug (but not tight) fit, so that they follow the contours of the body but without feeling uncomfortable or restrictive. A neck design with a short zip is useful for adjusting ventilation when required.

O.3.6.1.3 Mid layer

O.3.6.1.3.1 Next to the base layer is the mid layer. The objective of the mid layer is to trap as much warm air as possible between it and the base layer. Mid layers are usually thicker than base layers and are often made from a fleece fabric but they can also be in other forms, e.g. a woollen sweater; a lightweight duvet jacket filled with either man-made materials or natural down. In very cold conditions, two mid layers may be worn, e.g. a fleece next to the base layer and then a duvet jacket on top of this. Mid layers made from cotton should be avoided because cotton does not dry quickly and does not provide good insulation.

O.3.6.1.3.2 Mid layers should have good wicking attributes and should be worn with a looser fit than a base layer, so that they allow freedom of movement, but not so loose that the air between the layers (which provides insulation) can escape easily.

O.2.6.1.3.3 Some mid layers incorporate a draw cord through the bottom hem and adjustment at the sleeve cuffs. These can be tightened for optimum heat retention or loosened to provide ventilation. A neck design with a short zip is useful for adjusting ventilation when required.

O.3.6.1.4 Outer layer

O.3.6.1.4.1 The top (outer) layer should be windproof and water repellent but sufficiently breathable to allow unwanted moisture to escape.

O.3.6.1.4.2 Breathability is the ability of a material to allow moisture vapour (e.g. sweat that has been wicked through the base and mid layers) to pass through the fabric. Non-breathable fabric is best avoided because the water vapour wicked through the layers becomes trapped on the inside of the outer layer. The inside surface of the outer layer and the mid layer become wet and the insulating benefits of the layering system are consequently compromised.

O.3.6.1.4.3 The waterproofness and level of breathability of outer garments vary and are rated in accordance with standard tests. Manufacturers typically describe the waterproofness and breathability of fabrics using two numbers. The first number is in millimetres (mm) and is a measure of how waterproof a fabric is. Put simply, the test uses a vertical tube, to the bottom end of which is fixed a piece of the fabric to be tested. Water is poured into the tube until it reaches a height (actually, a pressure) at which the water begins to seep through the fabric, e.g. 10,000 mm. The bigger the number, the more waterproof the fabric is.

O.3.6.1.4.4 The second number is a measure of how breathable the fabric is, and is normally expressed in terms of how many grammes (g) of water vapour can pass through a square metre (m^2) of the fabric from the inside to the outside in a 24 hour period, e.g. 10,000. The bigger the number, the more breathable the fabric is.

O.3.6.1.4.5 A rating of 16,000/16,000 and above is recommended, the higher the better. At 16,000/16,000, a garment should protect against heavy rain, wet snow and some pressure. A garment rated at 20,000/20,000 and above should protect against heavy rain, wet snow and heavy pressure, e.g. pressure caused by harness straps or other equipment.

O.3.6.1.4.6 The top layer is normally unfilled, when it is known as a shell garment, but could also be a garment filled with insulation such as natural down or man-made insulation materials. The fit should be such that freedom of movement is not restricted. Most of these garments incorporate a full-length front zip, an adjustable hood (which should be large enough to fit over the safety helmet), a draw cord through the bottom hem and adjustment at the sleeve cuffs. These can be fastened or tightened for optimum heat retention, or unfastened or loosened to provide ventilation. Top layer garments that incorporate all these features are highly recommended.

O.3.6.2 Protecting other parts of the body

O.3.6.2.1 General

The layers described in **O**.**3.6.1** protect the arms, torso and, thus, the core of the body against the cold. However, it is essential that other parts, such as the head, hands, legs and feet are also well protected. These are the parts that most often become frost-bitten. This means that extra care has to be taken with these parts of the body, to ensure they stay as warm as necessary.

O.3.6.2.1 Protecting the head

A substantial amount of the body's heat can be lost through the head. The head can be protected by wearing a hat (e.g. a beanie or a hat with earflaps) and/or a balaclava under the safety helmet. Balaclavas are available in the same materials used as base layers for the torso. Covering the mouth, e.g. with a balaclava, can protect the lungs from entry of cold air, which can contribute to unwanted lowering of the core temperature. Masks made from neoprene for skiing in very cold conditions are effective. They protect the cheeks, nose and mouth. Goggles, e.g. ski goggles, can be used to protect the eyes from cold winds. A scarf can be used to protect the neck. Further protection is gained by wearing the hood of the outer garment over the safety helmet.

O.3.6.2.2 Protecting the hands

Mitts filled with down or man-made materials provide better insulation for the hands than gloves, although it may be more difficult to do detailed work in mitts. Under-gloves made from silk, merino wool or polyester fleece and worn next to the skin provide an insulating base layer and allow the removal of the top mitt or glove for short periods. Chemical hand warmers (one for inside each glove or mitt and inexpensive when bought in bulk) are effective and are recommended. These look like large tea bags and are supplied in sealed bags. They activate when the sealed bag is opened and the hand warmers are exposed to air. Mitts or gloves with an outer layer that is waterproof and breathable are recommended. Waterproof, breathable over-mitts are an alternative.

O.3.6.2.3 Protecting the legs

Legs can be protected from the cold by wearing trousers lined with an insulating material and/or wearing leggings as a base layer. Leggings are available made from the same materials as those described for the torso. The same fit criteria apply, i.e. they should be a snug fit and follow the contours of the legs but should not be tight or cause any restriction of movement. Trousers with a waterproof, breathable outer are recommended, or over-trousers with the same features.

O.3.6.2.4 Protecting the feet

Feet can be protected by wearing insulated, waterproof and, ideally, breathable boots, perhaps with two pairs of socks. Avoid a tight fit in the boots, which may reduce blood flow and increase the risk of frostbite. Long socks are available made from merino wool, with its superior insulating and comfort characteristics. There are also chemical foot warmers, which function in the same way as the hand warmers described in **O.3.6.2.2**.

O.3.7 Additional guidance

O.3.7.1 While normally there has to be only one competent first-aider in every rope access team (which is usually the rope access safety supervisor), it is recommended that, when working in cold conditions, the entire team is competent in recognizing hypothermia and frostbite and that each member knows what action should be taken, should either or both of the conditions occur. If only one person is competent, e.g. the rope access safety supervisor, and that person becomes hypothermic themselves – with confusion and lack of clear thinking a good possibility – the condition could easily remain undetected in them and others until it is too late.

O.3.7.2 It is essential that regular and frequent buddy checks are made for signs of hypothermia, e.g. constant shivering; confusion, and for frostbite, e.g. white patches on extremities such as the nose; ears; fingers; toes, so that any condition discovered can be remedied before it becomes more serious. The colder it becomes, the more often the checks should be carried out. Ensure regularly that there are no unnecessary exposed areas of skin.

