GLOBAL WIND ORGANISATION

Belay ROPE ACCESS Training for a job less ordinary...

Basic Safety Training

Manual Handling

Foreword

The Global Wind Organisation (GWO) is an association of Wind Turbines owners and manufacturers with the aim of supporting an injury free work environment in the wind industry.

The Basic Safety Training standard was created to establish consistent and recognisable basic training for the industry.

The BST includes five elements:

- First Aid
- Manual Handling
- Fire Awareness
- Working at Height
- Sea Survival

The standard describes the requirements for Basic Safety Training in the wind industry that are recommended by GWO. Where national legislation sets higher requirements for the training, the Training Provider shall incorporate these requirements in the training programme.

The GWO Basic Safety Training does not include any Technical Safety Training such as working with electricity, equipment with stored energy etc. Additional training may be required due to company or country specific requirements.

GWO recommends a company specific Basic Safety Introduction and Technical Safety Training as additional training.

Learning Objectives

The manual handling module is designed to ensure that:

a) The delegates are able to demonstrate understanding of the importance of carrying out work duties in a safe and sound manner in accordance with the legislative requirements of their geographic location.

b) The delegates are able to identify aspects of their job tasks that could increase a worker's risk of developing muscular / skeletal injuries

c) The delegates are able to demonstrate understanding of safe practices for manual handling including the correct handling of equipment

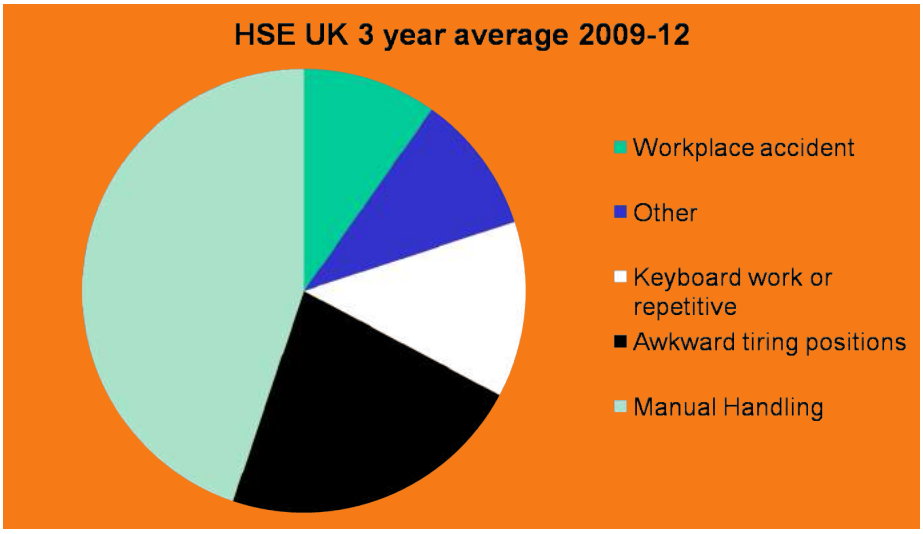
d) The delegates are able to identify signs and symptoms of injuries related to poor manual handling techniques and have knowledge of reporting methods

e) The delegates are able to demonstrate a problem solving approach to manual handling in a wind turbine environment

f) The delegates are able to demonstrate manual handling risk reduction techniques

Introduction

Manual handling is one of the most common causes of injury at work and causes over a third of all workplace injuries which include work related Musculoskeletal Disorders (MSDs) such as upper and lower limb pain/disorders, joint and repetitive strain injuries of various. It is important to understand the hazards and risks associated with manual handling and the methods for controlling those risks.



Legislation

Health and safety in the UK

The Health and Safety Executive (HSE) is the national independent watchdog for work-related health, safety and illness. HSE is an independent regulator and act in the public interest to reduce work-related death and serious injury across Great Britain's workplaces.

ACOPs and Guidance

HSE publish guidance and approved codes of practice (ACOPs) to assist employers to meet their legal obligations in relation to the regulations.

Guidance

HSE guidance provides advice to help you understand how to comply with the law; explanations of specific requirements in law; specific technical information or references to further sources of information to help you comply with your legal duties

ACOPs

ACOPs describe preferred or recommended methods that can be used (or standards to be met) to comply with regulations and the duties imposed by the Health and Safety at Work etc Act

If employers are prosecuted for a breach of health and safety law, and it is proved that they have not followed the relevant provisions of the ACOP, a court can find them at fault unless they can show that they have complied with the law in some other way.

Health and Safety at Work Act 1974

This legislation forms the foundation for health and safety in the UK. It sets out duties which employers have towards their employees and members of the public. It also sets out duties which employees have to themselves, their colleagues and the public. Many other regulations have been passed to support these regulations over the years.

Employer's duties

- Ensure the health, safety and welfare of their employees at work

- Provision of safe plant and equipment
- Ensure safety and avoid risks to health associated with articles and substances
- Provision of information, instruction and training to ensure the health safety of employees
- Maintain a safe place of work
- Provision of a safe and healthy work environment with adequate welfare facilities

Employees Duties

- Employees and the self-employed have a duty to take reasonable care for the health and safety of themselves and any other people who might be affected by their acts or omissions
- Cooperate with employers and others to enable them to comply with their statutory duties
- Must not intentionally or recklessly misuse anything provided in the interest of health and safety

Management of Health and Safety at Work Regulations

These regulations supplement the requirements of the Health and Safety at Work Order. More detail is given regarding the requirements of employers to manage health and safety. A systematic approach must be employed to identify and mitigate hazards in the workplace. Formal risk assessments and method statements play an important role in this. The regulation also requires a system to monitor safety and health of employees and of the management system itself. More detail is provided regarding information, instruction and supervision of workers and the issues surrounding young workers and expectant mothers are covered.

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)

These regulations require the immediate reporting of specific accidents, ill health and dangerous occurrences to the enforcing authority. Fatalities, over 7 day injuries, major injuries, diseases and dangerous occurrences must be reported to your company's nominated person who will notify the HSE where appropriate. It is also recommended that near misses be reported to help companies prevent future accidents. The following must be reported to HSE:

- Workplace deaths
- Specified Injuries
- Injuries resulting in +7 days incapacitation
- Occupational disease
- Dangerous occurrences (specified list)
- Gas incidents

Manual Handling Regulations

These regulations require employers to assess manual handling risks to employees and eliminate or reduce the risks to a reasonable level.

Employers have a duty to:

- ***Avoid*** the need for hazardous manual handling where reasonably practicable
- ***Assess*** the risk of manual handling that can't be avoided
- ***Reduce*** the risk of injury from manual handling so far as is reasonably practicable

Employees have a duty to:

- Follow systems of work in place for their safety
- Use equipment provided for their safety properly
- Cooperate with their employer on health and safety matters
- Inform their employer if they identify hazardous handling activities
- Take care to make sure their activities do not put others at risk.

Other Regulations and Standards

Depending on the nature of the task and the environment, there will be other applicable regulations that will need to be adhered to. Examples might include:

- Confined Space regulations
- Work at Height regulations
- Lift Operations and Lift Equipment Regulations (LOLER)
- Personal Protective Equipment Regulations
- Provision and Use of Work Equipment Regulations (PUWER)

Other jurisdictions will have their own regulations which must be adhered to when working in those areas. Employers must make themselves familiar with the legislative requirements for any jurisdiction they operate in.

There may also be applicable standards for equipment and practices which can be applicable locally or internationally. For example, there is an international standard for manual handling operations:

- ISO 11228-1:2003 Ergonomics. Manual handling lifting and carrying

Risks and Hazards

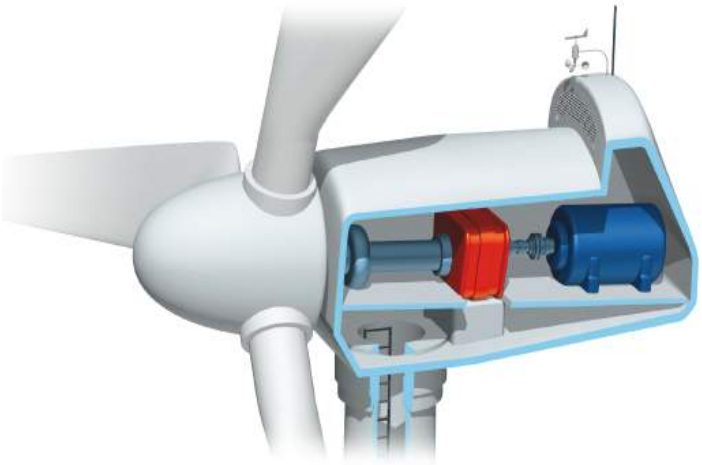
Definitions

"Manual handling operations" means any transporting or supporting of a load (including the lifting, putting down, pushing, pulling, carrying or moving thereof) by hand or by bodily force.

"Hazard" means a potential source of harm or adverse health effect on a person or persons.

"Risk" is the likelihood that a person may be harmed or suffers adverse health effects if exposed to a hazard.

Manual Handling Hazards



There are a number of manual handling hazards in the wind industry that must be assessed. Many areas on a wind turbine have restricted space and can make some routine manual handling operations more difficult and increase the risk of injury. The primary types of manual handling hazards are:

Awkward Body Position – This is primarily caused by the often limited area to stand up or lift efficiently.

Forceful Exertions – This hazard is always possible when working with heavy machinery and components.

Repetitive motions – The most likely cause of repetitive strain injuries (RSI's) is the climbing of the main access ladder from the ground to the nacelle. Over time the repetition of strain on the joints and muscles can lead to injuries. In some cases, these injuries could be serious and have long term implications.

Contact Stress – this is when soft tissue areas of the body come into contact with sharp or hard objects. This could occur when kneeling or lying on equipment to access awkward areas.

Vibration – vibration hazards are present in wind turbines and can come from a variety of sources including bearings, shafts and other associated machinery in the nacelle. There is also a certain amount of resonance caused by the wind against the structure.

After the hazards have been identified, an assessment must be made regarding the duration, intensity and frequency of exposure to the hazards. As the intensity of the hazard increases, the frequency and or duration of exposure should be reduced. Management of the level of risk associated with the hazards can be done through:

- Avoiding the need for hazardous manual handling where reasonably practicable
- Assess the risk of injury from any hazardous manual handling that can't be avoided
- Reduce the risk of injury from hazardous manual handling, so far as is reasonably practicable.

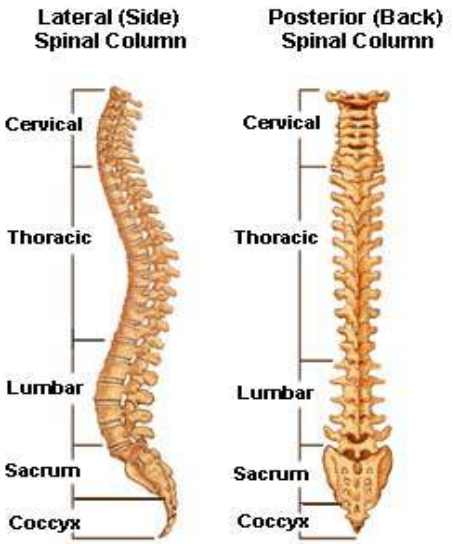
An example of this is the reduction of risk associated with repetitive strain injuries that may be caused by climbing the access ladder on the wind turbine. Many newer wind turbines are fitted with service lifts or climb assist systems to remove the hazard. In other cases, operating companies will establish daily climbing limits. For example, a 240 metre daily climbing limit would only permit 2 ascents on a 100 metre turbine.

Spinal Anatomy and Posture

Musculoskeletal Injuries

In 2011-12, the HSE reported that there were 176000 back injuries and 177000 upper limb injuries as a result of workplace injuries. Over one third of workplace injuries are a result of manual handling operations. It is important to understand the basic structure and function of the body in order to help reduce injuries.

Spinal Anatomy

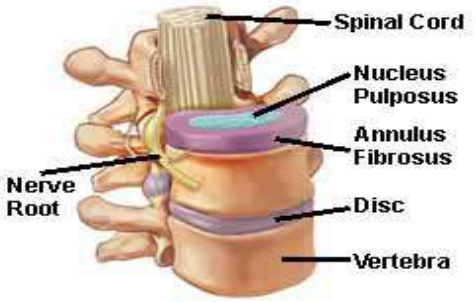


There are 5 regions of the spine which are normally held in a neutral position with a slight "lordotic" curve as seen on the left. The upper three regions are flexible, while the lower two are fused together and inflexible.

The spine has 3 primary functions:

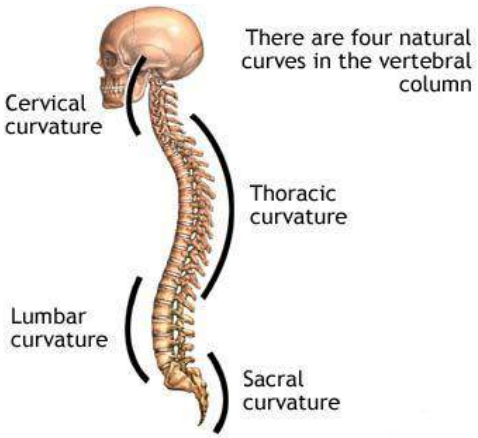
- Protection of the spinal cord
- Structural support
- Enables flexible motion

Between each vertebral body is an intervertebral disc. This disc acts as a shock absorber in the spinal column.

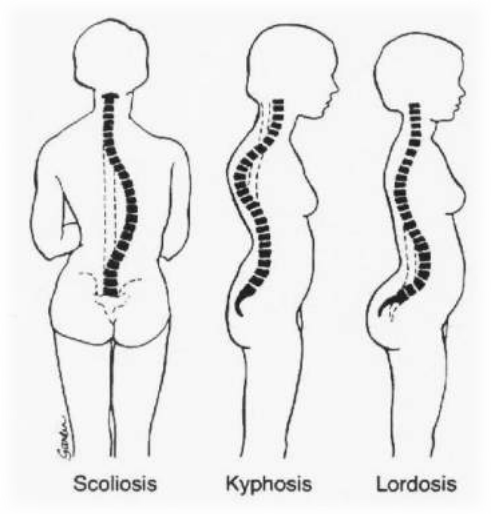


Posture

The spine has natural curves that play an important role in the strength, function and flexibility of the body. A misalignment in the spinal column can have an immediate effect on strength.



Postural abnormalities can be a result of a genetic disorder but can also be a result of repeated poor posture.



The 3 primary types of abnormal spinal curvature are:

- Scoliosis – a lateral deviation in the spine.

This can be common after childbirth as a result of mothers holding the child on one hip.

- Kyphosis – excessive mid back curvature.

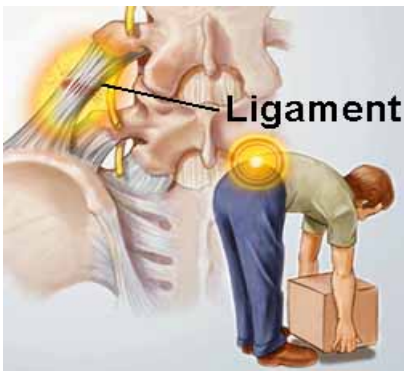
This is commonly caused by repeated poor posture during lifting, resulting in a "hunch".

- Lordosis – Excessive lower back curvature.

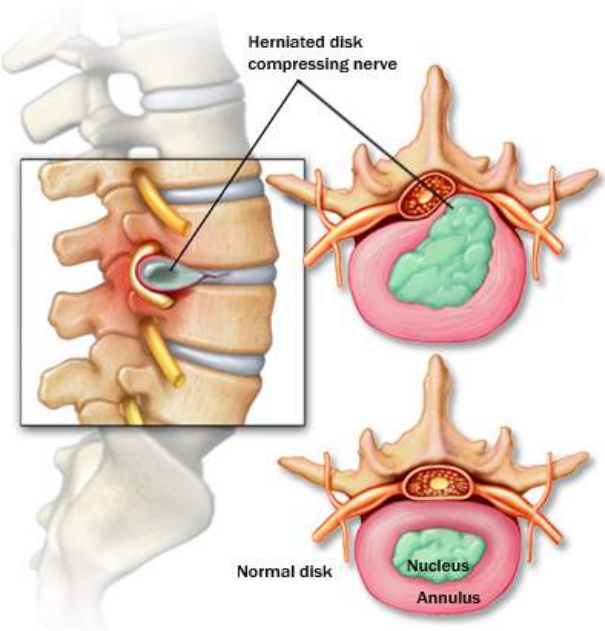
This can be caused by a weak abdomen which allows the lower body to tilt forward such as during pregnancy or obesity.

Spinal Injuries

Injuries to the back from manual handling are common. The most common area of the spine that is injured is the Lumbar region, which is found in the lower back. These injuries are generally a result of poor lifting technique. The most common injuries are:



- Muscle Strain
- Ligament sprain
- Prolapsed or herniated disc

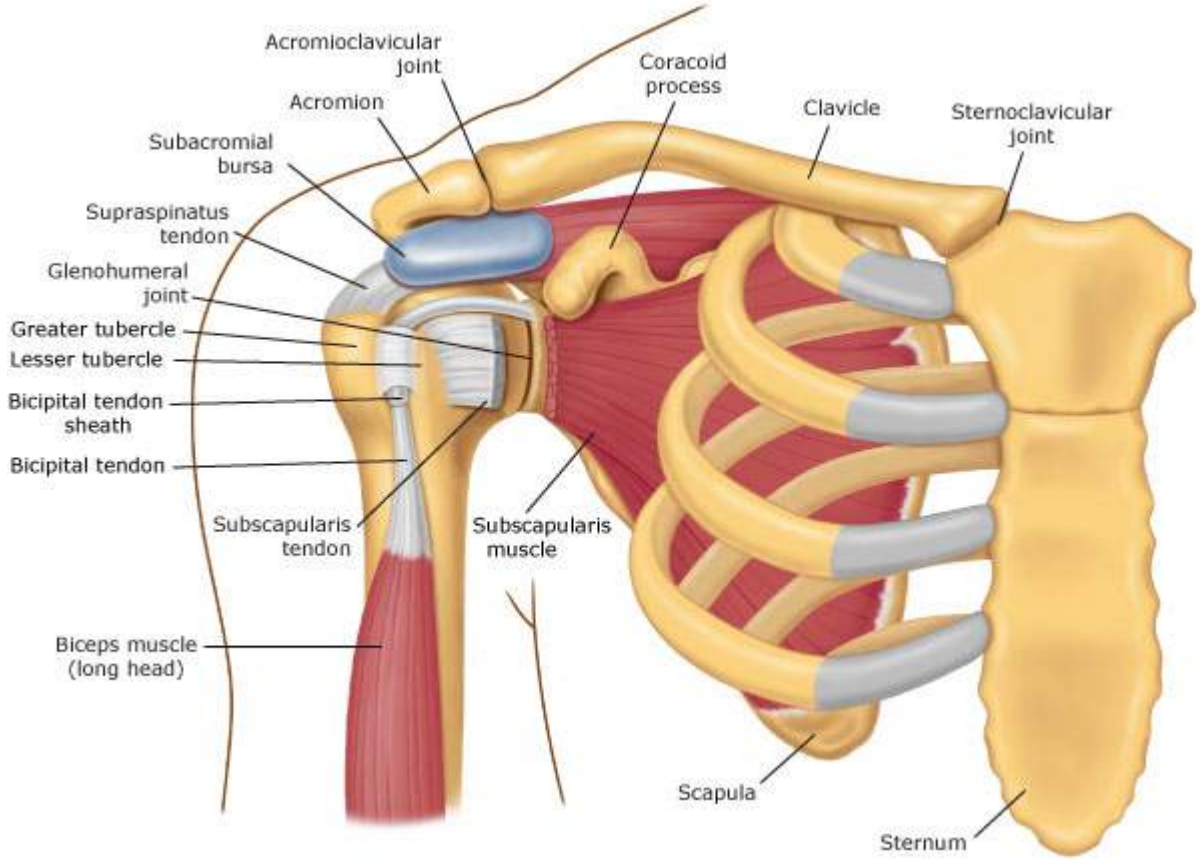


A herniated or prolapsed disc occurs when the wall of the intervertebral disc is ruptured and the soft tissue bulges out between the vertebrae. This results in contact with nerves running through the spinal column and is very painful.