O.3.7.3 The selection and wearing of appropriate clothing, see **O.3.6**, are key components of protecting against the effects of cold, as is the skill in knowing when it is necessary to stop work, if only temporarily, and warm up. At worksites where hypothermia or frostbite is a possibility, it is common practice to increase the number of breaks to minimize the time the rope access technicians are exposed to the hostile environment and to have those breaks in a warm location. Rope access managers and rope access safety supervisors should take these points into account when carrying out risk assessments and preparing method statements.

O.3.7.4 The selection and wearing of clothing intended to protect against the wet and cold should not adversely affect the performance of other items of safety equipment, e.g. helmets; buoyancy jackets.

O.3.7.5 When selecting clothing intended to protect against the wet and cold, account should be taken of site specific requirements, e.g. fire retardancy; high visibility colour; footwear.

O.3.7.6 Be aware that, in very cold conditions, bare skin can stick to metal and be difficult to remove without causing injury. Think carefully before removing gloves to carry out any work.

O.3.7.7 Remember that rain, ice or snow can turn a secure footing in the dry into a very insecure place. Ensure rope access personnel have appropriate footwear for these weather conditions and

when the weather could change rapidly and create these conditions. Special care should be taken in such circumstances.

O.3.7.8 In addition to the standard contents, first-aid kits should include equipment specific to the hazards likely to be encountered, e.g. chemical hand and feet warmers; thermal insulation blankets.

O.4 Protecting against hot conditions

O.4.1 Overview

O.4.1.1 Information in this section of Annex O (**O.4**) is provided on the risks associated with working in hot conditions, and advice is given on how to deal with them. For some general guidance on working in the environmental conditions covered by Annex O, see **O.1**.

O.4.1.2 Rope access technicians who are exposed to hot and dry or hot and humid conditions, outdoors or indoors (e.g. near a furnace), are at risk of hyperthermia (not to be confused with hypothermia) and dehydration, with related illnesses such as heat stroke, heat exhaustion, heat cramps, heat rash. The risk becomes greater as the temperature and humidity increase, especially for workers who have not been given time to adapt from more temperate conditions. Rope access technicians working outdoors in such conditions can also be at risk of over-exposure to ultra-violet radiation, which can result in sunburn, eye damage, and, more seriously, skin cancer, see **O.5**.

O.4.1.3 Both air temperature and humidity affect how hot a person feels. Humidity, which is moisture in the air, plays an important part in this feeling. Evaporation of perspiration (sweat) from the surface of the skin is one of the ways the human body cools itself. Sweat does not evaporate as quickly from the surface of the skin when the air is humid as it does in a dry climate. Thus, in high humidity conditions, the natural cooling process is reduced, making a person feel hotter. Low humidity can be a problem in hot, dry (i.e. low humidity) climates. In these conditions, sweat evaporates very rapidly, which can lead to severe dehydration if not enough water is drunk throughout the day.

O.4.1.4 Workers become overheated in two primary ways: the environmental conditions and body heat generated by physical activity, e.g. work. Heat-related illnesses occur when the body is not able to lose enough heat to balance the heat generated by physical work and external heat sources such as the weather, hot plant and machinery.

O.4.1.5 Organizations in several countries or regions have recognized the potential danger to health caused by excessive heat and have their own guidance and precautions. Two examples are:

a) Occupational Safety Health Administration (OSHA) of the USA, which publishes a document called: **Using the heat index: a guide for employers**;

b) Health Authority Abu Dhabi (HAAD) with its **Safety in the Heat** programme.

O.4.1.6 A summary of the documents listed in **O.4.1.5** is given in **O.4.2** and **O.4.3**. Either of these documents could provide a suitable regime for rope access technicians working in hot environments.

O.4.2 The heat index

O.4.2.1 The heat index was developed in 1978 by George Winterling, a retired television weatherman, from work done by Robert G Steadman. It was adopted by the U.S. National Oceanographic and Atmospheric Administration's National Weather Service and is presented in *Using the heat index: a guide for employers*, which is obtainable free of charge from: https://www.osha.gov/SLTC/heatillness/heat_index/pdfs/all_in_one.pdf.

O.4.2.2 The heat index is a single value that takes both temperature and humidity into account. It is a better measure than air temperature alone for estimating the risk to workers from environmental heat sources. The higher the heat index, the hotter the weather feels, since sweat does not readily evaporate and cool the skin.

O.4.2.3 **Table O.4.1** gives the heat index at various levels of humidity and temperatures in degrees Fahrenheit. **Table O.4.2** is a simple conversion from degrees Fahrenheit to degrees Celsius to the nearest whole number.

O.4.2.4 As well as recommending actions to be taken at each of the four risk levels shown in **Table O.4.1** and **Table O.4.2** as different blocks of colour or shading, the heat index guide covers planning checklists, training workers for working in hot conditions, preparing and responding to heat-related emergencies, work/rest schedules, estimating work rates or loads and monitoring workers at risk of heat related illnesses.

Table O.4.1 – Temperature, relative humidity and heat index in degrees Fahrenheit

Relative humidity (%) \ Temperature °F	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Heat index °F

Key

Caution | Extreme caution | Danger | Extreme danger

Table O.4.2 – Temperature, relative humidity and approximate heat index in degrees Celsius

Relative humidity (%) \ Temperature °C (simple conversion from °F to nearest whole number)	27	28	29	30	31	32	33	34	36	37	38	39	40	41	42	43
40	27	27	28	29	31	33	34	36	38	41	43	46	48	51	54	58
45	27	28	29	31	32	34	36	38	40	43	46	48	51	54	58	
50	27	28	29	31	33	35	37	39	42	45	48	51	55	58		
55	27	29	30	32	34	36	38	41	44	49	51	54	58			
60	28	29	31	33	35	38	41	43	47	51	54	58				
65	28	29	32	34	37	39	42	46	49	52	54					
70	28	30	32	35	38	41	44	48	52	57						
75	29	31	33	36	39	43	47	51	56							
80	29	32	34	38	41	45	49	54								
85	29	32	36	39	43	49	52	57								
90	30	33	37	41	45	50	55									
95	30	34	38	42	49	53										
100	31	35	39	44	49	56										

Heat index °C

Key

Caution | Extreme caution | Danger | Extreme danger

O.4.3 Safety in the Heat

O.4.3.1 *Safety in the Heat* is part of the Abu Dhabi government Environment, Health and Safety Management System (EHSMS) and is supported by a regulatory framework which determines certain working time limitations for working in the sun: see http://www.haad.ae/safety-in-heat. The document provides technical guidance and information for employers in the Emirate of Abu Dhabi that have employees working in high temperature environments. Guidance is given on heat illnesses and injuries, including symptoms and first aid; recommendations for employers and employees; educational messages; urine charts for self-assessment of hydration levels; a hydration test regime and examples of a dehydration report; a working in heat inspection checklist and a flag system for communicating heat condition.