Repeated poor lifting technique will place excessive strain on the wall of the disc and increase the likelihood of failure of the wall in the future.

Shoulder Anatomy

The shoulder is a complex combination of bones, muscles, tendons and ligaments that facilitate movement of the arms. Poor lifting technique or repeated strain can lead to injury and can result in long term mobility issues.



Common Injuries

Injuries to the shoulder are often caused by overhead lifting and repetitive strain. The two most common injuries are:

- Tendonitis – inflammation of the tendon (structures which connect muscle to bone)
- Bursitis – inflammation of the bursa (the lubricating structure between the tendons and bones
- Impingement syndrome – usually a result of tendonitis and bursitis which results in painful restriction of the space for tendons and muscles to move.

Planning Lifts

T.I.L.E. Principle

Planning lifts and other manual handling operations will require an assessment of the key factors that will influence the level of risk. A common mistake is to simply focus on the size or weight of a load prior to lifting. The word “TILE” can be used to remember the factors to consider when planning manual handling operations.

T - TASK
I - INDIVIDUAL
L - LOAD
E - ENVIRONMENT

Task

When assessing the task, consider whether the task will involve any of the following:

- Twisting
- Bending
- Stooping
- Overhead lifting
- Repetitive movements
- Long distances
- Fast pace

Individual

Consider the capabilities of the individual. The capability of an individual does not focus on strength alone and may consider factors such as:

- Height
- Posture
- Pregnant
- Health problems
- Injuries
- Disabled
- Training

Load

When considering the load, consider factors such as:

- Weight
- Size
- Texture
- Temperature
- Handles
- Contents likely to move
- Can it be split

Environment

The area where the manual handling operation takes place can often have a significant influence on the level of risk. Consideration should be given to:

- Space constraints
- Uneven flooring
- Obstacles
- Stairs
- Temperature
- Weather

Risk Control

Management of risks from manual handling should first look at trying to eliminate the risk where possible. Where this is not possible, the level of risk must be reduced as much as possible. Risk control measures might include:

Workplace design – hazards can be eliminated or reduced to very low levels through proper workplace design. This could include the installation of service lifts to reduce risks associated with climbing or carrying equipment aloft.

Work planning – this will include planning for adequate personnel to carry out tasks as well as suitable rest periods. Pre-planning may also help identify better ways to accomplish a task with minimal risk.

Training – personnel must be trained to avoid or minimise risks from manual handling. Training should include assessment and management of risks, safe lifting techniques, planning lifts and company procedures.

Safe lifting techniques – safe lifting involves the person lifting using good posture but must also consider the load, environment and the task. Can the load be broken up into smaller

pieces? Can the area be made safer for the lifting operation? Can the task be changed to reduce risks? Individuals must also consider any existing injuries they may have and inform supervisors of any concerns about capability.

Safe use of PPE – Some injuries occur as a result of poor selection or use of personal protective equipment. For example, fall arrest lanyards that are longer than necessary can pose a tripping hazard or get caught in the legs during lifts.

Environmental Controls – the work area should be made as safe as possible with consideration given to things like adequate lighting, temperature, noise, mechanical risks and general housekeeping.

Mechanical Handling Devices – mechanical handling aids are generally categorised as:

- Simple tools
- Trucks and trolleys
- Roller tracks and chutes
- Lifting devices
- Pallet trucks
- Conveyors

Wellness and fitness initiatives – Personnel should be encouraged to maintain a good level of fitness to avoid injuries at work and, more imprtantly, to improve their overall health. Employees may be required to have a medical/fitness assessment done on a regular basis depending on the nature of work to be carried out.

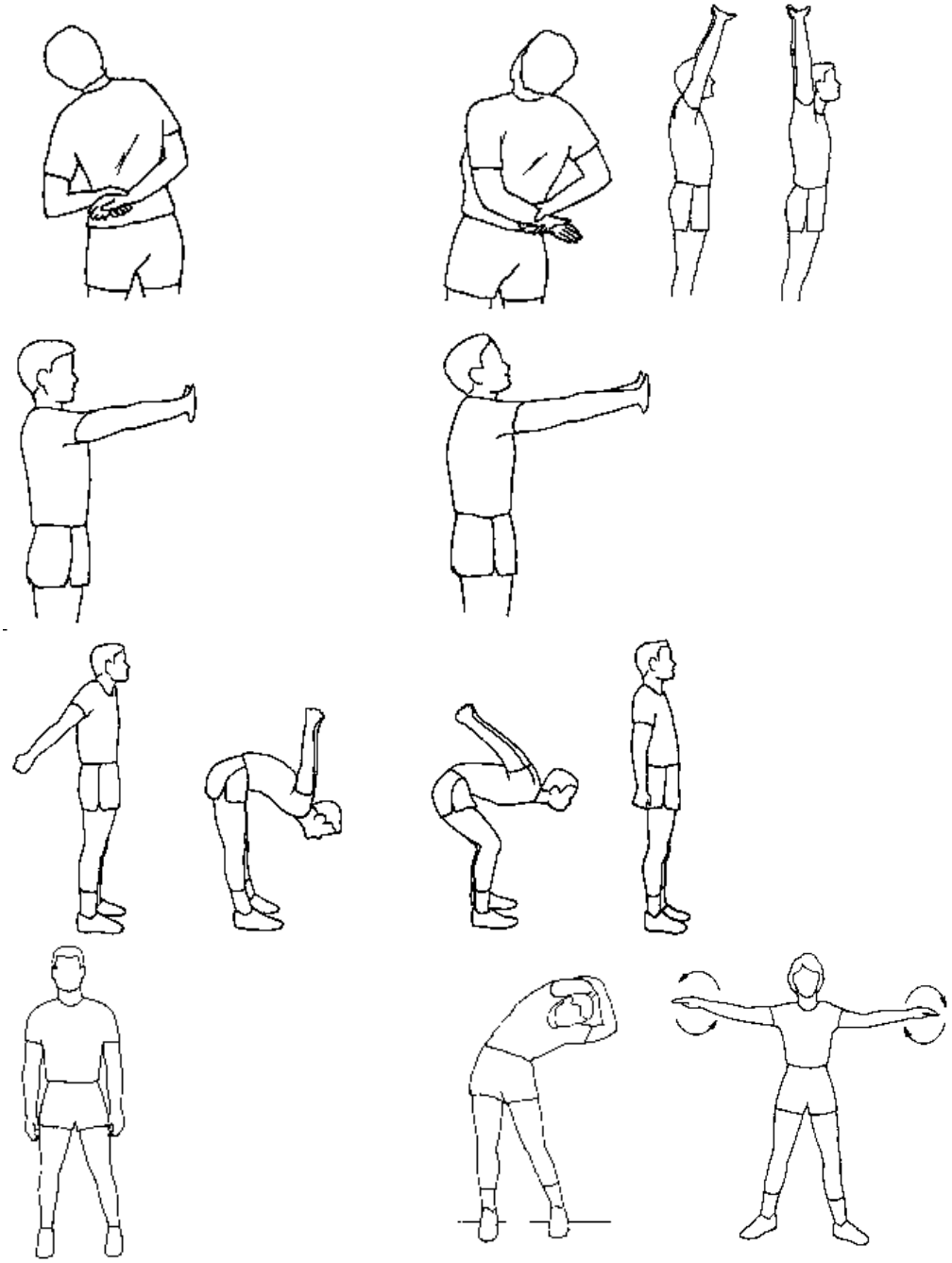
Safe Lifting Techniques

Stretching and Warming Up

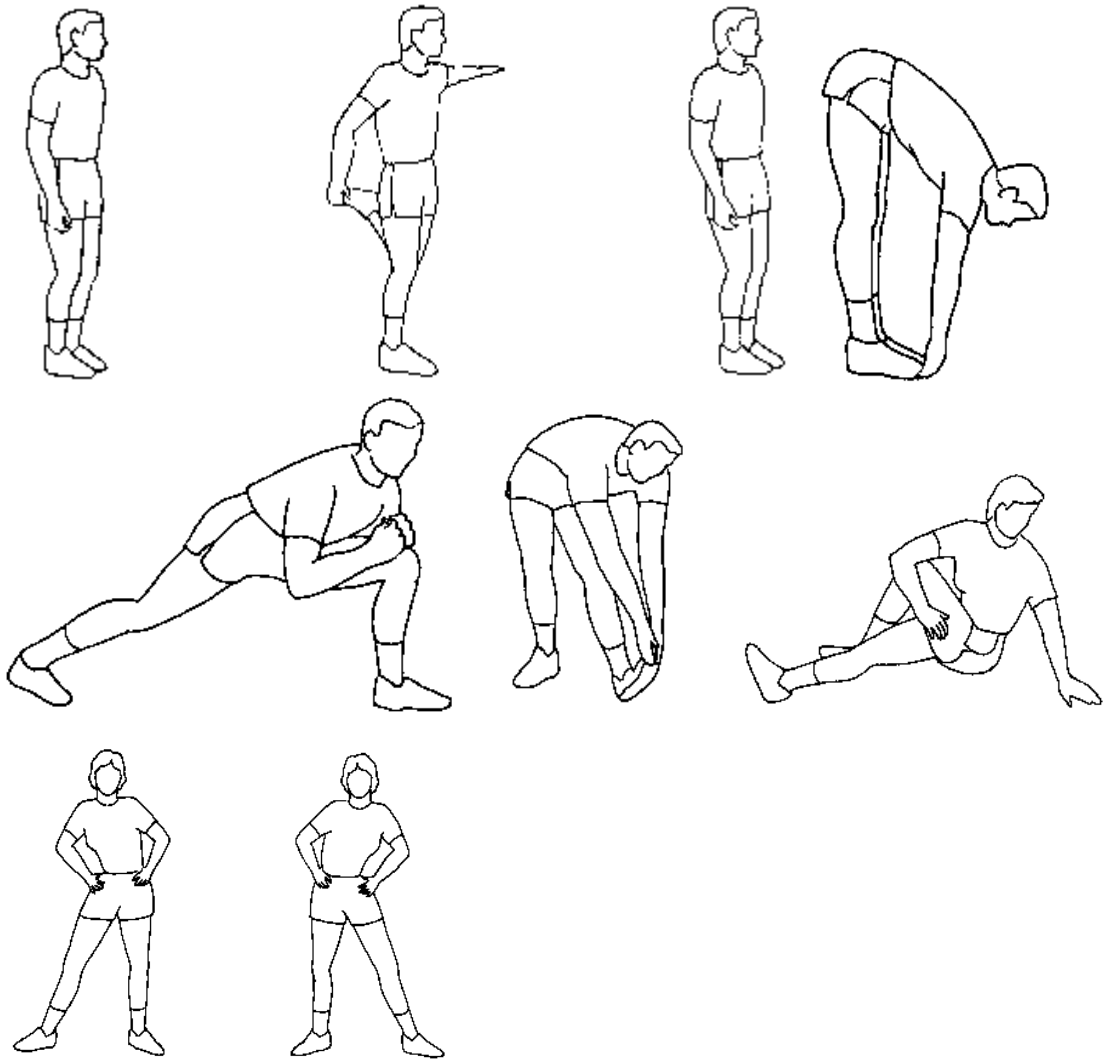
Prior to starting any manual handling, it is best to ensure the muscles are warm and have been stretched to minimise the risk of injury. A good stretch prior to and after any

strenuous work will also help reduce muscle aches and pains. The following stretches can be used as a general guide for different parts of the body.

Upper Body Stretches



Lower Body Stretches

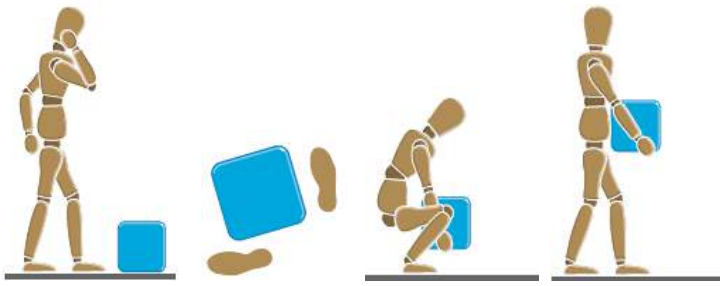


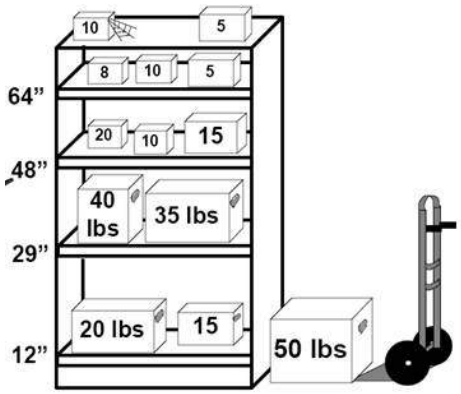
Basic Stretching Tips

- Be aware of any injuries you may have. When in doubt, check with your doctor
- Muscles will stretch easier when they are warm
- Only stretch to the point of tension and hold for a few seconds
- Do not bounce while stretching
- If you feel any pain, stop and notify your supervisor prior to commencing any manual handling tasks

Safe Lifting From the Floor

- Asses the load
- Establish a stable stance
- Squat down using the legs
- Maintain a neutral Spine
- Get a good hold
- Keep load close to body





Safe Lifting from Height

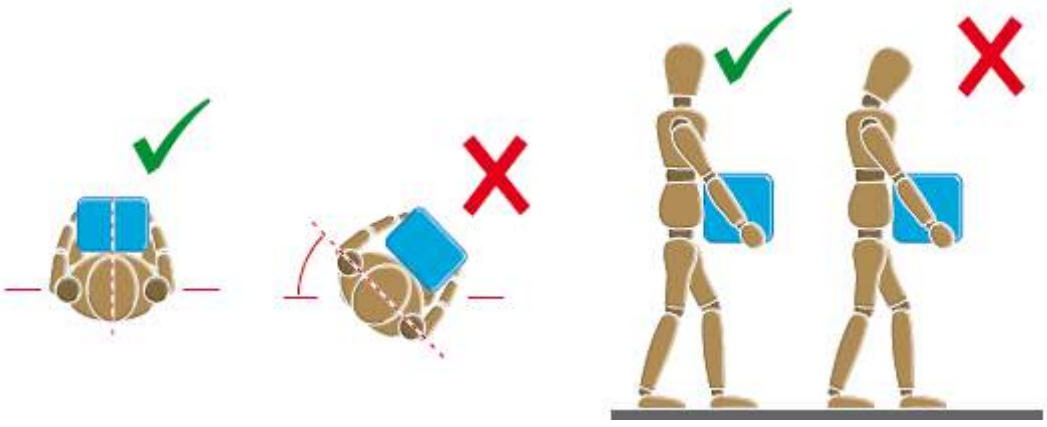
- Strength significantly reduced
- Increased risk of injury
- Stack heavier items on lower shelf
- Use steps
- Use mechanical devices

Multi-Person Lifts

Ensure the load is assessed to determine the heavier end and suitable grip points. Consider the height of the individuals and ensure good communication throughout the lift. If any person needs to set down the load or suspects they will drop it, they must speak up immediately.

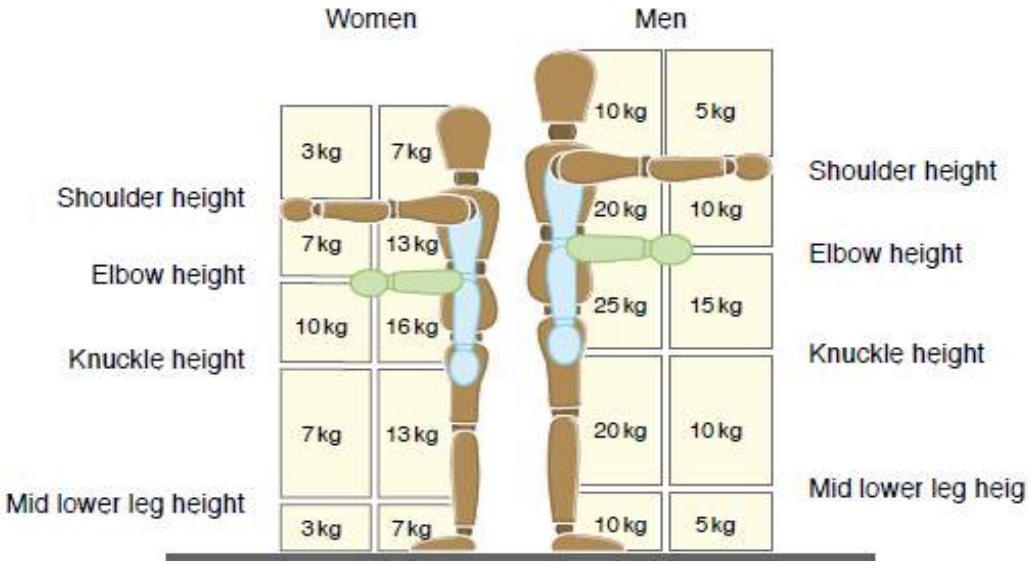
Carrying the Load

- Avoid twisting
- Keep head up
- Set the load down to rest or adjust grip

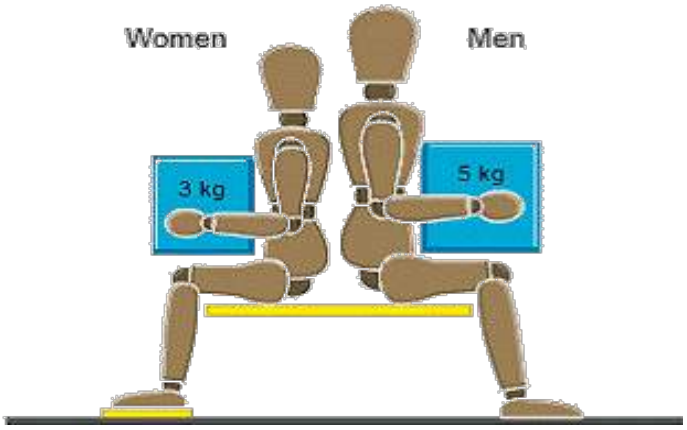


Load Guidelines

The following guidelines are provided by the HSE and are not a rigid requirement but a guideline. Some tasks may require lifts above the guideline mass. Where possible, measures should be taken to reduce the load or use other control measures.



Guidelines for handling while seated



Further Reading

http://www.hse.gov.uk/msd/manualhandling.htm

HSE INDG 143 Manual Handling at Work

HSE HSG 115 Manual Handling: Solutions you can handle

HSE INDG Are you making the best of lifting and handling aids?

HSE INDG 383 Manual handling assessment charts

GLOBAL WIND ORGANISATION

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Fire Awareness

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Learning Objectives

The Fire Awareness module is designed to ensure that:

a) The Delegates are able to demonstrate knowledge of the development and spread of fire
b) The Delegates are able to demonstrate knowledge of the causes of fires in wind turbines and the dangers related to this
c) The Delegates are able to identify any sign of a fire in a wind turbine environment
d) The Delegates are able to demonstrate knowledge of the contingency plans in a wind turbine environment including smoke detection and emergency escape procedures
e) The Delegates are able to demonstrate correct actions on discovering a fire including correct operation and fire extinguishing by means of the fire-fighting equipment in a WTG

Introduction

Fires in wind turbine generators can have devastating consequences. Each year there are fires that cause substantial cost, business interruption and loss of public confidence. Many of these fires can be easily avoided through regular preventative measures or prompt emergency actions.

A basic understanding of the principles of fire prevention and the emergency actions required during a fire can significantly reduce the number and severity of fires and fire related injuries.

Legislation

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If employers are prosecuted for a breach of health and safety law, and it is proved that they have not followed the relevant provisions of the ACOP, a court can find them at fault unless they can show that they have complied with the law in some other way.

In addition to general health and safety legislation, there are standards and regulations in place to help ensure workers are protected from fires and the appropriate equipment is provided. While different jurisdictions will have varying requirements, the main principles of fire prevention and emergency response are very similar.

Workplace Fire Regulations

England and Wales - Regulatory Reform (Fire Safety) Order 2005

Scotland- Part 3 of the Fire (Scotland) Act 2005

Fire Safety (Scotland) Regulations 2006

Northern Ireland - Part 3 of the Fire and Rescue Services (Northern Ireland) Order 2006

Fire Safety Regulations (Northern Ireland) 2010

The regulations are very similar but use some different terminology. The regulation for England and Wales uses the term “responsible person”, while the Scottish regulations use “duty holder” and the Northern Ireland regulations use “appropriate person”. The duties of these people are the same with regard to safeguarding people in the premises.

The *responsible person* could be:

- An employer
- Self-employed with business premises
- A managing agent or owner of shared premises
- A charity or voluntary organisation
- A contractor with a degree of control over any premises

The Order applies to virtually all premises and covers nearly every type of building, structure and open space. For example, it applies to:

- Offices & Shops
- Factories & Warehouses
- Sleeping Accommodation
- Residential Care Premises
- Educational Premises
- Small, Medium and Large places of assembly (including community halls, places of worship and pubs, clubs and restaurants)
- Theatres & Cinemas
- Outdoor Events
- Healthcare Premises
- Transport Premises & Facilities

It does NOT apply to private homes including individual flats in a block or house.

The Responsible Person is responsible for the safety of the employees and relevant persons by effectively managing:

- Fire risk assessments
- Fire safety policy
- Fire procedures
- Fire drills
- Means of escape

- Emergency lighting
- Fire alarms and extinguishers
- Fire doors & compartments
- Fire evacuations
- Signs & notices

The Responsible Person must keep records on risk assessments, the current fire safety policy, procedures, training and drills. The routine maintenance of all fire alarm systems and emergency lighting and extinguishers must also be recorded.

Fire Safety Standards for Wind Turbine Generators

Confederation of Fire protection Associations in Europe CFPA E

- CFPA E No 22:2010 F Wind Turbines Fire Protection Guideline

EN 50308, rev 1, wind turbines – safety requirements for design, operation and maintenance

National Fire Protection Association (Canada and USA)

- NFPA 850 “Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations, 2010 Edition”

Local Authorities

Local authorities such as the fire brigade can do very little to tackle a fire in a wind turbine generator. In order to minimise loss of life and property, duty holders must take the necessary precautions to reduce the likelihood of fires. Cooperation with the local authorities may also provide opportunities to broaden the response capabilities. Joint training exercises and emergency drills have been carried out on sites offshore and onshore.

Fire Combustion and Spread

Fires can be a variety of different types with unique characteristics and methods for extinguishment. There are 3 general types of fire with regard to the state fuel that is burning.

States of Fuel

Solids – wood, paper, some metals, rubber and plastic

Liquids – petroleum, oils, solvents

Gases – propane, butane, methane

No matter which state the fuel is in, it is the *vapour* coming off that fuel that is burning. Even a piece of wood in a fireplace is liberating vapours which then burn. The more surface area that is exposed, the greater the potential for vapour production.

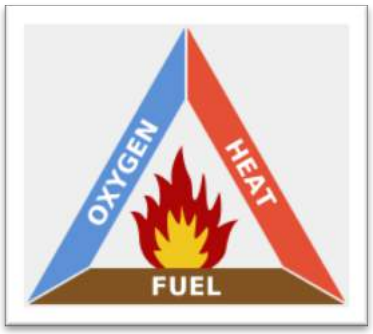
Characteristics of Fuels

Solid fuels have a three dimensional surface area which can liberate vapours. Many solid fuels will smoulder with an ember, which can make extinguishment more challenging.

Liquid fuels only have a two dimensional surface area but the liquid can spread making the surface area greater. Also, many flammable liquids are lighter than water. This means they will spread quickly if water is applied.

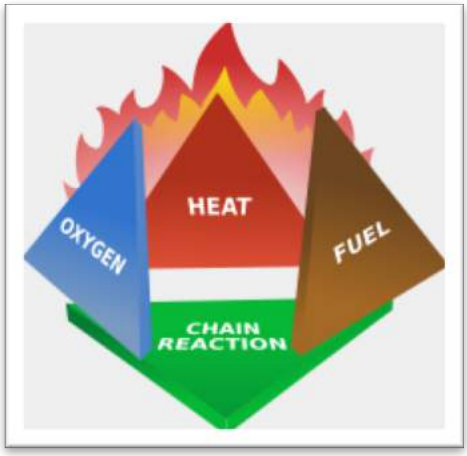
Gases are the most volatile and can fill a space or an enclosed area quickly. Many combustible gases are heavier than air and will settle in low areas.

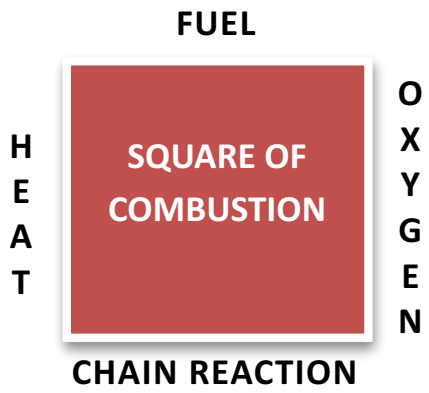
The Combustion Process



The fire triangle is widely used to help remember the three elements required for a fire to start. Those three elements are Fuel, Oxygen and Heat.

While this is still a valuable tool for assessing what is required to start a fire, it does not cover all the required elements involved once the fire has started. Once the fire has started, a fourth element influences the combustion process and that is a chemical chain reaction. To illustrate this, a four sided shape called a tetrahedron is commonly used. In some cases a square is used to make things easier to remember as most people do not know what a tetrahedron is.





Fuel

Fuel must be present in sufficient quantity in order to support combustion. Most combustible gases will have a known explosive range which can be measured using gas detectors. For example, methane has an explosive range of 5-15%. This means that at concentrations below 5% methane in air, there is not enough vapour to support

combustion. At concentrations above 15%, there is too much vapour in the air to support combustion.

Oxygen

Oxygen must be present to support combustion and typically need to be in concentrations above 15%. Normal air is 20.9%.

Heat

All fuels will require a certain amount of heat in order to liberate vapours. A piece of wood would require much more heat to ignite and stay ignited than petroleum. Many flammable and combustible liquids will have known temperatures where they can be ignited called flash point. Gasoline (Petrol) has a flash point of -43° C while kerosene is 38° C.

CAUTION, do not assume that a product with a high flash point such as kerosene or hydraulic oil is harmless. If these fuels are released under high pressure, they will be nebulised into fine droplets which can be easily ignited by a hot surface.

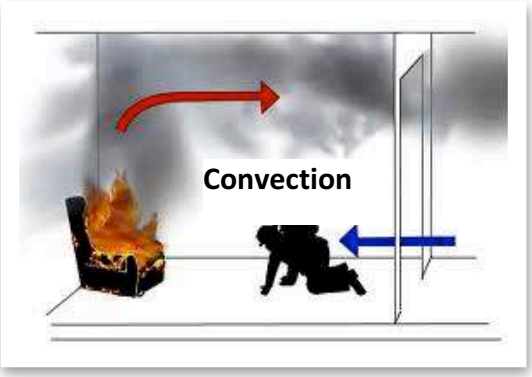
Chemical Reaction

Combustion consists of various chain reactions involving free radicals. A free radical is an atom, molecule, or ion that is highly reactive. These substances usually require heat in order to initiate the release of energy.

Fire Spread

There are three primary methods for fire spread through a building or structure. They are:

Conduction - the transfer of energy through matter from particle to particle. It is the transfer and distribution of heat energy from atom to atom within a substance.

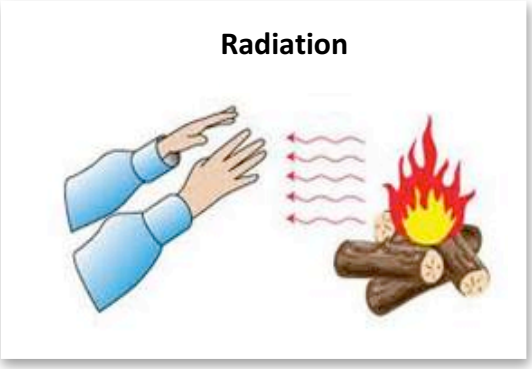


Convection - Convection is the transfer of heat energy in a gas or liquid by movement of currents.

Radiation - Electromagnetic waves that directly transport ENERGY through space. Sunlight is a form of radiation that is radiated through space

to our planet without the aid of fluids or solids.

Direct burning is commonly listed as another form of fire spread. Some feel this is inaccurate as it is simply a combination of other types of heat transfer. As the flames come into contact with an object, heat is transferred by heated air currents (convection) and radiant waves of heat transmitted by the fire.



Smoke and Gases

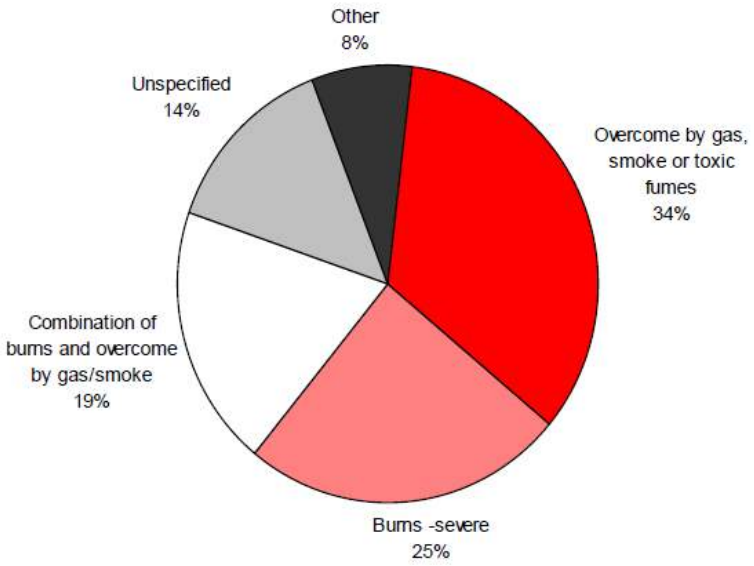
Smoke and other gaseous products of combustion are the cause of most fire deaths. The nature and composition of the smoke and gases will vary with different fuels. Nearly all fires will produce a toxic gas called carbon monoxide. This is produced whenever there is incomplete combustion.

Carbon Monoxide is a colourless, odourless gas which is both toxic and flammable. Carbon Monoxide plays a major role in fire deaths and in cases where heating appliances are not working properly. Carbon Monoxide attaches to the haemoglobin in the red blood cells, blocking oxygen from being absorbed by the body. Haemoglobin will absorb Carbon Monoxide 200 times more readily than oxygen. Carbon Monoxide has an explosive range of 12.5-74%.

Where plastics and other synthetic materials are burned, other dangerous gases may be formed such as:

- Cyanides
- Hydrogen Sulphide
- Sulphur Dioxide
- Phosgene
- Benzene
- Dioxins

Great Britain 2011-2012



'Other' includes head/chest or other physical injuries, fractures, shock or other medical conditions

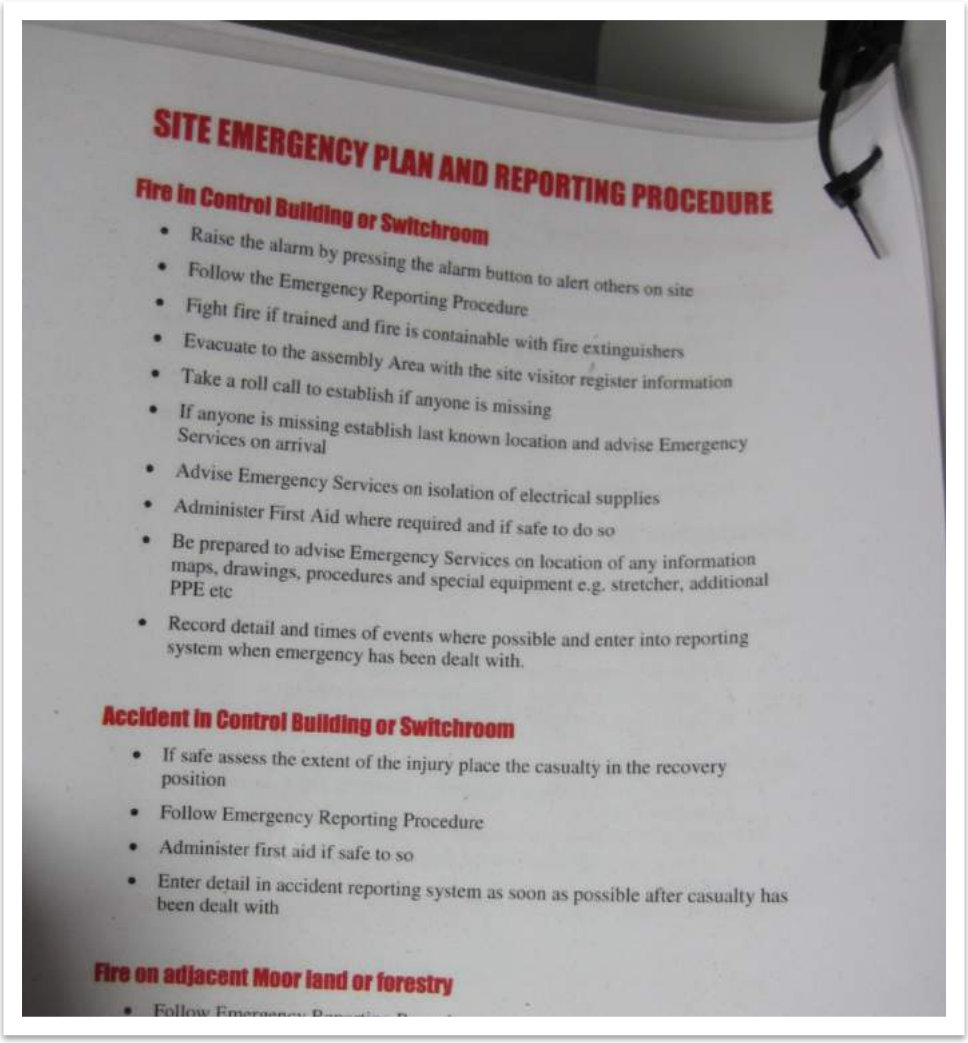
Emergency Planning

It is vital that employees are aware of the actions to take in the event of an emergency. It is a legal requirement to identify hazards, implement controls and educate workers. This applies to any number of hazards including fires. A thorough contingency plan should be created to make workers at all levels aware of the procedures to be followed during a fire in a wind turbine generator. The basic emergency procedures are typically communicated to staff and contractors in two ways.

Induction Training

Contractor and staff are made aware of any precautionary measures to be taken during higher risk operations such as hot work or work on electrical equipment.

Posted in the Turbine a copy of the emergency response procedures are typically posted at the base of the tower and again in the nacelle.



SITE EMERGENCY PLAN AND REPORTING PROCEDURE

Fire in Control Building or Switchroom

- Raise the alarm by pressing the alarm button to alert others on site
- Follow the Emergency Reporting Procedure
- Fight fire if trained and fire is containable with fire extinguishers
- Evacuate to the assembly Area with the site visitor register information
- Take a roll call to establish if anyone is missing
- If anyone is missing establish last known location and advise Emergency Services on arrival
- Advise Emergency Services on isolation of electrical supplies
- Administer First Aid where required and if safe to do so
- Be prepared to advise Emergency Services on location of any information maps, drawings, procedures and special equipment e.g. stretcher, additional PPE etc
- Record detail and times of events where possible and enter into reporting system when emergency has been dealt with.

Accident in Control Building or Switchroom

- If safe assess the extent of the injury place the casualty in the recovery position
- Follow Emergency Reporting Procedure
- Administer first aid if safe to so
- Enter detail in accident reporting system as soon as possible after casualty has been dealt with

Fire on adjacent Moor land or forestry

Planning is important because people will not always take the expected actions when confronted with an emergency situation. Even trained emergency responders have made fatal errors in judgement due to poor pre-planning. Some important items to consider for any contingency plan would be:

- Identification of possible emergencies
  - In or on the Turbine
  - Site buildings
  - Access roads
  - Fires adjacent to the site

- Procedures for safely dealing with potential emergencies
    - Safety of personnel
    - Making equipment safe
    - Fight the fire or evacuate?
    - First Aid
    - Muster areas
- Notification procedures
    - Local alarm
    - Site supervisor
    - Emergency services
    - Company emergency operations centre
- Interaction with emergency services
    - Capabilities
    - Assistance locating emergency scene
    - Incident Control
- Incident reporting

It is also important to test the effectiveness of any contingency plan by carrying out emergency drills. It is better to identify a deficiency in the emergency plan during a drill than in an emergency.

Fire Extinguishment

Tackling a fire involves more than simply activating an extinguisher. Personnel must make an assessment of the situation to ensure their safety and take the appropriate action to deal with the fire.

Assessing the fire

There are a number of things to consider when making an assessment of the situation. Some things will influence the way in which you tackle the fire or keep yourself safe while others will dictate how you can make the equipment safe.

Smoke

How much smoke and the colour of the smoke will affect your ability to see the fire and pose a risk to personnel. Thick black smoke will usually indicate a flammable liquid is involved while grey smoke would typically indicate a paper fire.

Location

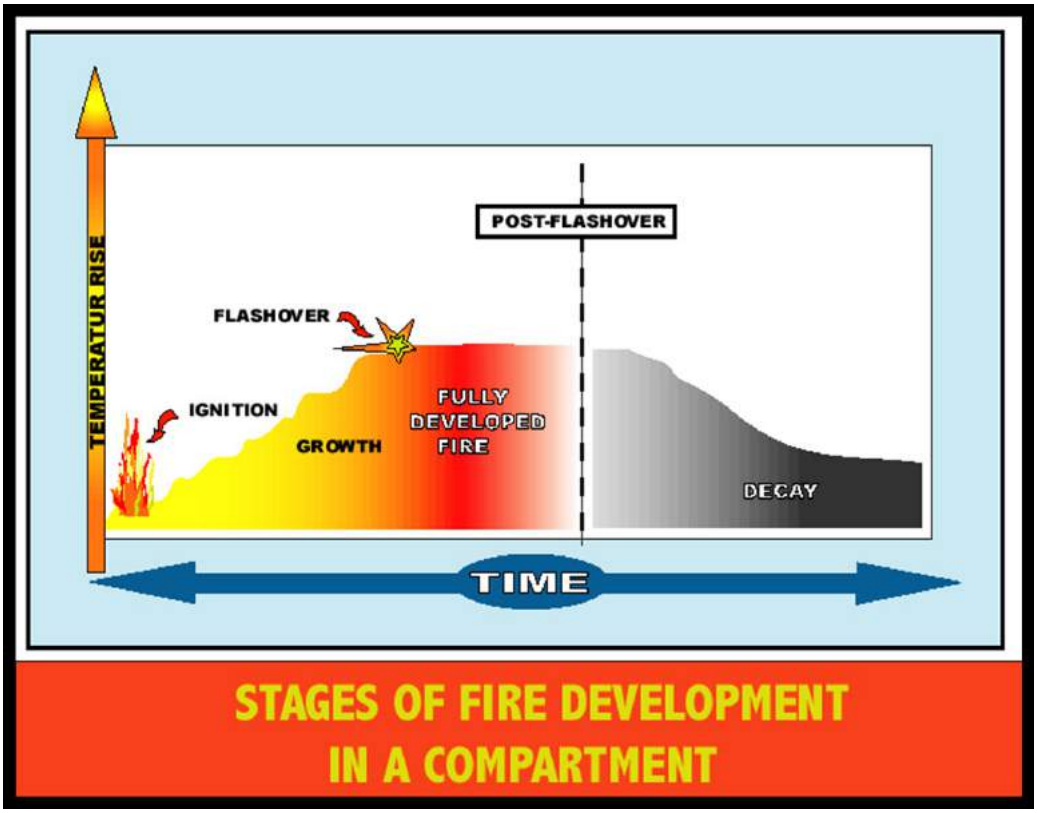
The location of the fire may help identify the cause. It may be caused by overheating machinery or faulty electrical equipment in the area. The location will also play an important role in your escape options. A fire near the entry point from the yaw platform may eliminate the ladder as an escape option unless you can extinguish the fire quickly. A fire located at ground level near the turbine may not seem hazardous to personnel in the nacelle but smoke and gases can travel up the tower like a chimney and make the nacelle untenable.