O.4.3.2 In *Safety in the Heat*, a Thermal Work Limit (TWL) is determined and guidance given on work/rest schedules, rehydration schedules and work restrictions, called interventions: see **Table O.4.3**, which has been taken from the EHSMS Safety in the Heat programme and modified by IRATA for rope access purposes.

O.4.3.3 TWL is a heat stress index, validated for Gulf conditions, which has been researched and adopted by the Health Authority Abu Dhabi to enable safe management of work in heat. It gives a measure of the maximum safe work rate for the conditions. If the TWL is too low, even low rates of work cannot safely be carried out continuously.

O.4.3.6 Instruments are available to carry out the measurements required to compute the TWL. Information on these instruments is available from HAAD. Care should be taken to perform measurements at the working location itself rather than at easier to reach locations nearby, especially as temperature levels can vary a lot depending on the height.

O.4.3.7 **Table O.4.3** refers to self-paced workers; unacclimatized workers, light work and heavy work. These terms are explained in a) to d) below.

a) Self-paced workers are allowed to adjust their work in accordance with environmental conditions. Paced work is when the work rate is not under the worker's control.

b) Unacclimatized workers are defined as new workers or those who have been off work for more than 14 days due to illness or on holiday in a cooler climate area.

c) Light work is light arm work carried out while sitting or standing.

d) Heavy work is carrying, climbing, lifting, pushing, whole body work.

O.4.3.8 **Table O.4.3** shows a fluid intake requirement of more than 1.2 litres per hour for heavy work. At high workloads and/or thermal stress, sweat rates exceed 1.2 litres per hour. Increasing fluid intake much above this level is not practicable due to gastric discomfort, as the upper limit for gastric emptying and fluid absorption is 1.5 litres per hour. Therefore, control measures to improve thermal conditions should be implemented, in addition to providing adequate hydration to replace lost sweat.

Table O.4.3 – Thermal work limit (TWL) and working zones for rope access technicians

Working zones	Interventions (NB No rope access technician to work alone)	Rehydration schedule (per hour)	Work/rest schedule (minutes)
Low risk unrestricted zone TWL: 140 to <220	No limits on self-paced work	Light work: 600 ml to 1 litre	Safe for all continuous self-paced work
Medium risk cautionary zone TWL: 115 to 140	Cautionary zone indicates situations in which environmental conditions require additional precautions. • Implement practicable engineering control measures to reduce heat stress, e.g. provide shade; improve ventilation. • Ensure adequate fluid intakes appropriate to the type of work.	Light work: 1 to 1.2 litres	Safe for continuous self-paced light work
		Heavy work: >1.2 litres	Continuous paced work: 45 work/15 rest
High risk zone TWL: <115	Strict work/rest cycle required • No unacclimatized person to work. • High risk induction required emphasising hydration and identifying signs of heat strain. • Provide personal water bottle (2 litre capacity) to be on-site at all times.	All work: >1.2 litres	Light work: 45 work/15 rest
			Heavy work: 20 work/40 rest

Source: Abu Dhabi Environment, Health and Safety Management System: Safety in the heat programme, modified by IRATA for rope access purposes

O.4.4 Hyperthermia

O.4.4.1 Overview

O.4.4.1.1 The term hyperthermia (not to be confused with hypothermia, which is suffering from the cold) is used to describe a condition where the rise in temperature of the body is greater than would be otherwise expected. In simple terms, hyperthermia is defined as a core body temperature greater than 37.5 °C to 38.3 °C (99.5 °F to 100.9 °F).

O.4.4.1.2 Hyperthermia is caused by raised core body temperature due to failure of the body to keep its temperature within acceptable levels. It occurs when the body produces or absorbs more heat than it dissipates. When the body becomes overheated, several reactions are triggered. The body first tries to rid itself of the excess heat by increasing circulation in the blood vessels close to the surface of the skin, which is why the face and hands often turn red. Then, the body attempts to dissipate the excessive heat through cooling via the perspiration (sweat) it creates. Water, in this case sweat, transfers heat from the body 25 times faster than air. As the sweat evaporates, the skin is cooled and large amounts of heat are removed from the body. When the heat becomes too great, the body protects its internal organs from the loss of water by gradually shutting down this mechanism.

O.4.4.1.3 It is worth noting that normal core body temperature fluctuates during each 24-hour period and that the temperature recorded depends upon the place in the body at which the measurement is made. Typical normal temperatures are 36.8° ± 0.4 °C (98.2° ± 0.7 °F) taken under the tongue and 37.0 °C (98.6 °F) taken internally. Normal core body temperature can be as high as 37.7 °C (99.9 °F) in the late afternoon.

O.4.4.1.4 As the body temperature rises above normal, the more serious the condition becomes. Body temperatures above 40 °C (104 °F) can be life-threatening.

O.4.4.2 Signs and symptoms

Persons suffering from hyperthermia have various symptoms and exhibit signs. Typical symptoms and signs at different core body temperatures are:

a) 38 °C (100.4 °F): feeling hot; sweating; feeling thirsty; very uncomfortable; feeling slightly hungry. This is classed as hyperthermia (if not caused by a fever);

b) 39 °C (102.2 °F): severe sweating; flushed and red. Fast heart rate and breathlessness; possibly exhaustion;

c) 40 °C (104.0 °F): fainting; dehydration; weakness; vomiting; headache and dizziness; profuse sweating. This condition can be life-threatening and should be treated as a medical emergency, as should those listed in d), e), f) and g);

d) 41 °C (105.8 °F): fainting; vomiting; severe headache; dizziness; confusion; hallucinations; delirium; drowsiness; possibly palpitations and breathlessness;

e) 42 °C (107.6 °F): the casualty may turn pale or remain flushed and red. The casualty may become comatose or be in severe delirium. There may be vomiting and convulsions. Blood pressure may be high or low and heart rate is likely to be very fast;

f) 43 °C (109.4 °F): normally death, or there may be serious brain damage, continuous convulsions and shock. Cardio-respiratory collapse is likely;

g) 44 °C (111.2 °F) or more: almost certainly death, although people have been known to survive up to 46.5 °C (115.7 °F).

O.4.4.3 Treatment

O.3.4.3.1 The underlying cause needs to be addressed. The body needs to be cooled. Move to a shaded area, which is cool, if possible. Cases of mild hyperthermia may be adequately treated through self-care measures, such as increased water intake and resting in a cool place. Monitor the casualty continuously until all signs and symptoms are gone. Seek professional medical attention for anything other than mild hyperthermia.

O.4.4.4 Prevention

O.4.4.4.1 Hyperthermia can be prevented by controlling the body's temperature so that it does not reach a point where symptoms develop. See **O.4.12** for guidance.