Events leading up to the fire

The events leading up to the fire can help identify the cause of the fire if it is not obvious. Knowing the cause of the fire can often aid in extinguishment.

Fire Intensity

Fire intensity may give a clue about the fuel involved or the stage of the fire. Fire growth typically follows a predictable curve as shown below.



Emergency Actions

It is important to remember to prioritise in an emergency. Personnel safety must always be the first priority. Only attempt to extinguish a fire if it can be done safely and won't restrict routes of escape. Also remember that the rope used in the evacuation system can burn. If the evacuation system is to be used, it must be used in an area where the fire and heat will not affect the equipment.

Principles of Extinguishment

Extinguishment of the fire can be done in a number of ways. Removal of any one of the elements of the fire tetrahedron or square of combustion will extinguish the fire. There are some methods of extinguishment which will act on more than one element of the combustion process.

Removal of Heat

This is the most common way of extinguishing a fire and is typically accomplished by applying water to the fire. This is the most effective way to deal with solid fuel fires.

Removal of Fuel

This can be accomplished by switching of the supply of fuel or by suppressing the vapours which are being burned. Where the source of fuel is a hose or pipe, there may be an option to close off a valve to prevent any more fuel being added to the fire. If the fuel is a gas, this can be a very effective way to extinguish the fire. If the fuel is a liquid, the fire will still burn until all the fuel has burned away. There is a risk that the heat from the fire will ignite other combustibles in the area. Vapour suppression is accomplished with foam. The foam blankets the top of the liquid, preventing vapour from being liberated.

Removal of Oxygen

This is often referred to as smothering the fire. Oxygen levels will need to be lowered below 15-16% to extinguish a fire. This can be accomplished by using a fire blanket or a CO2 fire extinguisher.

Inhibit the Chemical Reaction

This is accomplished by using a dry chemical extinguisher. The chemical in the extinguisher prevents the free radicals from contributing to the chain reaction.

Classes of Fire

Class A - Ordinary Combustibles

Class A fuels are solid fuels such as wood, paper, cloth, rubber and plastics. Class A fuels such as paper, wood and cloth will smoulder or burn with an ember. The most effective extinguishing method is cooling as it will knock down the fire and cool the embers to prevent re-ignition.

Class B – Flammable/Combustible Liquids

Class B fuels are liquids such as gasoline (petrol), diesel, kerosene, solvents and olis. Liquid fuels can spread quickly if not contained. In addition to extinguishing the fire, action must be taken to implement spill containment measures. Application of water to a class B fire will usually make the situation worse as the water is heavier than the fuel and will sink, allowing the fuel to spread further.

Class C – Flammable Gases

Class C fuels are gases such as propane, butane and methane. Care must be taken when extinguishing Class C fires as the gas can spread quickly and find another source of ignition. Class C fires should only be extinguished if the source can be switched off.

Class D – Combustible Metals

Some metals such as magnesium, sodium, titanium, lithiumand plutonium are combustible. It takes a lot of focused heat energy to ignite these materials but once they are ignites, they can be very difficult to extinguish. Applying water to a metal fire can intensify the fire. Special dry powders must be used to extinguish these fires.

Class F – Cooking oil (Fat) fires

Although these types of fires could be considered a type of flammable liquid (class B) fire, they are given special consideration due to the very high temperature of the oil when it is burning. Typical class B extinguishing agents are not always effective. Dry chemical, for example, may extinguish the flames momentarily but the oil is hot enough to re-ignite through auto-ignition. Special wet chemical extinguishers have been developed to tackle these fires. They work through a process called saponification. This means the chemical converts the surface fuel into a non-combustible soap-like substance while cooling the oil.

Electrical fires are not considered to be a class of fire in Europe as the electricity is simply the source of heat. Once it is isolated, you are typically left with a class a fire. If the electrical energy can't be switched off, it is important to use the appropriate extinguisher. Water can be very dangerous.

Suitable Extinguishing Agents

	Water	Foam	Dry Powder	M28 / L2	CO 2	Wet Chemical
A	✓	✓	✓	✗	✗	✓
B	✗	✓	✓	✗	✓	✗
C	✗	✗	✓	✗	✗	✗
D	✗	✗	✗	✓	✗	✗
	✗	✗	✓	✗	✓	✗
F	✗	✗	✗	✗	✗	✓

Fire Prevention

Taking suitable preventative measures is the best course of action. Thousands of fires each year could have been easily avoided with some basic fire prevention actions being taken by employees and business owners. Many of these preventative actions can be performed by staff without the need for any special qualification or technical training. The first and most important part of fire prevention is the identification and recognition of fire hazards and risks.

Fire Hazards and Risks

Fire prevention is generally a matter of controlling two of the parts of the fire triangle. There isn't usually a means of removing oxygen so we are left with the task of managing fuels and heat (sources of ignition). The risk of fire can be significantly reduced by reducing fuel loads, reducing sources of ignition or removing them completely.

Common Fuels

- Solids: Paper, furniture, wood, cardboard, rubbish
- Liquids: Diesel, Petrol, solvents, oils
- Gases: Heating gas, welding/cutting gases

Common Sources of Ignition

- Hot surfaces
- Sparks
- Open flame
- Hot work
- Friction
- Arson

Risk of Fires in Wind Turbine Generators

- High concentration of valuable equipment in the nacelle
- Concentration of potential ignition sources and fuels in the nacelle

- Possibly remote location
- Inability of fire brigade to tackle a fire
- Unmanned operation
- Risk of total loss of nacelle
- Spread to neighboring property
- High financial losses where there are fires

Common Causes of fires in Wind Turbine Generators

- Lightning
- Failure of electrical installations
    - Technical defects or components in the power electronics (e.g., switchgear cabinet, inverter cabinet, transformer)
    - Failure of power switches
    - Failure of control electronics
- Hot surfaces
- Mechanical brakes, lube failure of gearbox or generator
- Hot work
- Welding, cutting, grinding, etc.

Fuel Load in the Wind Turbine Generator

- Sound insulation
- Nacelle housing
- Hydraulic oil
- Gearbox oil and other lubricants
- Transformer oil
- Electrical equipment
- Waste products not removed from the nacelle

CASE STUDY

During a heavy summer thunderstorm, the blade of a 2 MW wind turbine was struck by lightning. The turbine was shut down automatically and the blades were pitched out of the wind.

The burning blade stopped at an upright position and burned off completely little by little. Burning parts of the blades that fell down caused a secondary fire in the nacelle.

Investigation of the cause of damage showed that the fire in the blade was caused by a bolted connection of the lightning protection system that was not correctly fixed. The electric arc between the arrester cable and the connection point led to fusion at the cable lug and to the ignition of residues of hydraulic oil in the rotor blades.

The nacelle, including the rotor blades, had to be referred to as a total loss. The upper part of the tower had also been destroyed due to the high temperature.

Operations were interrupted for approximately 150 days; the total loss amounted to approximately €2 million.

Preventative Measures

Fire prevention can be accomplished through behavioural actions on the part of staff or through engineering controls which reduce risk.

Behavioural controls are the regular activities we can all do to minimise the likelihood of fires and may include:

- Regular maintenance of equipment
- Training of staff
- Fire prevention
- Emergency response procedures
- Identification and mitigation of fire risks
- Housekeeping
- Safe storage of combustibles
- Minimise hot work where possible
- No Smoking

Engineering Controls

- Changes in construction materials
- Changes in location of valuable assets
- Changes in location of higher risk components
- Circuit breakers, Fuses, shut-down systems
- Fixed fire detection and suppression systems

Fixed Fire detection and Suppression Systems

Fixed fire detection and suppression systems have been utilised in commercial buildings and industrial facilities for a number of years. The success of these systems has even resulted in an increasing number of these systems being installed in a wide variety of environments. There are systems currently being installed in wind turbine generators in various parts of the world. These systems will typically perform two important functions.

Early Detection

Fixed systems are designed to detect a fire in its infancy which significantly improves the likelihood of extinguishment. The means of detection may vary depending on the nature of the hazard in the area.

Smoke Detection systems will detect the presence of smoke and sound an alarm locally and or at a central control point. Some of these will automatically trigger the release of an extinguishing agent to the area.

Heat detection systems are used in areas that would be prone to false alarms with smoke detection systems. These systems activate when the temperature increases significantly over a short time. These will trigger an alarm in the same way as a smoke detection system and activate the release of an extinguishing agent. Some systems utilise piping that runs adjacent to high risk areas which contains the gaseous

extinguishing media. When a fire is started in the area, the piping melts and releases the extinguishing media at the critical heart of the fire.

In other cases the gas in the piping is holding the main valves closed on a gaseous extinguishing system. When the pipe melts, the entire area is flooded by a sprinkler system fed by large cylinders of gas.

Extinguishing agents

Common extinguishing agents used for fixed systems are inert gases such as CO2, Argon, Nitrogen and proprietary products such as FM200 or Halotron which are safer alternatives to Halon. These agents are safe for use on electrical appliances. In areas where electrical hazards are not present, water mist may still be beneficial.

Firefighting Equipment in WTGs

Moibile firefighting equipment is still the most prevalent in many wind turbines. They are innexpensive to purchase and service and are relatively easy to use. As with any other piece of equipment, the fire extinguisher is only valuable if it is in good working order. It is important to have a regular inspection regime in place to ensure firefighting equipment is in the appropriate location and ready for use.

Inspection and Maintenance

Annual Service must be carried out on all fire extinguishers. This detailed inspection must be carried out by a competent person that is qualified to carry out maintenance operations on fire extinguishers.

A regular visual inspection must also be done to ensure the extinguisher is ready for use. This inspection can be done by any worker and should be done monthly. This will include:

- Location – is the extinguisher in the desiganted location?
- tamper seals – Are the tamper seals intact?
- Pressure – Does the extinguisher have the required pressure?
- signs of damage – is there any obvious visual damage?

The annual inspection and the regular visual inspection should be recorded to demonstrate compliance.

A pre-use inspection should also be done prior to use. This will be done quickly but is important to ensure the safety of the user and that the correct extinguisher is being selected. The extinguisher should be checked for:

- Type – is it the correct extinguisher for the fire?
- Tamper seals intact – has the extinguisher been tampered with or discharged?
- Pressurised – does the extinguisher have the required pressure?
- Signs of damage

People have been seriously injured and even killed when badly corroded extinguishers ruptured during use. Regular and pre-use visual inspections are meant to keep the user safe. It also provides an opportunity to ensure the appropriate equipment is being selected. During regular work activities, workers should notice and report any damage or misuse of firefighting equipment.

Firefighting Equipment

The main types of firefighting equipment which may be found in the wind industry are fire extinguishers and fire blankets. The most common type of fire extinguishers are CO2 and dry powder.

<u>CO2 (Carbon Dioxide) Extinguishers</u>

- Black Label
- Class B and Electrical Fires
- Short range – 3-4 m indoor/1-2m outdoor

Advantages

- No mess or damage to equipment

Disadvantages

- Excludes oxygen quickly in enclosed areas
- Not effective in windy conditions

Precautions

- Discharge nozzle and piping get very cold
- Careful when using in small enclosures. Oxygen depletion can be hazardous to the user in an enclosed area. Ventilate if possible.

Dry Chemical/Powder Extinguishers

- Blue Label
- Class A, B, C and Electrical Fires
- Medium-Long range – 6-8m

Advantages

- Works on most classes of fires
- Rapid knock down

Disadvantages

- Very messy
- Can damage electrical equipment

Precautions

- Irritant when used in enclosed areas

Water Extinguishers

- Red Label
- Class A fires only
- Medium range – 4-6m

Advantages

- Most effective for class A
- Inexpensive

Disadvantages

- Dangerous around electrical equipment

Precautions

- Do not use on class b or electrical fires

Fire Blankets

- Class A & B fires
- Short range – arms length

Advantages

- No mess
- Inexpensive

Disadvantages

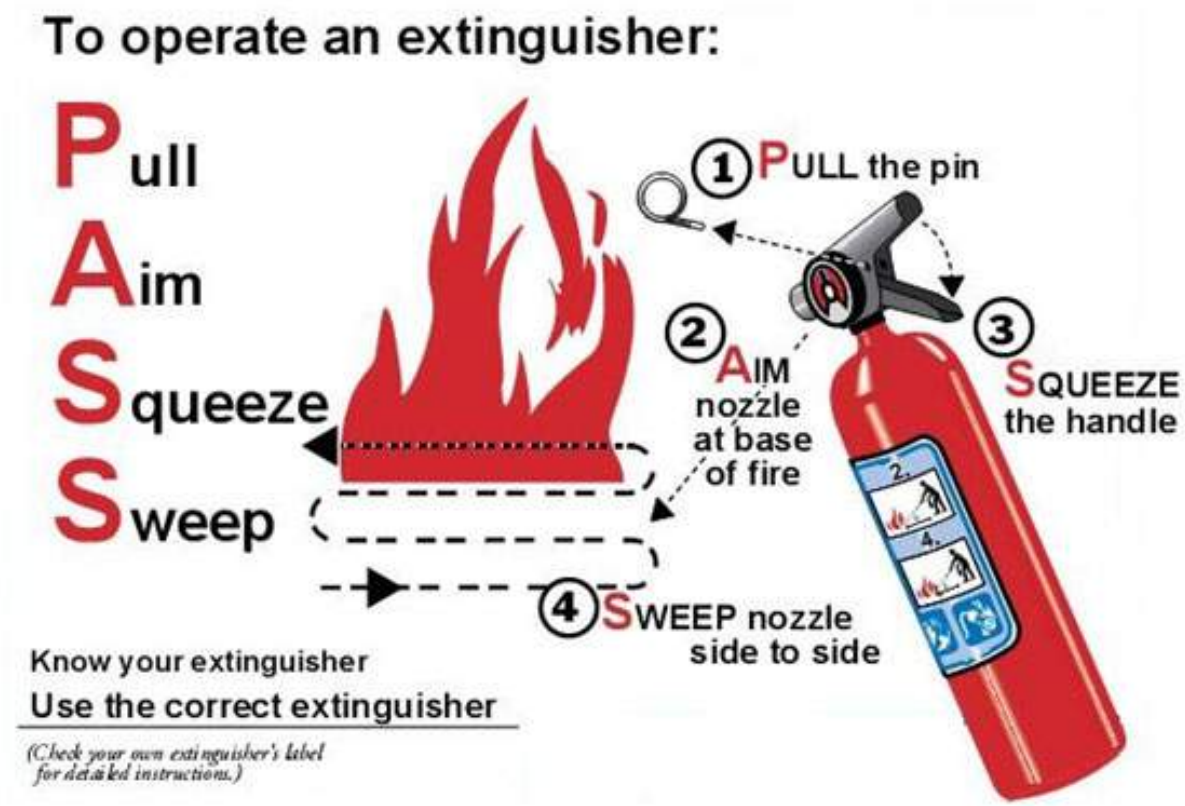
- User must get close to the fire

Precautions

- Use the blanket on small fires only
- Use the blanket as a shield between you and the fire

Safe Use of Fire Extinguishers

Fire extinguishers will all generally be used in the same manner but each type will have a different range or associated risks. The word PASS is used to help remember the procedure for operating a fire extinguisher.



Extinguishers are very effective during the early stages of a fire and if placed in appropriate areas, can make the difference between small fires with minimal damage to large fires resulting in total loss of the turbine. Users must understand the capabilities and limitations of each type of extinguisher. There may only be twenty seconds of fire fighting capability in a medium sized extinguisher.

Extinguishers should be considered first aid for fire fighting. If the user is not confident to tackle a small fire and ensure their safety, evacuation should be carried out. Worker safety is always the first priority.

GLOBAL WIND ORGANISATION

Belay ROPE ACCESS Training for a job less ordinary...

Basic Safety Training

First Aid

Foreword

The Global Wind Organisation (GWO) is an association of Wind Turbines owners and manufacturers with the aim of supporting an injury free work environment in the wind industry.

The Basic Safety Training standard was created to establish consistent and recognisable basic training for the industry.

The BST includes five elements:

- First Aid
- Manual Handling
- Fire Awareness
- Working at Height
- Sea Survival

The standard describes the requirements for Basic Safety Training in the wind industry that are recommended by GWO. Where national legislation sets higher requirements for the training, the Training Provider shall incorporate these requirements in the training programme.

The GWO Basic Safety Training does not include any Technical Safety Training such as working with electricity, equipment with stored energy etc. Additional training may be required due to company or country specific requirements.

GWO recommends a company specific Basic Safety Introduction and Technical Safety Training as additional training.

Learning Objectives

The First Aid module is designed to ensure that:

- The delegates are able to demonstrate understanding of the importance to carry out First Aid in a safe and sound manner in accordance with the legislative requirements of their geographic location and according to ERC and AHA guidelines
- The delegates are able to identify and explain normal function, normal signs, functions and symptoms of serious and minor injuries and illness related to the human body
- The delegates are able to demonstrate understanding and correct order of management in an emergency situation in a WTG environment
- The delegates are able to demonstrate correct use of lifesaving first aid using the primary survey A-B-C
- The delegates are able to demonstrate correct use of an automatic external defibrillator (AED)
- The delegates are able to demonstrate correct use of ordinary First Aid, the secondary survey
- The delegates are able to demonstrate correct use of first aid equipment in a first aid scenario

Introduction

Due to the often remote and harsh location of wind turbines, it is essential that all personnel have the first aid skills required to provide emergency assistance to a co-worker while waiting for advanced medical practitioners. This module covers basic workplace first aid with a focus on the wind industry and the risks encountered by workers.

Legislation and Standards

Health and safety in the UK

The Health and Safety Executive (HSE) is the national independent watchdog for work-related health, safety and illness. HSE is an independent regulator and act in the public interest to reduce work-related death and serious injury across Great Britain's workplaces.

Health and Safety at Work Act 1974

This legislation forms the foundation for health and safety in the UK. It sets out duties which employers have towards their employees and members of the public. It also sets out duties which employees have to themselves, their colleagues and the public. Many other regulations have been passed to support these regulations over the years.

Employer's duties

- Ensure the health, safety and welfare of their employees at work
- Provision of safe plant and equipment
- Ensure safety and avoid risks to health associated with articles and substances
- Provision of information, instruction and training to ensure the health safety of employees
- Maintain a safe place of work
- Provision of a safe and healthy work environment with adequate welfare facilities

Employees Duties

- Employees and the self employed have a duty to take reasonable care for the health and safety of themselves and any other people who might be affected by their acts or omissions
- Cooperate with employers and others to enable them to comply with their statutory duties
- Must not intentionally or recklessly misuse anything provided in the interest of health and safety

Management of Health and Safety at Work Regulations

These regulations supplement the requirements of the Health and Safety at Work Order. More detail is given regarding the requirements of employers to manage health and safety. A systematic approach must be employed to identify and mitigate hazards in the workplace. Formal risk assessments and method statements play an important role in this. The

regulation also requires a system to monitor safety and health of employees and of the management system itself. More detail is provided regarding information, instruction and supervision of workers and the issues surrounding young workers and expectant mothers are covered.

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)

These regulations require the immediate reporting of specific accidents, ill health and dangerous occurrences to the enforcing authority. Fatalities, over 7 day injuries, major injuries, diseases and dangerous occurrences must be reported to your company's nominated person who will notify the HSE where appropriate. It is also recommended that near misses be reported to help companies prevent future accidents. The following must be reported to HSE:

- Workplace deaths
- Specified Injuries
- Injuries resulting in +7 days incapacitation
- Occupational disease
- Dangerous occurrences (specified list)
- Gas incidents

First Aid regulations

The Health and Safety (First-Aid) Regulations 1981 set out the essential aspects of first aid that employers have to address. Employers have a legal duty to make arrangements to ensure their employees receive immediate attention if they are injured or taken ill at work.

There are generally four layers of first aid provision in the workplace:

- appointed person (AP);
- emergency first aid at work (EFAW);
- first aid at work (FAW);
- additional training

The level of provision will be based on a needs assessment which will need to consider factors such as number of workers, type of work, hazards and history of accidents.

International Standards for First Aid

While there are some differences of opinion globally regarding the best practice for first aid, there are organisation which liaise with one another to create a universal set of guidelines

for firs aid. The International Liaison Committee on Resuscitation (ILCOR) is made up of a number of resuscitation councils around the world including:

- AHA – American Heart Association
- ERC – European Resuscitation Council
- HSFC – Heart and Stroke foundation of Canada
- ANZCOR – Australia and New Zealand Committee on resuscitation
- RCSA – Resuscitation Council of South Africa
- IAHF - Inter-American Heart Foundation
- RCA – Resuscitation council of Asia

Most jurisdictions will follow either the American Heart Association or European Resuscitation Council guidelines. While they are very similar, there are some key differences.

American Heart Association	European Resuscitation Council
• **Unresponsive and not breathing normally?** – **No "look-listen-feel" for breaths** • **Shout for help and activate EMS** • **30 Compressions** • **2 breaths**	• Unresponsive? • Shout for help • Open airway • Not breathing normally? • 999 • 30 compressions • 2 breaths

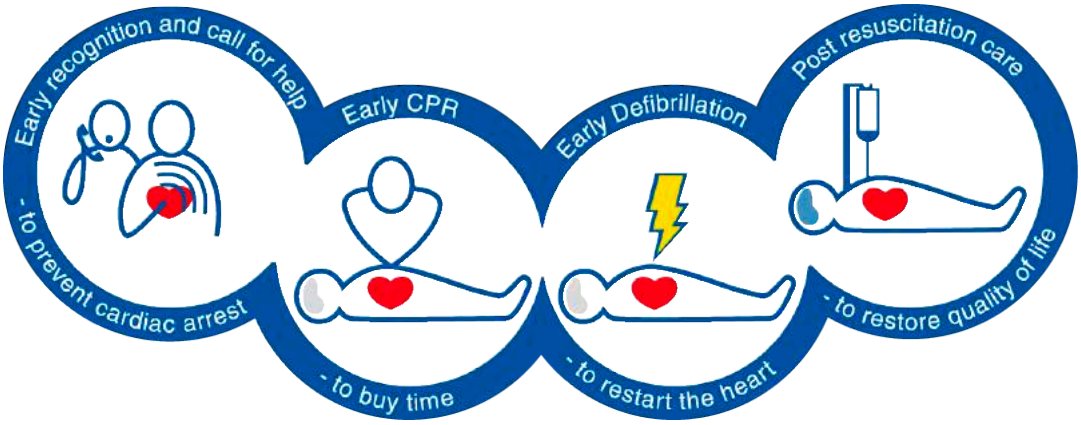
• **Adult Compressions:**
  – **At least 5cm**
  – **At least 100/min**
• **CAB Sequence for all**
  – **Compressions**
  – **Airway**
  – **Breaths**
	• Adult Compressions:
	  – 5-6cm
	  – 100-120/min
	• CAB Sequence for adults
	• 5 initial rescue breaths for children and infants.

Choking
• **Pre LOC**
  – **Abdominal thrusts**
• **Post LOC**
  – **CPR**
	Choking
	• Pre LOC
	  – 5 ab thrusts, 5 back blows
	• Post LOC
	  – CPR

Roles and Responsibilities

First aid is the initial care or treatment given to a person who becomes ill or injured. In the workplace you may be called upon to administer first aid to a customer or a colleague. The main aims of first aid are:

- **P**reserve life
- **P**revent the situation from getting worse
- **P**romote casualty recovery



Note: **Before commencing treatment of a casualty the first aider should ask for and receive the casualty's consent to treatment. If the casualty is unable to give their consent due to their injuries or because they are unresponsive you can assume their consent to treatment.**

Responsibilities of a first aider

- Ensuring first-aid equipment is fit for purpose
- Arriving at the scene
- Ensuring the scene is safe
- Contacting the Emergency Services
- Prioritising the treatment of casualties
- Clearing up after an incident
- Incident reporting and recording.

First Aider will generally be responsible for reporting any first aid incidents in the accident book. It is important to accurately report the following:

- What happened?
- Where did it happen?
- When did it happen?
- What was the casualty doing at the time of the accident?
- How did it happen?
- Details of the injured person
- What was the injury?
- What first aid was administered?
- What happened next? e.g. did the casualty attend hospital?

First Aid Kit Contents

CONTENTS	Leaflet	Contents list	Medium dressing	Large dressing	Triangular bandage	Safety pins	Eye pads	Plasters	Wipes	Adhesive tape	Nitrile gloves (pairs)	Finger dressing	Resus face shield	Foil blanket	Eye-wash (250ml)	Burn dressing	Safety shears	Conforming bandage
Type of Kit																		
SMALL	1	1	4	1	2	6	2	40	20	1	6	2	1	1	0	1	1	1
MEDIUM	1	1	6	2	3	12	3	60	30	1	9	3	1	2	0	2	1	2
LARGE	1	1	8	2	4	24	4	100	40	1	12	4	2	3	0	2	1	2
TRAVEL	1	1	1	1	1	2	0	10	4	1	1	0	1	1	1	1	1	1

First aid kits should not contain:

- Pills
- Medicines
- Sprays
- Creams
- Sharp scissors
- Cotton wool
- Inhalers

Hygiene

It is important to protect the first aider and the casualty from infection by using proper barrier devices. To assist in minimising the risk of infection and cross-contamination there are various precautions that can be taken such as:

- Having good personal hygiene
- Ensuring that barrier devices are used
- Covering any open cuts or sores
- Minimising contact with blood or bodily fluids
- Changing gloves between casualties
- Washing hands thoroughly after removing gloves.

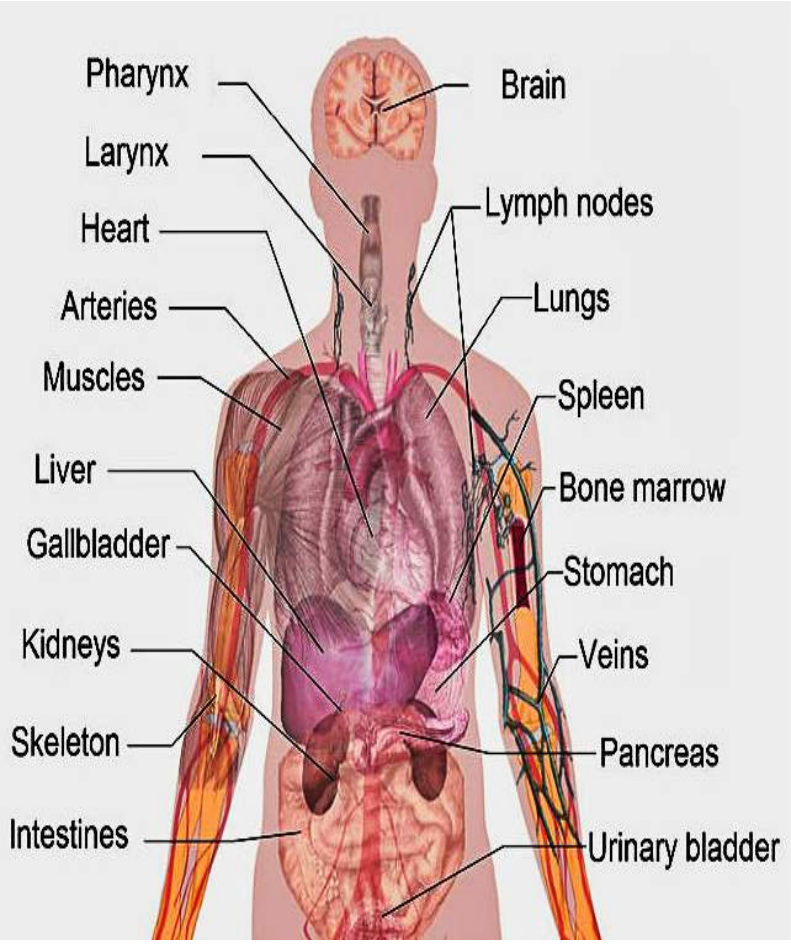
Barrier devices include nitrile gloves, pocket masks and face shields.

Anatomy for First Aid

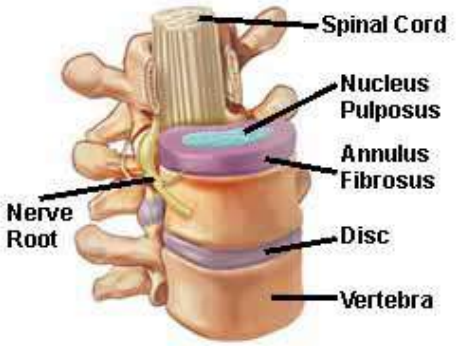
A basic understanding of human anatomy will help the first aider during assessment of the casualty to understand:

- Normal structure and function vs. abnormal
    - Airway, breathing
- Signs and symptoms
    - Signs – things we see
    - Symptoms – what the casualty tells us
- Recognition of common illnesses
- Identifying proper treatment.

Vital Organs



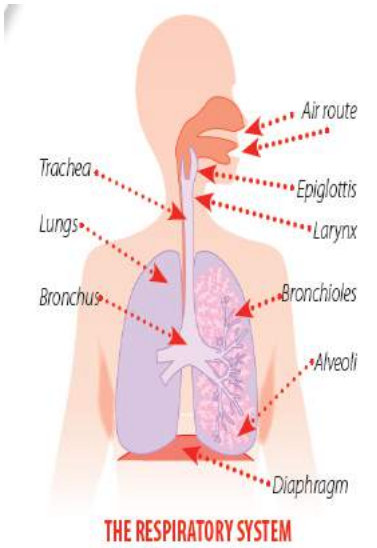
Nervous System



The nervous system is made up of the brain, spinal cord, sensory organs, and nerves. The nervous system controls bodily function and movement. The nervous system is very susceptible to threats from:

- Physical damage (falls, striking blunt objects)
- Reduction of blood supply (Stroke)
- Disease (epilepsy)

Respiratory System



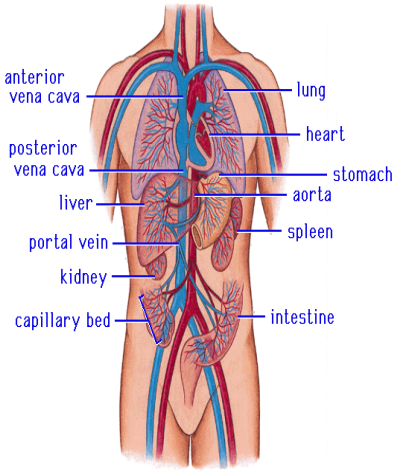
The respiratory system is responsible for the gaseous exchange of oxygen and carbon dioxide in the blood and is susceptible to threats from:

- Obstruction
- Toxins (H2S, CO)
- Physical Damage
- Disease (Asthma)

Normal function

- 12-18 breaths per minute (2-3 breaths in 10 seconds)

Circulatory System



The circulatory system is comprised of the heart, blood and blood vessels. The blood carries vital nutrients to the cells and brings waste back to be filtered in the organs and exhaled through the lungs. The circulatory system is susceptible to threat from:

- Poison
- Blood loss / restricted flow
- Shock
- Disease (heart disease)

Normal Function: 60-100 beats per minute

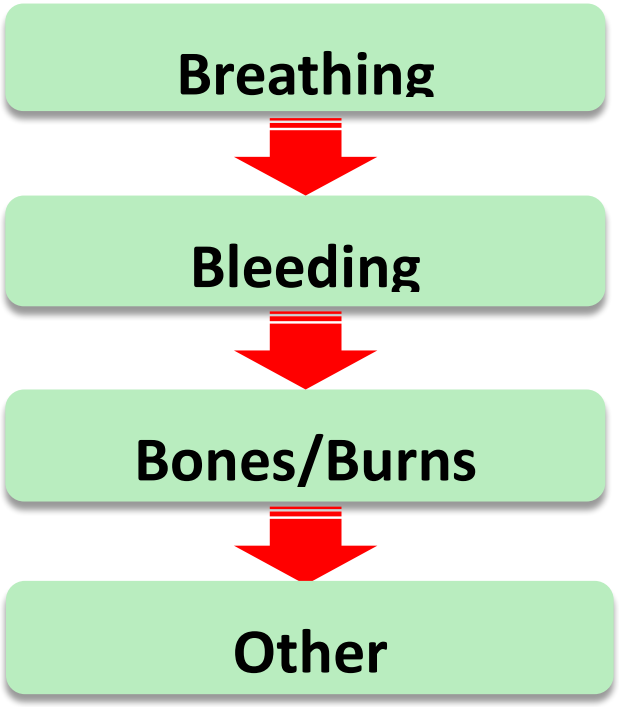
Incident Management

The outcome of any first aid incident will be better if it is properly managed from start to finish. When arriving on scene:

- Always try to remain calm
- Take charge of the situation
- Conduct a scene survey
- Ensure the safety of yourself, bystanders and others
- Gather information from bystanders and the casualty
- Fully brief the Emergency Services

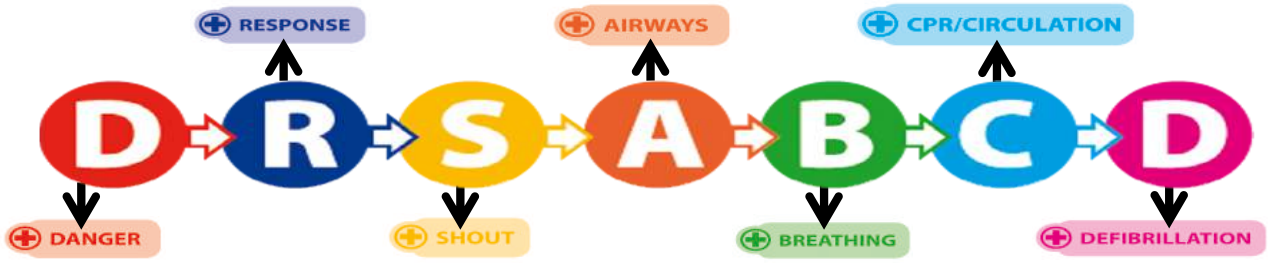
There may be additional resources available such as on site emergency response teams or external agencies such as the ambulance service or the coast guard. It is critically important that all personnel are aware of the procedure for emergency communication.

Prioritising Treatment



Primary Survey

The primary survey is a systematic process of; approaching, identifying and dealing with immediate and or life-threatening conditions.



Danger – ensure the area is safe to enter

Response – assess responsiveness of the casualty. If possible, approach the casualty from the feet as this prevents hyperextension of the neck from a responsive casualty.

Shout – If unresponsive, shout for help. If you are on your own, stay with the casualty at this point.

Airway – Ensure the airway is open using the head tilt/chin lift

Breathing – Ensure the casualty is breathing normally. After opening the airway look, listen and feel for normal breathing for no more than 10 seconds.

If the casualty is not breathing call 999/112 if onshore. If Offshore contact Standby vessel via radio.

CPR/Circulation – if the casualty is not breathing, commence CPR (30 compression / 2 ventilations.

When communicating with the casualty, it is important to gather as much information as you can in case they lose consciousness. The key things to look for are history, signs and symptoms.

History is about uncovering as much information about the casualty and the incident as possible; this will cover the time and nature of the accident, witnesses and injuries sustained. It is also a good idea to ascertain if the casualty is currently taking any prescribed medication or has suffered from any previous injuries.

Signs are what you as the first aider can see, smell or hear.

Symptoms are what the casualty actually feels. You should encourage them to tell you if they are suffering with pain, or are feeling nauseous or weak.

Secondary Survey

If the casualty is breathing a secondary survey should be carried out. Inform the casualty what you are doing at all stages. If the casualty is responsive ask them to tell you if they feel any pain during the head-to-toe survey which will include:

- Head and face
    - Look at the casualty's head and face for any obvious signs of injury or trauma.
    - Remove spectacles if the casualty is wearing them. Gently feel around the head, face and scalp for any bleeding, swelling or depressions.

    - Look at the casualty's ears for signs of bleeding or the presence of cerebrospinal fluid (CSF).
- Neck
    - Loosen any restrictive clothing such as ties or collars.
    - Gently feel around the cervical spine area and back of the neck to check for any bleeding, swelling or deformity and also check for medical necklaces.
- Chest and shoulders
    - Gently feel around the shoulders to check for signs of deformity and bleeding.
    - Check the chest for normal breathing movement (rise and fall) and check for any bleeding.
- Arms and hands
    - Check along the arms, feel for signs of deformity, swelling and bleeding.
    - Check the wrists for medical bracelets.

- Spine
    - Try to check as much of the spine as possible without moving the casualty; feel for tenderness and deformity as well as signs of bleeding.
- Pelvis
    - Visually check the hips and pelvis for deformity, unnatural positioning or bleeding
- Abdomen
    - Gently check the abdomen for signs of bleeding, swelling or unnatural softness.

- Legs and feet
    - Check the legs and feet for bleeding, unnatural positioning, swelling and deformity.
    - Check the pockets of skirts or trousers for objects that may cause discomfort or pain should the casualty be moved.

The Recovery Position

The recovery position is used to maintain a clear airway and assist with normal breathing when a casualty is unresponsive but breathing. It also assists when the casualty vomits or excretes saliva as it allows it to naturally drain from the mouth or nose.

However, if you suspect that a casualty has had a spinal or head injury, you must carefully consider the movement of the casualty.

Casualties with an injury (head or chest) should be placed injured side down if possible.

Bring the other arm across the casualty's chest and secure the back of their hand onto their nearest cheek with your hand.

With your free hand grasp the casualty's clothing around the knee and draw the leg up ensuring the foot remains on the ground.

Kneel to the side of the casualty; remove glasses, watches and any large objects from side pockets

Place the arm nearest to you at a right angle to the casualty's (allow it to rest in a natural position)

When placing a pregnant woman into the recovery position she should be placed onto her left hand side, as this prevents compression of the inferior vena cava.

Keeping the casualty's hand on their cheek to control the head movement, pull their leg towards you so the casualty turns onto their side

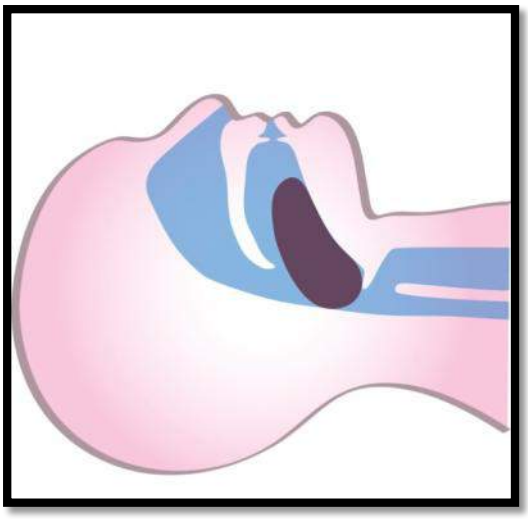
Adjust the casualty's upper leg so that the knee and lower leg are at right angles to the hip making a stable base.