O.4.4.4.2 Prevention is better than cure. Watch out for symptoms, and signs in others (buddy checking), and take early remedial action. Advise the first-aider in the group of any concerns.

O.4.5 Dehydration

O.4.5.1 Overview

O.4.5.1.1 Dehydration, which means not enough body water, occurs when the body loses more water than it takes in. When the normal water content of the body is reduced, it can cause the balance of the body's mineral salts or electrolytes to be disturbed – especially the concentrations of sodium and potassium – which can affect the way the body functions.

O.4.5.1.2 Water is lost from the body in many ways. Examples are: breathing; sweating; urinating; vomiting; diarrhoea. It is thought that water loss from the body increases as altitude increases but scientific studies have shown this may not be the case (*Energy and water balance at high altitude*: Klaas R. Westerterp, 2001).

O.4.5.1.3 Dehydration is usually caused by not drinking enough fluid to replace what has been lost. The environmental conditions, the amount of physical effort being used (particularly in hot weather), diet and a person's tolerance to a decrease in body water can all contribute to the condition.

O.4.5.1.4 Typically, the body loses approximately two to three litres of water per day through normal bodily functions. It is essential that this water loss is replaced. The body is able to monitor the amount of water it needs to function by the thirst mechanism, which signals the body to drink when the body water content is reduced. Failure to match intake and loss of water and minerals, especially sodium and potassium, may lead to dehydration.

NOTE *In people over age 50, the body's thirst sensation diminishes and continues to diminish with age.*

O.4.5.1.5 Dehydration can occur due to excessive sweating as the body tries to combat hyperthermia. It can also occur due to an illness, such as persistent vomiting and diarrhoea, or sweating from a fever.

O.4.5.2 Signs and symptoms

O.4.5.2.1 Clause **O.4.5.2** expands on the symptoms given in **O.4.5.1.4**.

O.4.5.2.2 Symptoms of dehydration include, thirst, headache, discomfort, loss of appetite, dry skin decreased urine volume, confusion, unexplained tiredness and irritability. Rope access technicians may experience a reduction in performance, elevated body temperatures, and the rapid onset of fatigue.

O.4.5.2.3 The symptoms of dehydration become increasingly severe with greater water loss, leading to abnormally dark urine, rapid breathing, constipation, dizziness or fainting when standing up, listlessness, insomnia. Heart and respiration rates begin to increase, while body temperature may rise because of decreased sweating. At around 5 % to 6 % water loss, grogginess or sleepiness, severe headaches or nausea, and a tingling in the limbs may all be experienced. With 10 % to 15 % fluid loss, muscles may become spastic, there may be decreased skin turgor, (which is indicated when the skin on the back of the hand is pulled up for a few seconds and does not return to its original state), vision may dim, urination is likely to be greatly reduced and may become painful, and delirium may begin.

O.4.5.3 Treatment

O.4.5.3.1 For minor dehydration, drinking fresh water and stopping fluid loss, e.g. by sweating, is often considered the most effective treatment. However, it should be noted that water on its own restores only the volume of the blood plasma, and not the electrolytes.

O.4.5.3.2 In more severe cases, rehydration should be by the replenishment of both the necessary water and electrolytes. This is usually taken orally and is the treatment of choice for mild dehydration. Avoid drinking seawater or alcohol. They only worsen the condition.

O.4.5.3.3 For severe cases of dehydration, e.g. where there is fainting, unconsciousness and/or other serious symptoms and signs such as the casualty being incapable of standing or is confused, emergency medical attention is required. Under professional medical care, fluids containing a proper balance of replacement electrolytes are given orally or intravenously and the electrolyte status is continuously assessed. There is usually a complete recovery in all but the most extreme cases.

O.4.5.4 Prevention

In normal circumstances, the thirst mechanism should provide an adequate way to maintain proper hydration. In hot environments, especially when coupled with physical effort, the thirst mechanism may not be sufficient on its own and a regular intake of additional water is likely to be required. When large amounts of water are being lost through sweating and at the same time are being replaced by drinking water, maintaining the proper balance of electrolytes can become an issue. Care should be taken when drinking fluids that are hypertonic or hypotonic, with respect to sweating, as there can be serious consequences if levels acceptable to the body are exceeded.

O.4.6 Heat stroke (sun stroke)

O.4.6.1 Overview

Heat stroke, also known as sun stroke, is a form of hyperthermia where the core body temperature is greater than 40.6 °C (105.1 °F) due to exposure to environmental heat and an inability to keep the core body temperature within safe boundaries. Preventive measures include drinking plenty of cool liquids and avoiding excessive heat and humidity.

O.4.6.2 Signs and symptoms

O.4.6.2.1 The signs and symptoms for heat stroke follow the same pattern as those for hyperthermia and dehydration. In addition, the casualty may appear to be intoxicated and may be hostile and confused. There is a drop in blood pressure and a corresponding increase in heart and breathing rate as the body tries to maintain correct circulation. In advanced cases, the decrease in blood pressure sometimes results in pale or bluish coloured skin.

O.4.6.2.2 Other symptoms are that, as sweating ceases, the skin is hot to touch, and headache and gastrointestinal disturbances are prominent, e.g. stomach pain; diarrhoea; vomiting. Acute neurological disturbance, e.g. poor co-ordination; confusion; altered level of behaviour or consciousness, are key signs of heat stroke. Without treatment, progression to coma and death is very likely.

O.4.6.3 Treatment

O.4.6.3.1 Anyone suspected of suffering from heat stroke should be treated as a medical emergency. In such cases, the body temperature needs to be lowered quickly. The casualty should

be moved to a cool, shaded area and excess clothing removed to assist heat loss. Any other treatment should be by a qualified medical professional.

O.4.6.3.2 Immersing a person into a bath of cold water is a recognized method of cooling but should only be carried out by a qualified medical professional.

O.4.6.4 Prevention

See O.4.12.

O.4.7 Heat exhaustion

O.4.7.1 Overview

Heat exhaustion is a warning to the body that it can no longer keep itself cool. Great care should be taken because heat exhaustion can lead to heat stroke.

O.4.7.2 Signs and symptoms

Casualties suffering from heat exhaustion may experience thirst, dizziness, weakness, nausea, a lack of co-ordination, heavy sweating and cold and clammy skin. Some people with heat exhaustion have a rapid pulse.

O.4.7.3 Treatment

O.4.7.3.1 Rest in a cool place and drink plenty of fluids but not alcohol or drinks containing caffeine, e.g. coffee; tea; some carbonated drinks. If the symptoms do not disappear in approximately 15 minutes, or if in doubt, seek medical help.

O.4.7.3.2 After recovery from heat exhaustion, the body is likely to be more sensitive to high temperatures for approximately one week. Avoid hot weather and heavy exercise until advised by a medical professional that it is safe to resume normal activities.

O.4.7.4 Prevention

See O.4.12.