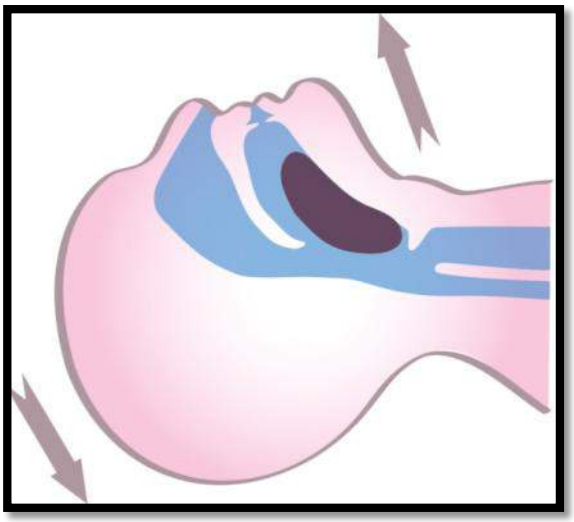
CPR

Basic life support (BLS) comprises of four main elements. Initial assessment, airway management, chest compressions and ventilations. CPR is a method of combining chest compressions with effective rescue breaths in order to artificially circulate blood and to put air into the lungs.

Airway management

It is important that the casualty's airway is properly opened and remains open. The airway should be checked periodically while the casualty is in the recovery position. The opening of the airway is accomplished by utilising the head tilt/chin lift procedure.





Once the airway is open, look listen and fell for 10 seconds to assess breathing. If not breathing normally, begin CPR.

Chest Compressions

Chest compressions must only be administered to a casualty who is not breathing normally.

- Depth of compression should be 5-6 cm
- Rate of compression should be 100-120 compressions per minute
- Administer ***30 chest compressions*** before moving on to ventilations.

Kneel by the side of the casualty. Place the heel of one hand in the centre of the casualty's chest

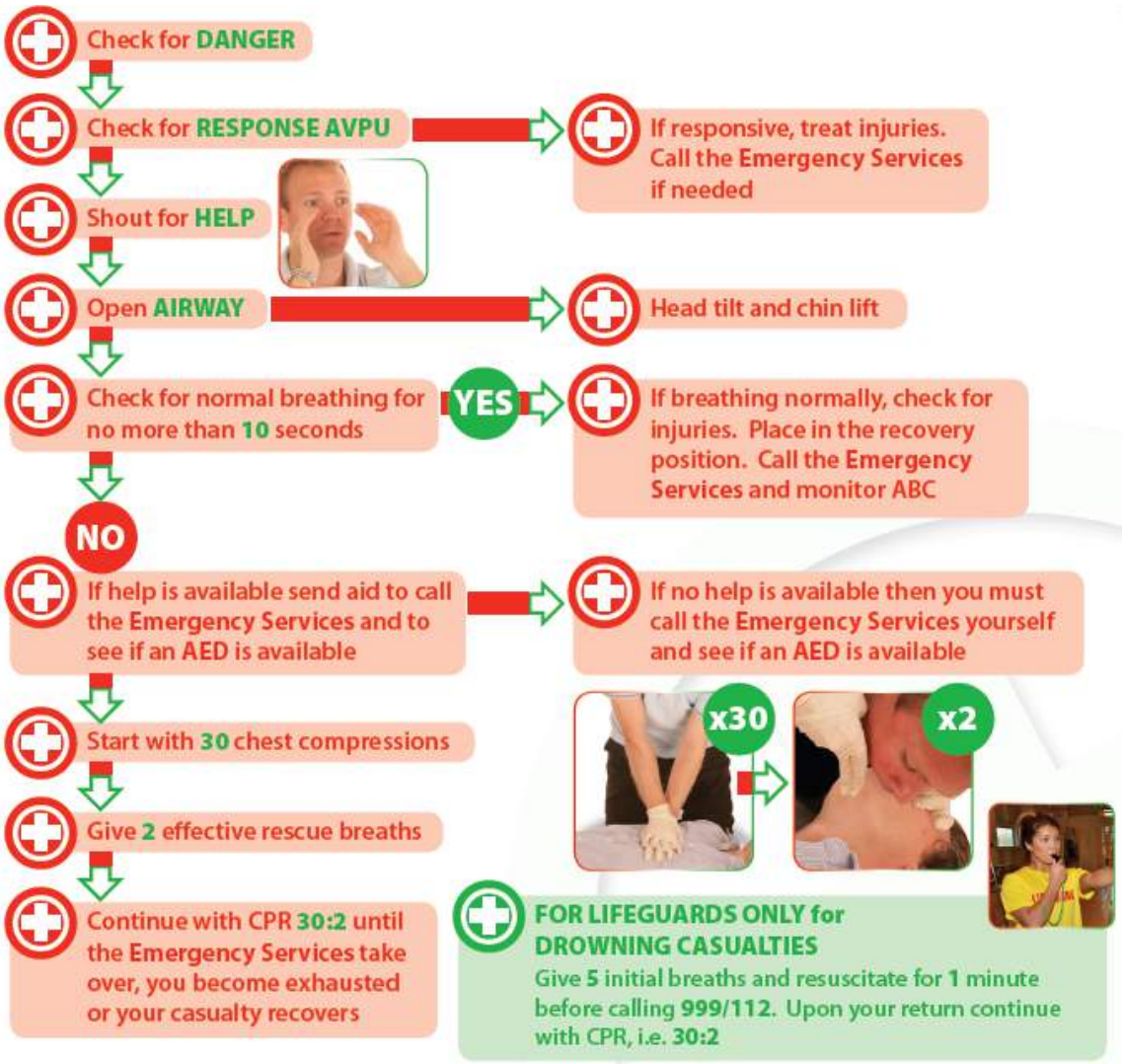
Place the heel of your other hand on top of the first hand. Interlock the fingers of your hands.

Ventilations

After completing 30 chest compressions the emergency first aider must then administer 2 effective rescue breaths. Each breath should take one second to complete and the casualty's chest should rise as in normal breathing; this is known as an effective rescue breath. Administering the 2 breaths should not take more than 5 seconds to complete in total. Once the first breath is administered remove your mouth from the casualty's mouth, turn your head and watch the chest rise and fall, then administer the second breath. A barrier device should be used for administration of rescue breaths.

Continue CPR (30 compressions, 2 breaths) until:

- Qualified medical assistance takes over
- The casualty shows signs of regaining consciousness such as coughing, opening their eyes, speaking or moving and starting to breathe normally
- You become physically exhausted and cannot continue
- If there is assistance available when administering CPR you should change over every 1-2 minutes.

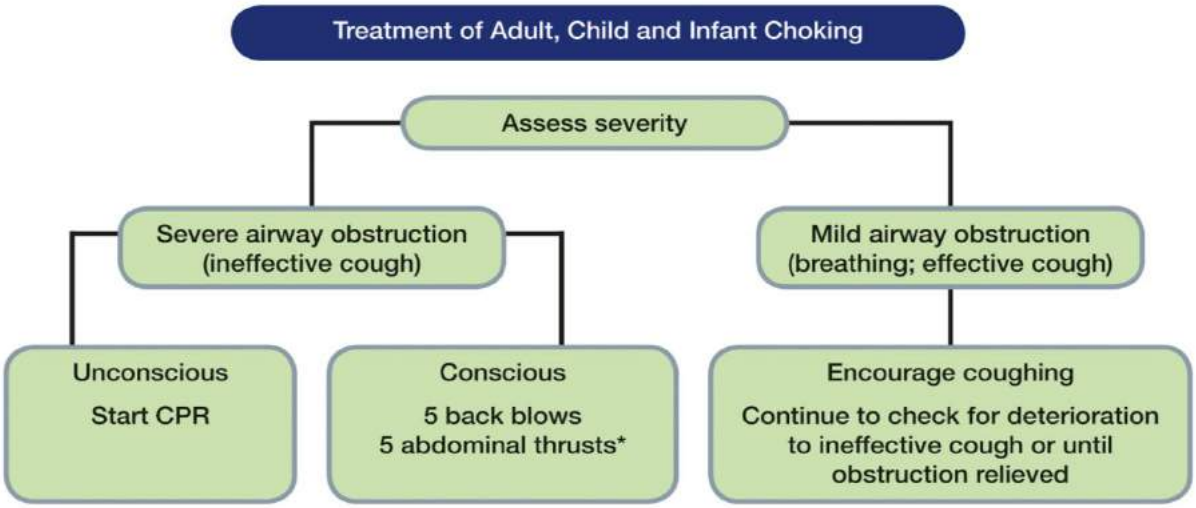


Compression only CPR

If you are not trained, the casualty has extensive facial injuries or you are unwilling to give rescue breaths then chest compressions only may be administered. If chest compressions only are given these should be continuous at a rate of 100-120 compressions per minute

Choking

Choking occurs when a piece of food or other material is swallowed but goes down the trachea (windpipe) rather than the oesophagus (gullet). This results in blockage of the airway. Unless help is given urgently the casualty will suffocate, become unconscious and may die.

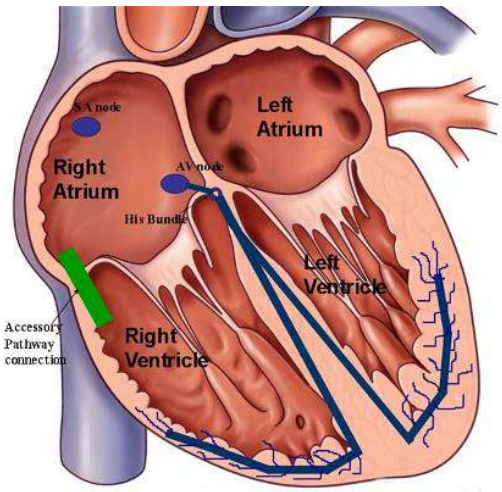


Automated External Defibrillator (AED)

An automated external defibrillator (AED) is a portable electronic device that automatically diagnoses the potentially life threatening cardiac arrhythmias.

- Ventricular Fibrillation
- Ventricular Tachycardia

AEDs deliver a shock to interrupt the malfunctioning electrical signal and allow the heart's natural pace maker to start up.



Heart Function

SA Node sends signal to contract heart muscles creating coordinated contraction and relaxation between the four chambers.

Any interruption of normal rhythm will prevent proper circulation.

Poor circulation = low oxygen

Arrhythmias

Definition: a problem with the rhythm or rate of heart beat

Ventricular Fibrillation

Disorganised/Chaotic contraction of heart muscle

- Heart quivering

Ventricular Tachycardia

- Fast heart rhythm
- Can lead to Ventricular Fibrillation

Once the AED arrives:

- If more than one rescuer is present, continue CPR while the AED is switched on. If you are alone, stop CPR and switch on the AED
- Follow the voice and or visual prompts
- Attach the electrode pads to the casualty's bare chest
- Ensure that nobody touches the casualty whilst the AED is analysing the heart rhythm
- There is no need to shave the chest unless it will affect the pads sticking to the skin
- Look for signs of a pacemaker or piercings; if visible ensure that the pads are kept clear of them.

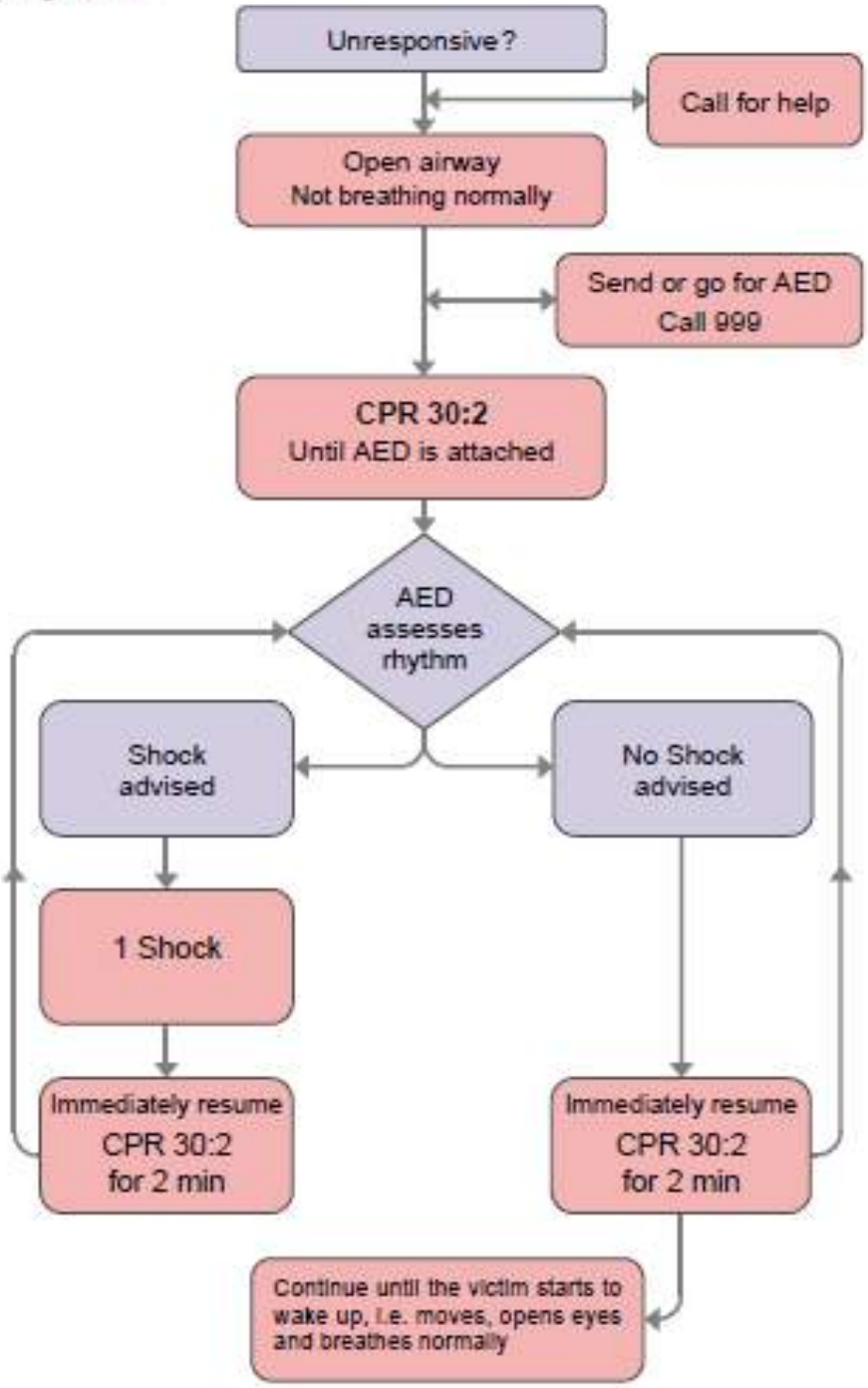
If a shock is indicated:

- Ensure that nobody is in contact with the casualty and give clear instructions for everyone to 'stand clear'
- Press the shock button as directed (fully-automatic AEDs will deliver the shock automatically)
- Continue as directed by the AED's voice and visual prompts
- The AED will inform you to continue with CPR; continue with CPR until the voice prompt informs you to stop

If no shock is indicated:

- Resume CPR immediately using a ration of 30 chest compressions to 2 rescue breaths
- Continue as directed by the voice/visual prompts.

AED algorithm



Bleeding

The circulatory system in its basic form consists of the heart, blood vessels and blood. Problems or malfunctions with the circulatory system can lead to major life-threatening conditions and cause health issues such as angina, heart attacks, strokes and blood clots.

The average adult heart beats continuously at a rate of 60-100 beats per minute. The average adult human body holds 8-10 pints of blood. The body struggles to operate if one third of its blood has been lost, blood pressure will fall quickly and the situation becomes critical.

Types of Bleeding

Capillary bleeding: This is a bleed that is red in colour and slowly oozes from the wound or from underneath the skin, e.g. bruising.

Venous bleeding: This is a bleed from a vein, the blood will be dark red in colour (deoxygenated blood) and will gush or flow from the wound.

Arterial bleeding: This is a bleed from an artery and will be bright red in colour (oxygenated blood); the blood will pump from the wound in time with the casualty's heartbeat.

Types of wounds

Laceration (tear)

A jagged wound that can be caused by tearing the skin in a jagged edge wound.

Puncture (piercing)

These are caused by an object puncturing or piercing the skin such as a small nail, a needle, a splinter or a shard of glass.

Abrasion (graze)

A superficial wound where the top layer of skin has been scraped off.

Penetrating wound (embedded)

Caused by a knife or bullet entering the body. The object passes through the skin and disrupts the underlying tissue. There could be severe internal and external blood loss.

Incision (cut)

Can be caused by the blade of a knife, scissors or a sharp piece of glass. The wound will appear neat in appearance and dependant on severity, may result in severe blood loss.

Contusion (bruise)

A contusion occurs when blood vessels are damaged or broken. In the majority of cases a contusion will be classed as a minor injury and will heal fairly quickly without treatment. Can be caused by a blow from a blunt object or when the body comes into contact with a hard surface. If the cause is severe, such as a fall, there is a possibility of serious internal bleeding.

Signs and Symptoms

There will usually be obvious sins of bleeding, however, if the casualty is wearing heavy clothing, a serious bleed may not appear quickly. Examine the entire body to ensure no bleeding is missed. Some common symptoms of blood loss are:

- Pain in the affected area
- Shock
- Thirst
- Weak but rapid pulse

Signs & symptoms	10% Blood Loss	20% Blood Loss	30% Blood Loss	40% Blood Loss
Response level	Normal	Nausea	Lowered levels of response, signs of shock	Possibly unresponsive
Skin colour	Normal	Pale/cool to the touch	Cyanosis (blue/grey tinges to the lips and extremeties, cold and clammy)	Extremely pale, cold and clammy
Breathing	Normal	Slightly raised	Rapid	Gasping for breath
Pulse rate	Normal	Slightly raised	Rapid weak pulse (hard to detect)	Undetectable

Treatment of Bleeding

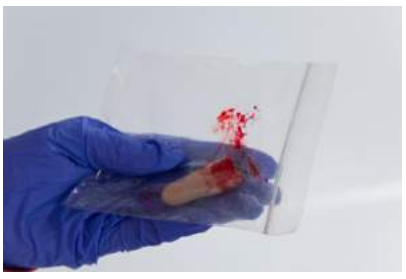
- Ensure that you put on your disposable gloves
- Sit or lay the casualty down on a firm, stable base
- Examine the wound
- Do not attempt to remove any embedded foreign objects
- Apply direct pressure onto the wound to try and stem the bleeding
- Dress the wound with a sterile dressing and elevate the injured part if possible
- If blood seeps from the first dressing then apply a second dressing directly over the top of the first one.
- If the blood seeps through the second dressing then remove both dressings and start again. This course of action is carried out because there is not a sufficient seal between the dressing and the wound. Once the dressing becomes saturated with blood it becomes ineffective
- Support and elevate the wound part and be prepared to treat the casualty for shock
- A triangular base can be folded into a broad fold bandage to help support a limb. It can also be used to help to apply pressure over a sterile dressing
- Do not allow the casualty to smoke or to consume any food or drink
- Contact the Emergency Response Service or Standby vessel if offshore and monitor the casualty.

Embedded objects

- Do not remove the object.
- Apply dressings and pressure to either side of the object.
- If possible, apply a larger dressing over the top and secure the dressing in place.
- Ask the casualty to assist, if able

Amputation

- Dress the casualty's wound
- Place amputated part in a plastic bag or cling film
- Wrap cloth around the plastic
- Place on a bag of ice
- Write the casualty's name on the bag along with details of the body part (record the approximate time of the amputation if possible)



Internal bleeding

This is when blood escapes from the circulatory system but remains inside the body. Sometimes signs of internal bleeding can be visible such as when the casualty coughs up blood or vomits blood but most of the time internal bleeding is not apparent.

Causes of internal bleeding could include:

- Rupture of arteries, veins or capillaries within the body
- Damage to internal organs
- Blunt force trauma(falls, crush injuries)
- Fractures which damage blood vessels or internal organs

Internal bleeding can pose a number of threats including:

- Pressure on internal organs
    - Head – pressure on brain
    - Abdomen – pressure on diaphragm (breathing)
- Shock

Recognition	Treatment
• **Consider mechanism of injury** • **Signs and symptoms of shock** • **Pain** • **Thirst** • **Confusion** • **Possible collapse** • **Bruising/swelling** • **Bleeding from orifices**	• **Treat casualty for shock** • **Call for help** • **Monitor casualties condition** • **Calm and reassure the casualty** • **If casualty becomes unresponsive, follow BLS procedure** • **Recovery position – injured side down**

If bleeding is in the chest or abdomen, raising the legs will cause pressure on the internal organs and make breathing difficult. Place casualty in a semi-seated position with knees bent and support underneath.

Shock

Shock is defined as a failure of the circulation, which leads to an inadequate supply of blood to the vital organs.

Shock can be caused by a number of factors including:

- Low blood volume - bleeding (hypovolemic shock)
- Loss of bodily fluids - vomiting, diarrhoea, burns or severe dehydration
- Low cardiac output - not enough blood being pumped round the body by the heart (cardiogenic shock)

Recognition

SIGNS	SYMPTOMS
• Pale, cold, clammy skin • Blueness of lips • Weak rapid pulse • Rapid, shallow breathing • Unconscious	• Dizziness • Confusion • Disorientated • Nauseous • Thirsty

Treatment of Shock

- Assist the casualty to lie down, raise their legs
- Treat the cause of shock if possible
- Reassure the casualty
- Keep them warm, prevent heat loss
- Monitor the casualty
- Don't give them any food or drink
- Place the casualty in the recovery position – if unconscious and breathing normally
- Call 999/112 for emergency help

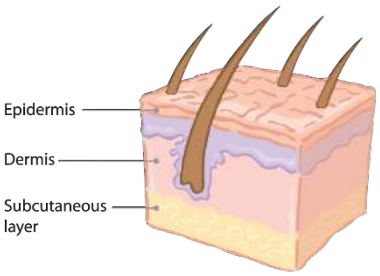
Ordinary First Aid

This section will cover other injuries and illness that are often considered secondary and less life threatening. If left untreated, they can lead to serious complications and become life threatening. This section will look at:

- Burns
- Chemical contacts
- Hypothermia
- Hyperthermia
- Bite wounds
- Eye injury
- Fractures
- Injury to joints, muscles and bones
- Other Illnesses – Heart attack, stroke, epilepsy, asthma, diabetes

Burns

The skin is made up of a number of layers called the Epidermis, Dermis and the subcutaneous layer. The severity of a burn injury will depend on the depth of the burn as this will dictate the amount of tissue and nerve damage. Burns ae classified by their severity as either first, second or third degree burns.



First Degree Burns

- Affects top layer of tissue
- Pain at the site of the injury
- Redness, tenderness and swelling
- Possible blistering.

Second Degree Burns

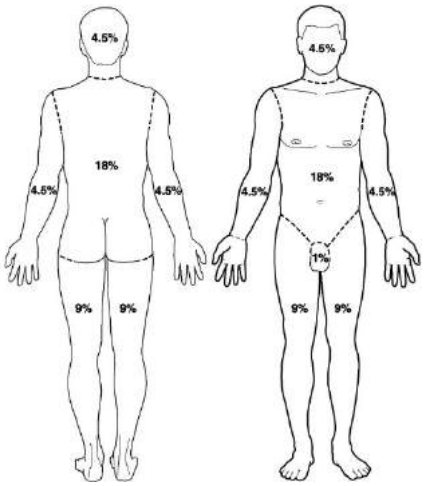
- Dermis and epidermis are burnt
- High risk of infection
- The skin will appear raw and swollen
- The wound will be painful
- Blisters may be present that omit a clear fluid

Third Degree Burns

- All layers of tissue are burnt
- Usually less painful as nerves may be damaged
- The injury appears a brown/black colour and often looks charred
- The texture is dry and leathery
- Limited movement (stiffness) around the injured area
- There may be pain at the site of the injury.

Treatment of Burns

1st degree	2nd degree	3rd degree
• **Remove from the source of the burn if necessary** • **Place on your disposable gloves** • **Immerse in tepid running water (not freezing) for the minimum of 10-20 minutes (the longer the better)** • **Remove restrictive clothing or jewellery in case of swelling** • **Do not remove anything that is stuck to the burnt skin** • **Place a dry sterile dressing or if unavailable then apply cling film around the injury **** • **Seek medical attention immediately if the burn covers more than 5% of the body or it is effecting the airway and breathing**	• For electrical burns ensure that the source has been disconnected and there is no further danger to yourself, bystanders and the casualty • Remove the source of the burn if possible • Place on your disposable gloves • Remove clothing and then flush the area of the wound with tepid water for the minimum of 10-12 minutes • Remove restrictive clothing or jewellery in case of swelling – however, do not remove anything that is stuck to the burnt skin • Do not burst any blisters that may have formed • Place a dry sterile dressing or if unavailable then apply cling film around the injury. • See medical attention if more than 1% of the body or it is affecting the airway and breathing. More than 9% of the body then be prepared to treat for shock	• For electrical burns ensure that the source has been disconnected and there is no further danger to yourself, bystanders and the casualty • Remove the source of the burn if possible • Place on your disposable gloves • Remove clothing or jewellery in case of swelling • Do not remove anything that is stuck to the burnt skin • Place a dry sterile dressing or if unavailable apply cling film around the injury. • Seek medical attention immediately



Chemical Burns

Chemical burns can be extremely dangerous. Body tissue is damaged, usually by direct contact with the chemical or its fumes. Exposure can severely damage tissue and also lead to disability and scarring. All chemical burn casualties should be referred to hospital as soon as possible.

Treatment of Chemical burns to the body

- Make sure the area is safe
- Ventilate, wear ppe
- Flood the area with water for 20 minutes

Treatment of chemical burns to the eye

- Wash chemical from the eye for a minimum of 10 minutes with fresh running water
- Ensure chemical does not run into the other eye
- Cover with sterile pad and seek medical attention

Electrical Shock

Once the electrical supply has been isolated:

- Call 999/112 for emergency help
- If the casualty is not breathing, start CPR
- If the casualty is unconscious but breathing normally, place them in the recovery position and monitor
- Treat burns
- Treat the casualty for shock

Hypothermia

Signs and Symptoms

- Pale, cold skin (caused by blood vessels drawing into the body to assist with maintaining heat around the core)
- Shivering at onset, then the muscles in the body stiffen as the condition gets progressively worse
- Lethargy
- Breathing, speech and pulse slowing
- Disorientation and confusion
- Diminishing levels of response leading to unconsciousness and eventually death.

Classifications of Hypothermia	Core BodyTemperature	Patient's ability to rewarm without external heat source	Clinical presentation of Hypothermic Patient	
Normal	Above 35ºC	N/A	Cold sensation shivering	
Mild	35-32ºC	Good	Physical impairment • Fine motor • Gross motor	Mental impairment • Complex • Simple
Moderate	32-28ºC	Limited	**Below 32ºC shivering stops** **Below 30ºC consciousness is lost**	
Severe	Below 28ºC	Unable	Rigidity, Vital signs reduced or absent Severe risk of mechanically stimulated ventricular fibrillation (VF) (rough handling)	
	Below 25ºC	Unable	**Spontaneous ventricular fibrillation (VF)Cardiac arrest**	

Treatment of Hypothermia

Mild	Moderate - Severe
• Call 999 • Warm the person slowly – Dry clothing, blankets – External heat may be applied to areas such as under arms • Give warm, high sugar drinks	• Call 999 • Handle gently. Rough handling can cause ventricular fibrillation • DO NOT rub the skin • Lay horizontally and gently remove wet clothing and cover with dry blankets or clothing • Gentle re-warming as with mild hypothermia • DO NOT place in hot bath or shower • NO oral food or drink

Hyperthermia

Heat Exhaustion	Heat Stroke
• Hot flushed skin • Profuse sweating • Fatigue • Headache, nausea and vomiting • Rapid pulse • Confusion • Urinating less (urine a dark colour).	• High temperature (above 40 degrees C) • Hot dry skin • Nausea, dizziness and vomiting • Intense headache • Lower response levels • Rapid pulse and breathing • Muscle cramps • May be unconscious.
Treatment	
• Move the casualty to a cool place • Give the casualty water to rehydrate • Remove any excessive clothing • Monitor the casualty's response levels • Seek medical attention.	• Move the casualty to a cool place • Contact the Emergency Services • Give the casualty water to drink • Try to cool the skin by applying a damp towel or spraying them with water • Be prepared to carry out basic life support

Bites and Stings

Although painful, most bites and stings are not serious. Bites or stings in the mouth can lead to swelling which can restrict breathing. There may also be a risk of anaphylaxis.

General Treatment

- Ensure Safety
- Wear gloves
- Keep casualty still to limit effects of venom
- Control bleeding
- Minimise infection, cover the area
- Monitor casualty
- Seek medical attention if necessary
- Do not remove stingers with tweezers. Use a blunt edge such as credit card.

Jellyfish

Jellyfish and sea anemones have stinging cells that stick to the skin. These contain venom and although relatively harmless in the UK, this venom can cause swelling and anaphylactic reactions.

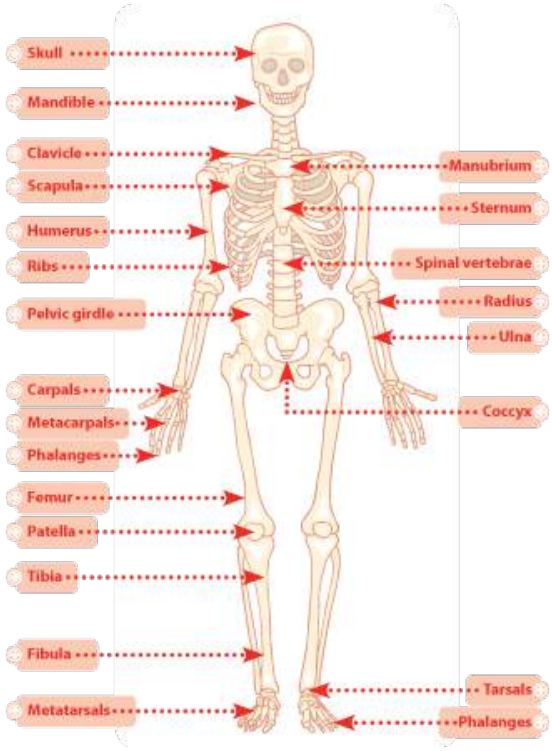
Treatment

- Brush off the cells with powdered chalk or pour vinegar over the area to neutralise the cells
- Keep the casualty calm to reduce the effects of venom
- Use ice pack to reduce swelling
- Monitor casualty
- Seek medical attention if necessary

Eye Injuries

Treatment

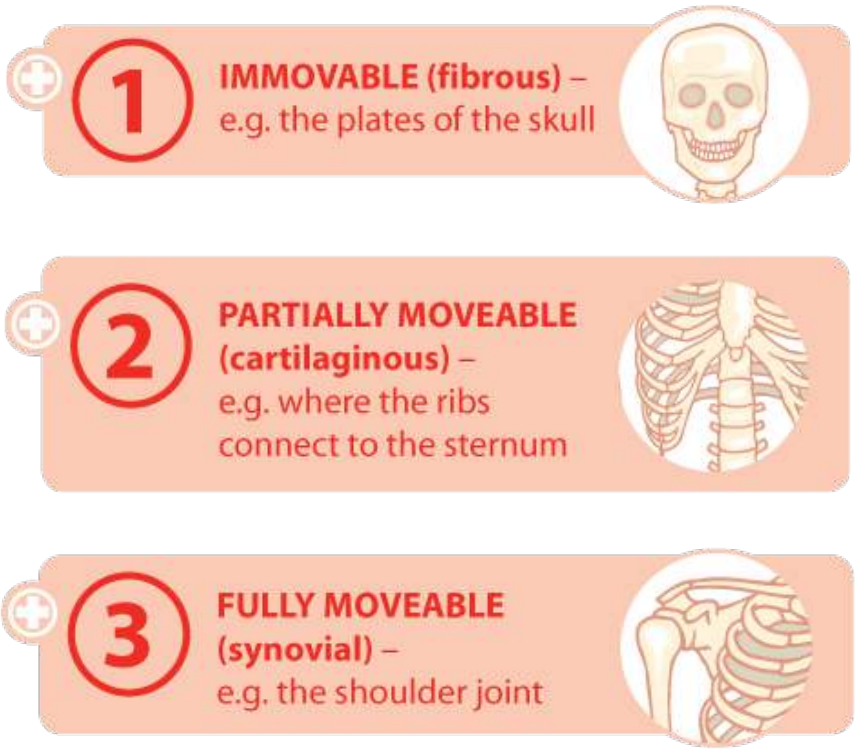
- Take particular care if the casualty is wearing contact lenses
- Advise the casualty not to rub the eye
- Gently separate the eyelids with your finger and thumb to examine
- If you can see a foreign body, wash it out
- If this does not work, carefully apply an eye pad to the affected eye
- Make arrangements for the casualty to get medical help
- If it is a chemical injury give the details to the emergency services and wash the eye(s) with a sterile solution or tap water ensuring the water runs away from the good eye



The adult human skeleton is made up of 206 bones. The skeleton shapes and forms our bodies and protects vital organs such as the brain, heart and lungs.

Joints connect individual bones and allow for movement through muscles which are attached to the bone by fibrous tissues called tendons.

There are 3 types of joints:



Types of Fractures

CLOSED FRACTURE

THE SKIN IS NOT BROKEN

THERE MIGHT BE:

- BRUISING
- SWELLING
- DEFORMITY

SKIN HAS BECOME BROKEN BY THE BONE WHICH MAY OR MAY NOT STILL BE PROTRUDING FROM THE WOUND.

HIGH RISK OF INFECTION

COMPLICATIONS CAUSED BY THE FRACTURE SUCH AS TRAPPED BLOOD VESSELS OR NERVES

Symptoms:

- Injured area is hard to move and generally painful
- Severe pain is common, it is not always present

Signs:

- Cracking sound may be heard
- Bleeding can be seen where a fracture is open
- Swelling and deformity can usually be seen
- Crepitus

Treatment

- Keep the casualty in the position in which they were found, move only if absolutely necessary
- Immobilise or support to reduce the potential of further damage to the injury
- Support upper limbs by hand or with a sling
- Support lower limbs with pads of blankets, clothing or similar soft materials
- Cover any exposed wound with a sterile dressing (do not apply direct pressure to an open fracture)

Support Sling

A support sling supports and immobilises an injured arm, wrist or ribs, this can only be used for casualties who can bend their elbow.

Elevation Sling

The elevation sling supports the arm and hand in a raised position, this will help to control bleeding and minimise swelling or shoulder injuries.



Dislocations

Happens when a bone or joint is displaced, often associated with ligament and muscle damage.

Symptoms:

- Nausea is also a characteristic of a dislocation due to the pain and can lead to shock

Signs:

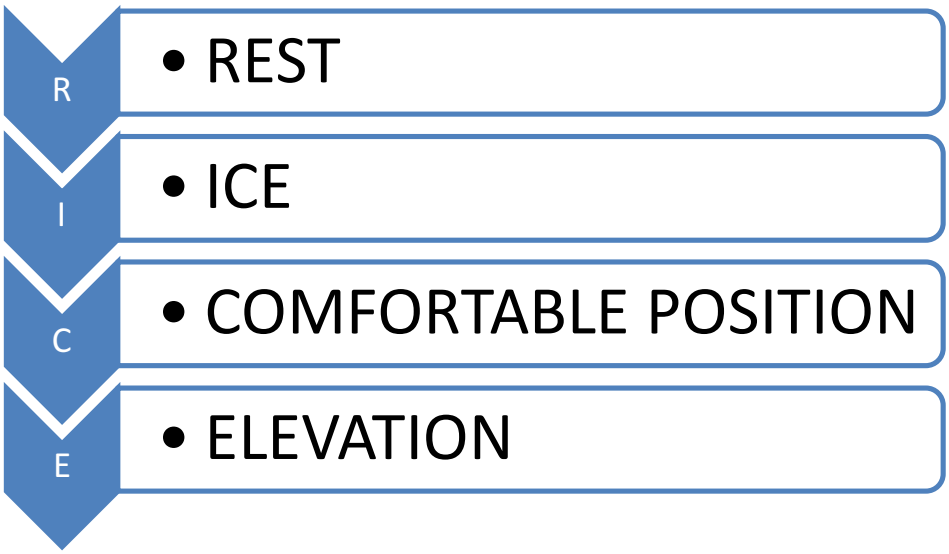
- Reluctance to move the area
- Severe pain
- Deformity
- Swelling

Treatment of Dislocations

- Allow them to find the most comfortable position for themselves
- Support that position with padding and/or bandages
- Don't try to relocate the joint or aggravate the injury
- Call 999/112 for emergency help

Sprains	Strains
Sprains happen at joints where ligaments have been wrenched	**Occur if a muscle is over-stretched**
Symptoms: • **Pain** • **Difficulty moving** **Signs:** • **Swelling soon after the injury** • **Bruising and discolouration over time**	**Symptoms:** • **Localised, intense pain** **Signs:** • **Swelling** • **There may be severe cramp**

Treatment of Strains and Sprains



Spinal Injuries

Spinal injuries can be very serious as they can result in paralysis or even death if the spinal cord is damaged. Common causes of spinal injuries in the workplace are falls, vehicle collisions and blunt force trauma.

Signs	Symptoms
• **Bruising or swelling at impact area of head, neck or spine** • **Deformity or irregularity of the spine** • **Loss of muscle control** • **Unconsciousness**	• **Lack of movement/power in one or more limbs** • **Disorientation or bewilderment** • **Numbness or tingling in the limbs** • **Pain in the neck or back**

PRINCIPLES OF CASUALTY MANAGEMENT

Because most accidents happen unexpectedly, it is often impossible to know exactly what happened, the nature of the injury and any subsequent damage to the spine. It is important to treat and follow the basic principles below:

Stabilising the head, neck and upper spine

The higher the spinal injury the more of the body can potentially be paralysed. Therefore the first action must be to stabilise the head in a neutral position, keep the neck and upper spine supported and in line, this is called in-line stabilisation and maintain the casualty in a horizontal position.