O.4.8 Heat oedema

O.4.8.1 Overview, signs and symptoms

Oedema is the medical term for fluid retention in the body. Heat oedema is a medical condition in which there is swelling of the hands, ankles and feet when a person is hot. Heat oedema occurs when the hot conditions cause the blood vessels to dilate (expand) and thus allow body fluids (e.g. blood) to move by gravity more easily than normal into the legs (sometimes also the hands), where it pools, which causes the swelling. It can particularly affect a person who is in a prolonged upright position, either sitting or standing.

O.4.8.2 Treatment

Rest in the shade or in a cool building, with the legs elevated. Drink plenty of fluids, but not alcohol or drinks containing caffeine, e.g. coffee; tea; some carbonated drinks. The swelling should disappear after a short while. If it does not, seek medical help.

O.4.8.3 Prevention

O.4.8.3.1 To prevent heat oedema, avoid excessive heat and prolonged sitting or standing, especially immobile sitting and standing.

O.4.8.3.2 Keeping the body cool should reduce dilation of the blood vessels, and thus reduce the pooling of fluids in the legs (and hands).

NOTE There is an increased risk of heat oedema for older persons, especially those with other blood circulation problems.

O.4.9 Heat rash

O.4.9.1 Overview, signs and symptoms

O.4.9.1.1 Heat rash is a skin irritation, which looks like a group of red pimples or small blisters and typically occurs on the neck and upper chest, in the groin, under the breasts and in elbow creases. These small, itchy bumps may also feel prickly, stinging or burning.

O.4.9.1.2 Heat rash begins with excessive sweating, usually in hot, humid conditions. The heavy sweating allows dead skin cells and bacteria on the skin to block the sweat glands, thus forming a barrier and thereby trapping sweat beneath the skin, where it builds up, causing the characteristic bumps. As the bumps burst and sweat is released, there may be a prickly or stinging sensation, hence the condition's alternative name of *prickly heat rash*.

O.4.9.2 Treatment

O.4.9.2.1 In most cases, heat rash is likely to clear up on its own in a few days if the affected area is kept cool and dry.

Rope access technicians experiencing heat rash:

a) should keep the affected area dry;

b) may use an appropriate medical preparation to reduce discomfort (as advised by a medical professional);

c) should refrain from using any type of oil-based product on their skin (which might block the sweat glands);

c) should try to work in a cooler, less humid environment if possible.

O.4.9.2.2 If the heat rash does not disappear within a few days, or there is an infection where the bumps have burst, seek medical advice, as medication may be needed.

O.4.9.3 Prevention

To prevent heat rash occurring:

a) avoid excessive heat and humidity;

b) keep cool with a fan or air conditioning;

c) take a cool shower or bath and let the skin air dry.

O.4.10 Heat cramps

Heat cramps are a painful tightening of muscles in the stomach, arms, or legs. These cramps can result from hard physical work. Heat cramps are a sign that the body is too hot and needs to be cooled down. However, body temperature and pulse usually stay normal during heat cramps and the skin may feel moist and cool. Rest in the shade or in a cool building. Drink plenty of fluids, but not alcohol or drinks containing caffeine, e.g. coffee; tea; some carbonated drinks.

O.4.11 Heat syncope

Heat syncope is a sudden dizziness that may happen during activities in hot weather. Rest in the shade or in a cool building, with the legs elevated. Drink plenty of fluids, but not alcohol or drinks containing caffeine, e.g. coffee; tea; some carbonated drinks. The dizziness should disappear after a short while. If it does not, seek medical help.

O.4.12 General guidance on the prevention of heat-related illnesses

O.4.12.1 Rope access technicians new to working in hot conditions are generally most at risk from heat-related illnesses. The workload for such persons should be easy at first and increased only gradually. There should be more frequent breaks to help new workers and those returning to a job after time away to build up a tolerance for hot conditions. It is important that they understand the risks when working in hot conditions. Rope access technicians should not be pressured, or feel they are being pressured, into performing above their usual capabilities, particularly when starting a new job.

O.4.12.2 Plan for rescue. When planning the work for a given task in hot and humid conditions, consider the potential for heat-related issues that may result in the need to rescue a rope access technician. Plan the access and retrieval systems accordingly, keeping in mind the use of rig-for-rescue arrangements, and the condition of the rope access technicians and stand-by team.

O.4.12.3 Employers should take steps to protect employees from heat-related illnesses. Examples are:

a) schedule maintenance and repair jobs in hot areas for cooler months;

b) schedule hot jobs for the cooler part of the day;

c) include sufficient time for rope access technicians to egress the workplace with a safe margin to prevent overexposure during that egress;

d) lower the ambient temperature by the use of natural or forced ventilation (indoors);

e) consider the use of commercially available temperature relief products, such as cooling vests and cooling snakes in the helmet;

f) consider the use of water mist sprays;

g) reduce the physical demands on employees, increasingly so as the temperature and or humidity rises, e.g. short shifts with longer rest periods in between; job-rotation schedules with maximum working times;

h) provide cool water or liquids to employees (not drinks with caffeine, alcohol or large amounts of sugar) and have a drinks regime to ensure regular intake;

i) consider the provision of cool water showers, baths or sponge baths;

j) provide rest periods with water breaks;

k) provide cool areas for use during break periods;

l) monitor employees for risk of heat stress;

m) provide heat stress training that includes information about:

  (i) the risks involved when working in high temperatures;

  (ii) how to prevent heat-related illness;

  (iii) the symptoms of heat-related illnesses;

  (iv) the importance of monitoring oneself and co-workers for symptoms (buddy checking);

  (v) treatment for heat-related illnesses (first aid);

  (vi) using personal protective equipment when working in hot conditions;

n) continuously assess the risks, e.g. by monitoring the temperature and by buddy checking for signs of heat-related illnesses;

o) provide emergency contacts.

O.4.12.4 Wherever possible, rope access technicians should avoid exposure to extreme heat, sun exposure, and high humidity. When these cannot be avoided, rope access technicians should take the following steps to prevent heat-related illnesses:

a) wear light-coloured, loose-fitting, breathable clothing such as cotton, which ideally should contain solar protection;

b) cover the head and wear high factor sunscreen (minimum 30 SPF, the higher the better), at least on any exposed parts of the body;

c) avoid non-breathable synthetic clothing;

d) gradually build up to heavy work;

e) carry out any heavy work during the coolest parts of day;

f) increase the number of rest periods in extreme heat and humidity and when the work is strenuous;

g) take breaks in the shade or in a cool area when possible;

h) increase fluid intake, regardless of activity level. Drink water frequently and enough so that there is never a feeling of thirst. Do not wait until thirsty to drink;

i) avoid drinks with caffeine, alcohol, and large amounts of sugar as these cause body fluid loss. Also avoid very cold drinks, because they can cause stomach cramps;

j) replace salt and minerals. Heavy sweating removes salt and minerals from the body. These are necessary for the body and it is essential they are replaced. A sports beverage can replace the salt and minerals lost in sweat. Persons on a low salt regime should check with their doctor before drinking sports beverages or taking salt tablets;

k) be aware that protective clothing or other protective equipment may increase the risk of heat stress;

l) monitor own and co-workers' physical condition (buddy checking). Heat-induced illness can cause a person to become confused and not realise their condition.

O.4.12.5 Indoor worksites in hot conditions, e.g. coal-fired power stations, should have air-conditioned refuge areas located at strategic positions.

O.4.12.6 In addition to the standard contents, first-aid kits should include equipment specific to the hazards likely to be encountered, e.g. sunburn cream and dressings.

O.4.12.7 **Table O.4.4** is taken from the Heat Index and provides a useful summary of what actions should be taken if symptoms are experienced or signs observed in colleagues for various heat-related illnesses. (See https://www.osha.gov/SLTC/heatillness/heat_index/pdfs/all_in_one.pdf.) In such cases, the casualty should stop work immediately, and action should be taken to help him/her. Remember that heat stroke is a medical emergency and the emergency services should be called immediately. Colleagues should follow the guidelines in **Table O.4.4** for helping the casualty, while waiting for the emergency services to arrive.

Table O.4.4 – Guidance on how to respond to heat-related emergencies

Heat-related illness	Symptoms	First aid
Heat stroke Most serious	Confusion Fainting Seizures Excessive sweating or red, hot, dry skin Very high body temperature	Call the emergency services. While waiting for help: 1. Place casualty in a shady, cool area. 2. Loosen clothing, remove outer clothing. 3. Fan air on the casualty; cold packs in armpits. 4. Wet person with cool water. 5. Provide fluid (preferably water – no alcohol or caffeine) to conscious casualties only. 6. Stay with the casualty until help arrives.
Heat exhaustion	Cool, moist skin Heavy sweating Headache Nausea or vomiting Dizziness Light headedness Weakness Thirst Irritability Fast heartbeat	Take the following actions: 1. Get the casualty to lie down in a cool, shady place. 2. Give the casualty plenty of water or other cool beverage to drink – no alcohol or caffeine. 3. Cool the casualty with cold compresses or ice packs. 4. Take to clinic or emergency room for medical evaluation or treatment if signs or symptoms worsen or do not improve within 60 minutes. 5. Do not return to work that day and not until approval from a medical professional.
Heat cramps	Muscle spasms Pain, usually in abdomen, arms or legs	Take the following actions: 1. Get the casualty to rest in a shady, cool area. 2. Give the casualty plenty of water or other cool beverage to drink – no alcohol or caffeine. 3. Wait a few hours before allowing the casualty to return to strenuous work. 4. Get the casualty to seek medical attention if the cramps do not stop.
Heat rash (Prickly heat) Most common	Clusters of red bumps on the skin Often appears on the neck, upper chest, folds of skin	Take the following actions: 1. Try to work in a cooler, less humid environment when possible. 2. Keep the affected area dry.
The information in this table is not definitive and is for guidance only		

Source: US National Oceanographic and Atmospheric Administration's National Weather Service (modified).

O.5 Protecting against ultra-violet radiation

O.5.1 Overview

O.5.1.1 The information and advice contained in this section of Annex O (**O.5**) covers the risks of exposure to ultra-violet radiation. While this section focuses on work outdoors and the effect of ultra-violet radiation from the sun, it should be noted that welders, working indoors or outdoors, can be exposed to ultra-violet radiation from the welding arcs. For some general guidance on working in the environmental conditions covered by Annex O, see **O.1**.

O.5.1.2 Exposure to ultra-violet radiation (referred to from now on as UV radiation) without proper protection can be hazardous, with risks of sunburn, damage to the eyes and several types of skin cancer. This section explains what UV radiation is and how to protect against it in a working environment. It gives information on the UV index, Sun Protection Factors (SPFs), the UVA Protection Grade (PA) or UVA Protection Factor (UVA-PF) and the UVA star rating. Information and advice is given on sunscreens and protective clothing, plus some additional advice for both rope access technicians and their employers.

O.5.1.3 The strength of UV radiation varies, depending on the world location, the time of year and on a number of different weather factors. Sunlight and, therefore, UV radiation is at its strongest during the summer and between 10:00 h and 16:00 h. However, there is UV radiation even on cloudy days. Working outdoors without proper protection increases the possibility of sunburn and of more serious conditions, i.e. skin cancer and eye damage, especially during the summer.

O.5.1.4 At worksites where there are areas of reflective surfaces, e.g. snow; light-coloured sand; concrete; glass; metal; bodies of water, any exposed skin may be subject to UV radiation not only from above and to the side but also from below by reflected light, with an increased risk of sunburn and other harmful effects.

O.5.1.5 It should be noted that many commonly-used drugs increase a person's sensitivity to sunlight and, thus, the risk of getting sunburn. Examples are: thiazides; diuretics; tetracycline; doxycycline; sulfa antibiotics; non-steroidal anti-inflammatory drugs such as ibuprofen; some anti-malarials.

O.5.2 Ultraviolet radiation

O.5.2.1 Ultraviolet rays

O.5.2.1.1 UV radiation is invisible electromagnetic radiation emitted from the sun with wavelengths between 100 and 400 nanometres (nm). These rays cause increasing damage to an exposed person as the wavelength decreases, i.e. the shorter the wavelength, the greater the energy and the greater the risk of damage to the exposed person.

O.5.2.1.2 Based on its characteristics and effects, UV radiation is divided into three wavelength ranges: UVA, UVB and UVC:

a) **UVA** covers the wavelength range 320 to 400 nm. UVA is not absorbed by the ozone layer (see **O.5.2.2**) and is the greatest source of solar radiation at the Earth's surface.

b) **UVB** covers the wavelength range 280 to 320 nm. UVB is partially absorbed by the ozone layer. UVB rays that are not filtered out cause sunburn and other harm to persons.

c) **UVC** covers the wavelength range 100 to 280 nm. UVC is the most dangerous form of UV radiation but generally does not pose a risk to rope access technicians, because the rays are absorbed by the ozone layer. However, artificial UVC (e.g. that emitted by electrical discharges) is a threat for certain groups of workers, e.g. welders.

O.5.2.1.3 UV rays can penetrate and change the structure of skin cells. UVA penetrates beyond the top layer of human skin and is known to cause premature skin ageing. Scientists believe that UVA radiation can increase the risk of developing skin cancer. UVB radiation, which causes sunburn, penetrates less deeply into skin than UVA radiation, but can still cause some forms of skin cancer.

O.5.2.2 Ozone layer

The ozone layer is found mostly in the stratosphere, which is an area of the Earth's atmosphere at an altitude ranging from approximately 10 km (6 miles) to 50 km (31 miles) above the Earth's surface. Ozone is a molecule composed of three atoms of oxygen. It absorbs the most dangerous ultraviolet rays before they can hit the Earth, thus protecting life from their adverse effects. However, ozone depletion occurs in some areas of the globe, where dangerous UV rays can penetrate.

O.5.2.3 UV index

O.5.2.3.1 The UV index is a way of expressing a forecast of the amount of UV radiation at a geographical location at a given time and was developed by the World Health Organization. The aim of the index is to warn people of increased risk and to encourage them to protect themselves against the risks of skin cancer and skin damage such as sunburn. The UV index is a good way to get an idea of the UV radiation levels in the geographical area of the worksite. It is presented as a range of numbers:

1 to 2: low exposure;

3 to 5: moderate exposure;

6 to 7: high exposure;

8 to 10: very high exposure;

11 plus: extreme exposure.

O.5.2.3.2 The higher the number in the UV index, the greater the amount of skin- and eye-damaging UV radiation there is. Therefore, the higher the UV index, the less time it takes before skin or eye damage can occur.

O.5.2.3.3 The UV index can be high at many times of the year. It does not have to be hot and there may be cloud cover. It is important, therefore, that the forecast is checked regularly and in different weather conditions.

O.5.2.3.4 The exposure time to the sun at a given UV index level depends also on the skin type. For example, for people with fair skin, when the UV index is seven, it takes less than 20 minutes until the skin starts to redden. For someone with darker skin, the same UV index level may need more than 40 minutes to cause an effect.

O.5.2.3.5 Wavelengths in UVB rays are the main contributors to the UV index. The contribution from the UVA rays is only about 10 %. The UV index, therefore, is highly affected by the thickness of the ozone layer.

O.5.3 Effects of exposure to UV radiation

O.5.3.1 Sunburn

O.5.3.1.1 General

Sunburn is skin damage caused by spending too much time outdoors without wearing a protective sunscreen and/or appropriate protective clothing. It is often very painful. Periods of overexposure to the sun can lead to an increased risk of skin cancer. The eyes can also be burned from exposure to the sun. Excessive exposure of eyes to sunlight may cause cataracts, tissue growth that leads to blindness, and possibly macular degeneration, a well-known cause of blindness.

O.5.3.1.2 Signs and symptoms

O.5.3.1.2.1 Signs and symptoms of sunburn include:

a) red, warm and tender skin;

b) swollen skin;

c) blistering;

d) headache;

e) fever;

f) nausea;

g) fatigue;

h) red, dry and painful eyes, sometimes feeling as though they have grit in them.

O.5.3.1.2.2 The symptoms of sunburn usually start to manifest themselves about four hours after exposure to the sun. The pain from sunburn is worse between six and 48 hours after sun exposure and is usually resolved in three to five days. Skin peeling usually begins three to eight days after sun exposure.

O.5.3.1.3 Treatment

O.5.3.1.3.1 The symptoms of sunburn can be treated by:

a) appropriate painkillers (in doses as recommended by the manufacturer) to relieve pain and headache, and to reduce fever;

b) drinking water to help replace any loss of fluid;

c) cool baths or by the gentle application of cool wet cloths on the burned area to give some relief from the pain;

d) the application of a suitable after-sun cream, which may give additional relief;

e) applying a low-dose (0.5 % to 1 %) hydrocortisone cream (applied as recommended by the manufacturer), which may be helpful in reducing the burning feeling and swelling, and may assist the healing process.

O.5.3.1.3.2 Rope access technicians with sunburn should avoid further exposure to the sun until the burn has gone. This includes direct sunlight through windows.

O.5.3.1.3.3 Seek professional medical attention if there any feelings of ill health considered to be attributable to the sunburn; if there are any concerns about the sunburn, or if there are any of the following symptoms:

a) severe sunburn covering more than 15 % of the body;

b) blistering;

c) chills;

d) dizziness;

e) headaches;

f) nausea;

g) high fever (more than 38 °C/101 °F);

h) dehydration;

i) extreme pain.

O.5.3.1.3.4 It is important to avoid the risk of infection. If blistering occurs, actions that can be taken are:

a) lightly bandage or cover the area with gauze to prevent infection;

b) do not break the blisters, as this could slow the healing process and increase the risk of infection;

c) when the blisters break and the skin peels, dried fragments may be removed and an antiseptic ointment or hydrocortisone cream may be applied (in accordance with the manufacturer's instructions).

O.5.3.1.4 Prevention

See **O.5.4** for guidance on protecting against the effects of UV radiation.

O.5.3.2 Skin cancer

O.5.3.2.1 General

There are three types of skin cancer: basal cell; squamous cell and melanoma. All three types are serious but melanoma is the most serious.

O.5.3.2.2 Signs and symptoms

Signs and symptoms of skin cancer include:

a) a flat or slightly elevated discoloured patch on the skin (tan, brown, red, black, blue, or white);

b) a scaly, reddish patch area of skin;

c) a sore that does not heal;

d) red lumps;

e) a crusty, warty appearance on the skin;

f) a scar-like area that is white, yellow or waxy;

g) a small raised bump that looks smooth, shiny and translucent;

h) a raised growth with a depression in the centre;

i) moles with colours that are not the same throughout;

j) a change in the size, shape, or colour of an existing spot or mole;

k) moles that are not symmetrical in shape or have irregular borders (ragged, notched, or blurred edges);

l) large moles (say more than 8 mm/5/16 inch in diameter);

m) itchy or painful moles;

n) the appearance of new moles.

O.5.3.2.3 Treatment

O.5.3.2.3.1 If there are any of the signs or symptoms described in **O.5.3.2.2**, seek professional medical attention without delay.

O.5.3.2.3.2 Basal cell cancer and squamous cell cancer can usually be removed by surgery or topical treatments. Malignant melanoma has significant implications and can be fatal.

O.5.3.2.4 Prevention

Rope access technicians are encouraged to check their own skin often for the signs and symptoms given in **O.5.3.2.2**. They should seek professional medical attention as soon as possible if they notice anything unusual. See **O.5.4** for guidance on protecting against the effects of UV radiation.

O.5.4 Protecting against the effects of UV radiation

O.5.4.1 Sun Protection Factor

O.5.4.1.1 The Sun Protection Factor (SPF) is a number quantifying the effectiveness of sunscreens against UVB radiation. It is important to note that SPF is measured in the laboratory under standardized conditions, so caution should be used when estimating the time a person can actually stay in the sun. SPF may be rated not only in numbers (e.g. SPF 30) but also by description, intended to make the SPF system easier to understand:

Low protection (SPF 6 to SPF 14);

Medium protection (SPF 15 to SPF 29);

High protection (SPF 30 to SPF 50);

Very high protection (SPF 50 plus).

O.5.4.1.2 SPF plays no part in protecting the body from harmful effects caused by UVA radiation. UVA protection in sunscreens is presented two ways. These are explained in **O.5.4.2** and **O.5.4.3**.

O.5.4.2 UVA Protection Grade (PA)/UVA Protection Factor (UVA-PF)

The UVA Protection Grade (PA) or UVA Protection Factor (UVA-PF) is a system of determining the amount of protection of a sunscreen against UVA radiation. The test is carried out on human beings (as is the SPF test) and is considered to be the most rigorous form of UVA testing. Under this system, UVA results are usually marked on sunscreens within a circle containing the letters PA in one of three levels, with PA+ being the lowest level of protection and PA+++ the highest.

O.5.4.3 UVA star rating

O.5.4.3.1 The UVA star rating is a method of showing the UVA protection in a sunscreen when compared as a ratio to the levels of protection provided against UVB. The level of UVA protection is determined by the UVA-PF test (see **O.5.4.2**) and then calculated based on the SPF of the product. The stars range from nought to five, the bigger the number of stars the better the protection. However, it should be borne in mind that the number of stars is based on the SPF, so a high number of stars for a sunscreen with a low SPF gives less protection against UVA than the same number of stars for a higher rated SPF.

O.5.4.3.2 In the European Union, a sunscreen that achieves a UVA protection rating of one third or more of the UVB protection (SPF) is allowed to use a logo comprising a circle with the capital letters UVA inside it and the relevant number of stars may also be placed inside the circle.

O.5.4.4 Sunscreens

O.5.4.4.1 Sunscreens are products which combine several ingredients to help prevent the sun's UV radiation from reaching the skin. Sunscreens that protect against both UVA and UVB radiation, which are known as *broad spectrum sunscreens*, are recommended.

O.5.4.4.2 Sunscreens with a minimum SPF of 30 and a UVA rating of 4 or 5 stars are generally considered to be an adequate standard of protection. Sunscreens with a higher SPF do give a higher protection against UVB rays but not proportionally, e.g. an SPF 60 sunscreen does not give twice as much protection as an SPF 30 sunscreen.

O.5.4.4.3 The first application of sunscreen should be at least 20 minutes before exposure to the sun.

O.5.4.4.4 Choose a sunscreen that is water resistant for longer-lasting protection.

O.5.4.4.5 Apply sunscreens liberally, regularly and in accordance with the manufacturer's instructions, paying special attention to covering the ears, scalp, lips, neck, backs of hands and any other exposed skin.

NOTE Rope access technicians with a natural sun tan also need to apply sunscreen. A tan does not provide any significant protection from UV exposure.

O.5.4.4.6 In the absence of clear manufacturer's instructions, sunscreens should be reapplied at least every two hours and each time a person might have compromised the covering, e.g. due to heavy perspiration; submersion in water.

O.5.4.4.7 Some sunscreens may be less effective when applied in combination with an insect repellent. A more frequent application of sunscreen may be required when the two products are used together.

O.5.4.4.8 The performance of a sunscreen is also affected detrimentally by wind and humidity.

O.5.4.4.9 Check the use-by date on the sunscreen packaging. Sunscreens can lose their potency with time. Out of date sunscreens should be discarded.

O.5.4.5 Clothing

O.5.4.5.1 An effective way to protect against exposure to UV radiation is by wearing suitable clothing.

O.5.4.5.2 Clothing made from a material with a close weave should be chosen as it is more protective against UVA and UVB than clothing made from loosely-woven materials. Shiny, dark materials provide more protection than light-coloured pastel shades or materials with a rough finish. Dark colours usually absorb more UV rays than lighter colours but have the disadvantage of absorbing heat as well. Bright colours, e.g. reds and yellows, give more protection than pale ones. White fabrics containing optical brightening agents (often found in washing powders and liquids) absorb both UVA and UVB rays, but especially UVA. Choose clothing that covers as much skin as possible.

O.5.4.5.3 Clothing with built-in protection against UVB is made by several manufacturers and is recommended. There is a rating system for such sun-protective textiles and clothing, known as Ultraviolet Protection Factor (UPF), which represents the ratio of UVB protection when measured with and without the protection of the fabric.

The levels of protection are:

Good: UPF 15 to UPF 24 (93.3 % to 95.9 % UVB filtered out);

Very good: UPF 25 to UPF 39 (96 % to 97.4 % UVB filtered out);

Excellent: UPF 40 to UPF 50+ (97.5 % to 98+ % UVB filtered out).

O.5.4.5.4 Rope access technicians should refer to the UPF rating (which should be on the clothing label) and choose clothing with the highest rating available that is appropriate to the task and location.

Close-weave fabric with a UPF of 30 or greater offers excellent protection and should be suitable for most applications. Where fabric does not have a UPF rating, a general rule is that UV radiation is likely to penetrate the fabric if light can be seen through it.

O.5.4.5.5 It is important to protect all parts of the face, especially the nose and ears, which can receive significant exposure. Lightweight balaclavas exist for such a purpose. The hands are also vulnerable, which can be protected by wearing appropriate lightweight gloves.

O.5.4.5.6 When wearing a safety helmet, additional protection may be needed to protect the face, ears and neck. Various sun protection accessories are available for attachment to helmets, e.g. broad rims, peaks and neck flaps that cover the back and sides of the neck. Also see **O.5.4.5.3**. Rope access technicians should not forget to cover their head and neck after removal of their safety helmets outdoors. A wide brimmed hat and neck flap made from a close-weave fabric of UPF 50+ should provide sufficient head protection. As a hat is likely to protect the face only from direct sunlight and is unlikely to stop exposure from reflected or scattered UV radiation, an appropriate sunscreen should be used also.

O.5.4.6 Additional guidance

O.5.4.6.1 To prevent excessive exposure of the sun to the eyes, it is recommended that sunglasses or safety sunglasses, as required, are worn. These should have high UVA and UVB protection (as close as possible to 100 %) and should include side panels.

O.5.4.6.2 Even when working in the shade or under overhead protection, rope access technicians should continue to use sun-protective clothing and sunscreen for maximum protection.

O.5.4.6.3 Employers should actively assist the protection of rope access technicians against excessive exposure to UV radiation, e.g. by:

a) where possible, avoiding the scheduling of work outdoors when exposure to sunlight and, therefore, UV radiation is at its greatest;

b) considering reducing the length of a rope access technician’s work period to minimize exposure to UV radiation, e.g. by job rotation;

c) ensuring that rope access technicians are wearing adequate protective clothing and that appropriate sunscreens are being used and applied regularly;

d) where possible, providing shade to the area in which work is being carried out;

e) providing shaded or indoor rest areas;

f) providing training to workers to enlighten them about UV radiation, including:

(i) the risks of exposure and why rope access technicians working outdoors are a high risk group;

(ii) how to prevent and protect against exposure;

(iii) the signs and symptoms of over-exposure and actions to be taken if there are such signs and symptoms.