INCIDENT MANAGEMENT PRIORITIES

The first priority of the first aider is to save life. Where the casualty is not breathing CPR would need to start. It is important to remember that the casualty's airway takes priority over injury. Ultimately your decision must be based on the priority of saving life. There are three key priorities to follow:

- Save life
- Stabilise the casualty's head, neck and upper spine
- Maintain their horizontal position

Treatment for Spinal Injuries

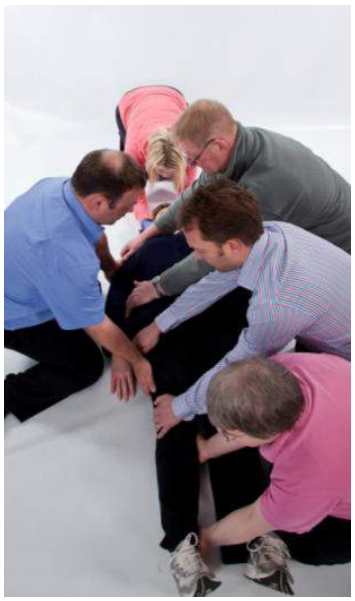
- Advise the casualty not to move
- Reassure the casualty
- Call 999/112 for emergency help
- Stabilise the casualty's head
- Rolled blankets can be used as additional support
- Monitor and reassure the casualty until emergency help arrives

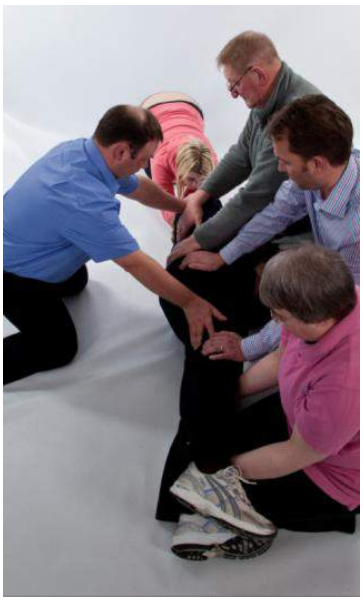
Spinal Injury if CPR is required

- When opening the airway, attempt to use chin lift alone to avoid injury to the spine. If this is unsuccessful, add head tilt, but only the minimum needed to obtain a clear airway.
- When a first aider with help is present, the first person should kneel at the casualty's head, look down the line of the body, and apply manual in-line stabilisation of the cervical spine, keeping his elbows on the floor. The second person should perform CPR in the normal way. Once the airway has been opened, the head position should be maintained by the person stabilising the spine.
- In the unlikely event that only one first aider is present with no additional support, standard CPR should be performed.

Managing Regurgitation of Stomach Contents

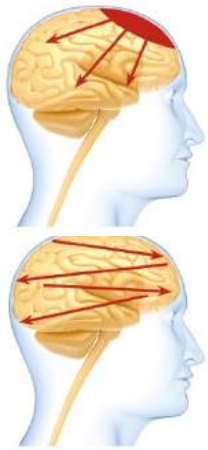
If you need to turn the casualty onto their side due to regurgitation during CPR, the same principles for managing regurgitation of stomach contents apply. If there is a person providing manual in-line stabilisation of the head, ensure effective communication to roll the casualty while keeping the head, neck and chest in line. Where there are additional team members they can assist with the roll of the casualty. In the unlikely event that you are on your own, carry out management of regurgitation in the normal way taking care to minimise any head and neck movement.





Head Injuries

Signs	Symptoms
• Changes in skin colour • Unusual breathing pattern • Blood in white of the eye • Dilated pupil(s) • Bleeding or fluid coming from an ear or the nose • Bleeding, swelling or bruising • Soft area or depression in the skull	• Dizziness, confusion • Possible nausea or vomiting • Possible short term memory loss • Headache • Possible seizures



Concussion is where a casualty may briefly become unconscious after a blow or other injury to the head. Compression is a potentially fatal condition where there is pressure to the brain from either a traumatic head injury (skull fracture) or bleed in the brain. It is not essential to try and diagnose the type of head injury, as all are serious and qualified emergency help should be summoned.

Head Injury Treatment

- Call 999/112 for emergency help
- If conscious, help the casualty to lie down and keep the head, neck and body in line in case there is a neck injury
- Look for and treat any other injuries
- If unconscious but breathing normally place the casualty into the recovery position
- Maintain airway and breathing

Penetrating Chest Injury

Signs	Symptoms
• Where there is an open wound, you may hear air being sucked into the chest cavity • Blue / grey skin color • Frothy coughed up blood • Bubbling blood from the wound • Sound of air being sucked in through the wound as the casualty breathes in	• Difficult and painful breathing that can be rapid, uneven or shallow • Severe and acute pain

Treatment

- Call 999/112 for emergency help
- Sit the casualty in the most comfortable position leaning towards the injured side
- Use the palm of their hand to cover the wound
- Place a sterile dressing over the wound, covering with a plastic bag or cling film and secure firmly with adhesive tape along three edges

- As long as the casualty remains conscious, support in the same position
- If the casualty becomes unconscious but breathing normally place them in the recovery position (on the injured side)
- If the casualty is not breathing normally carry out CPR

Blunt Force Trauma

Signs	Symptoms
• **Shallow breathing** • **Signs of shock** • **Signs of internal bleeding**	• **Pain at the site of the fracture (this may be sharp)** • **Painful when breathing** • **Symptoms of shock** • **Symptoms of internal bleeding**

Flail Chest

When a casualty breathes in and their chest wall expands as normal, the flail section moves in and when the casualty exhales the section moves out. This can be a result of blunt force trauma such as a fall.

Treatment of Blunt Force Trauma / Flail Chest

- Call 999/112 for emergency help
- Sit the casualty in the most comfortable position leaning towards the injured side
- Support the arm on the injured side to help keep the weight of the arm off the injury (an elevation sling can be applied)
- If the casualty becomes unconscious but breathing normally place them in the recovery position (on the injured side)
- If the casualty is not breathing normally, carry out CPR

Poisoning

There are many potential poisons with varying effects, however, most poisonings will result in similar signs and symptoms. The key to proper treatment is to identify the poison by looking for evidence in the area or asking the casualty.

Signs	Symptoms
• **Evidence of the poisonous substance** • **Unusual smell in area or on breath e.g. gases** • **Vomiting** • **Burns and swelling** • **Headache** • **Pale skin**	• **Difficulty breathing** • **Dizziness** • **Nausea** • **Abdominal pains** • **Confusion**

Treatment

- Move the casualty to a safe place
- Remove the cause (where possible)
- Do not induce vomiting
- For swallowed corrosive substances rinse the mouth and give sips of water or milk
- Treat injuries i.e. burns
- Call 999/112 for emergency help
- If CPR is required, use a face mask (barrier resuscitation)
- If the casualty is unconscious but breathing normally, place them in the recovery position
- Pass on to emergency services any information about the poison

Anaphylaxis

This is a serious, potentially fatal condition caused by a massive allergic reaction. In sensitive casualties, anaphylactic shock can develop within a few seconds or minutes following contact with any substance that a casualty is allergic to. Common triggers include:

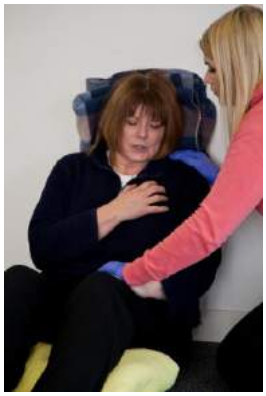
- Foods
- Insect bites and stings
- Medication
- Latex

Signs	Symptoms
• **Anxiety/panic** • **Swelling of the hands, feet and / or face** • **Swelling of the tongue and throat** • **Red itchy rash on skin** • **Red itchy watery eyes** • **Pale or flushed skin** • **Unconsciousness** • **Medic Alert bracelet** • **Difficulty in breathing** • **Signs of shock**	• **Nausea** • **Shock** • **Impaired breathing** • **Rapid pulse** • **Feeling of terror** • **Confusion and agitation**

Treatment

- Ask the casualty if they have their auto injector with them e.g. an epi-pen, and give it to them to use as prescribed
- Call 999/112 for emergency help
- If the casualty has difficulty breathing they may prefer to sit up
- If the casualty feels faint lay them down immediately and raise their legs
- Monitor the casualty's breathing
- Prepare to carry out CPR if required
- Unconscious normal breathing casualties should be placed in the recovery position and breathing monitored

Heart Attack



A heart attack occurs if there is some interruption in the blood supply to the heart itself such as a blood vessel becoming blocked. This would result in the heart muscle being starved of oxygen.

Signs	Symptoms
• **Pale grey skin** • **Coughing** • **Blue tinge to skin and lips** • **Sweaty skin** • **Casualty may find breathing difficult** • **Clutching chest** • **Sudden collapse**	• **Dizziness, nausea** • **Severe crushing or tightening sensation/pain in chest** • **Tingling sensation/pain in left arm, may spread to jaw or other areas** • **Feeling of indigestion** • **Rapid, weak or irregular pulse** • **Feeling of impending doom** • **Anxiety**

Treatment

- Call 999/112 for emergency help
- Assist the casualty to sit in a comfortable position (half sitting)
- Loosen tight clothing around the neck and waist
- Ask the casualty if they have any medical conditions or medication and if so, advise them to use as prescribed
- Reassure the casualty
- If possible, remove any causes of stress or anxiety
- Monitor the casualty
- Be prepared to perform CPR if the casualty stops breathing
- Explain that slowly chewing one standard aspirin tablet is beneficial

Aspirin

The First Aid Regulations do not advise giving tablets or medicines to treat illness. The only exception to this is where aspirin is used when giving first aid to a casualty with a suspected

heart attack, in accordance with currently accepted first-aid practice. If the casualty wants to take aspirin, get the tablets for them if available (300mg of aspirin is recommended).

Angina

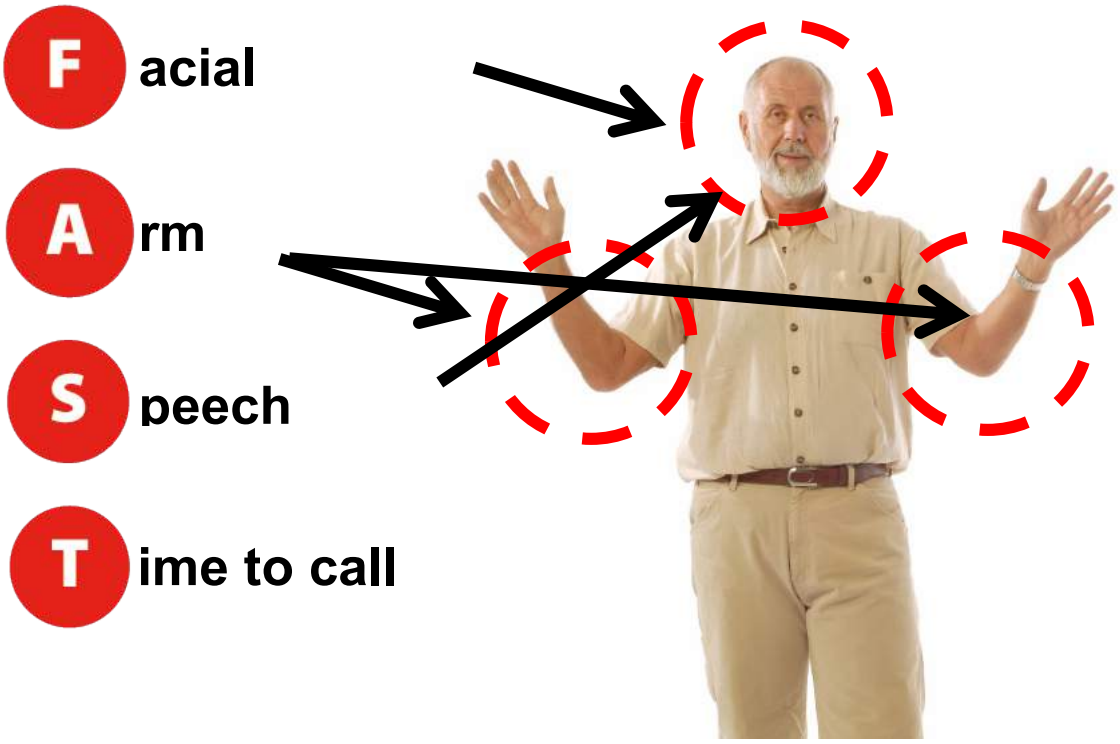
Angina (angina pectoris) is caused by a build-up of fatty deposits inside the coronary arteries causing them to narrow. This narrowing impedes the flow of blood to the heart and causes pain similar to that of a heart attack. An angina attack is similar to a heart attack; however an angina sufferer will recover with rest and the attack should only last between 1-15 minutes.

Treatment

- Ascertain if this is the first attack or if they have previously been diagnosed
- Rest the casualty
- Encourage them to take their medication if applicable usually GTN spray (Glyceryl trinitrate)
- Seek medical attention if it's the casualty's first attack or if you are unsure of the condition

Stroke

A stroke is a serious medical condition that occurs when the blood supply to part of the brain is cut off. The acronym F.A.S.T. is used to remember the signs and symptoms.



Treatment

- Call 999/112 for emergency help
- Lay the casualty down with their head and shoulders slightly raised
- Reassure them but do not bombard them with questions that they may have difficulty in answering if they have a problem with their speech
- Monitor constantly
- If the casualty is unconscious but breathing normally, place them in the recovery position and monitor breathing

Epilepsy

Seizures occur when normal brain activity is suddenly disrupted. This can be caused by a number of different illnesses or injuries. Some casualty's may be diagnosed with epilepsy

and epilepsy is currently defined as a tendency to have recurrent seizures. The common signs of a major seizure are:

- Casualty may collapse
- Muscles may stiffen
- Lips go blue
- Limbs may make sudden jerking movements
- Eyes may roll
- Teeth may clench
- Breathing may be noisy
- May lose control of bladder or bowel

Treatment for major seizure

- Remove objects that could cause injury
- Protect the head
- Loosen any tight clothing
- Note the time and duration
- Once the seizure is over, the casualty may feel tired and fall into a deep sleep

When to call 999/112

- If the seizure lasts for longer than 5 minutes
- The casualty has a second seizure
- The casualty has injured themselves
- The casualty's first seizure
- If they do not wake up after 10 minutes of recovery
- If the seizure lasts longer than normal
- If you are unsure

Signs and Symptoms of a Partial Seizure / Absence

- Jerking or twitching
- Plucking at their clothes
- Swallowing repeatedly
- Lip smacking
- Wandering around appearing dazed

Treatment

- Keep them away from any danger
- Sit or lie them down in a quiet place
- Reassure
- Stay with the casualty until they are fully alert

Asthma

Asthma is where the muscles of the air passages go into spasm and narrow the airway causing wheezing and shortness of breath.

Signs and Symptoms

- Breathing difficulties
- Wheezing, breathlessness
- Anxiety (which could have brought on the attack)
- Difficulty in speaking
- Pale and clammy grey or blue lips (cyanosis)

Treatment

- Reassure the casualty
- Sit them in a comfortable position
- Encourage them to use their prescribed medication
- Remove from the cause if known (e.g. dusty room, fumes)
- Be aware that cold winter air can make an attack worse

Call 999/112

- The casualty becomes unconscious
- An attack is severe
- An attack lasts longer than normal
- Medication doesn't help
- The person becomes distressed or exhausted

Diabetes

Diabetes is caused by a disturbance in the body's ability to regulate blood sugar levels. It can result in:

- Hyperglycaemia – too much blood sugar, normally develops gradually
- Hypoglycaemia – too little blood sugar

Hypoglycaemia is usually caused by insufficient food, exercise or excess insulin in the body and is the condition you are most likely to encounter.

<table>
<tr><th colspan="2">Diabetes Signs and Symptoms</th></tr>
<tr><th>Hypoglycaemia</th><th>Hyperglycaemia</th></tr>
<tr><td>Symptoms:

• Rapid pulse
• Casualty may feel faint
• Limbs may tremble
• Confusion
• Occasional aggression

Signs:

• Pale skin
• Profuse sweating
• Shallow breathing
• Unconsciousness
• Could be mistaken for someone who is drunk</td><td>Symptoms:

• Rapid pulse and breathing
• Drowsiness which may lead to unconsciousness

Signs:

• Warm dry skin
• Excessive thirst
• Sweet, fruity smell on breath</td></tr>
<tr><th colspan="2">Treatment</th></tr>
<tr><td>Conscious casualty

• Sit them down and give them a sugary drink
• If they respond – the problem was excess insulin or lack of sugar
• If they don’t respond 999 / 112

Unconscious casualty

• Call 999 / 112
• Place them in the recovery position
• Monitor airway and breathing
• Carry out CPR if required</td><td>• Call 999 / 112
• Place in the recovery position
• Monitor airway and breathing
• Carry out CPR if required</td></tr>
</table>

Psychological First Aid

First aid incidents can cause serious emotional distress for first aiders, casualties, bystanders and even professional emergency responders. It is simply a normal reaction to an abnormal situation. In addition to the primary first aid incident, rescuers must be aware of the potential for psychological effects. Some signs and symptoms might include:

- Depression
- Grief
- Anger
- Nightmares
- Poor concentration
- Distant or isolated
- Fatigue

If any team member is suspected of suffering from any adverse effects, it is important to address concerns as soon as possible. It may be necessary to seek professional assistance.

GLOBAL WIND ORGANISATION

Belay ROPE ACCESS Training for a job less ordinary...

Basic Safety Training

Sea Survival

Foreword

The Global Wind Organisation (GWO) is an association of Wind Turbines owners and manufacturers with the aim of supporting an injury free work environment in the wind industry.

The Basic Safety Training standard was created to establish consistent and recognisable basic training for the industry.

The BST includes five elements:

- First Aid
- Manual Handling
- Fire Awareness
- Working at Height
- Sea Survival

The standard describes the requirements for Basic Safety Training in the wind industry that are recommended by GWO. Where national legislation sets higher requirements for the training, the Training Provider shall incorporate these requirements in the training programme.

The GWO Basic Safety Training does not include any Technical Safety Training such as working with electricity, equipment with stored energy etc. Additional training may be required due to company or country specific requirements.

GWO recommends a company specific Basic Safety Introduction and Technical Safety Training as additional training.

Learning Objectives

The Sea Survival module is designed to ensure that:

- The Delegates are able to demonstrate knowledge of dangers and symptoms related to hypothermia and drowning
- The Delegates are able to demonstrate understanding of the advantages and limitations of the different Life Saving Appliances (LSA), Personal Protective Equipment (PPE) and Personal Fall Protective Equipment (PFPE) commonly used in the offshore wind energy industry and are able to wear and use them accordingly
- The Delegates are able to demonstrate safe transfer from vessel to dock, vessel to foundation
- The Delegates are able to demonstrate knowledge of the emergency and safety procedures on installations, vessels and WTG
- The Delegates are able to demonstrate knowledge of Search and Rescue (SAR) and Global Maritime Distress and Safety System (GMDSS)
- The Delegates are able to demonstrate recovery and First Aid treatment of a “man over board”
- The Delegates are able to demonstrate evacuation from a mock WTG to the water by means of rescue device
- The Delegates are able to demonstrate individual and collective survival techniques at sea

Introduction

Accidents in the offshore environment can quickly develop into life threatening situations due to the extreme conditions caused by weather and open water. Control measures have been put in place to increase chances of survival during an emergency offshore. This module will provide valuable information to help maintain safety while working in the offshore wind industry.

Legislation and Standards

Health and safety in the UK

The Health and Safety Executive (HSE) is the national independent watchdog for work-related health, safety and illness. HSE is an independent regulator and act in the public interest to reduce work-related death and serious injury across Great Britain's workplaces.

Maritime and Coastguard Agency – MCA

The MCA implement the government's maritime safety policy in the UK and works to prevent the loss of life on the coast and at sea. They provide guidance documents as well as the **Code of Safe Working Practices for Merchant Seamen.** This document applies to all UK registered vessels and covers:

- Regulatory framework
- Roles and responsibilities on ships
- Safety Management
- Inductions and personnel safety
- Various work practices
- Safety for specialist ship operations

SOLAS – Safety of Lives at Sea Convention

The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety.

Exposure, Hypothermia and Drowning

Cold Water exposure

A large amount of research has been carried out regarding the effects of cold water on the human body. It is generally accepted that water temperatures below 20°C should be considered cold water. Average sea temperatures in UK regions are:

- North Sea 6-14**°**
- Irish Sea – 4-18°
- Atlantic NW of Scotland 9-14°
- Scottish Cont. Shelf 6-14°

Upon entry into cold water there are some rapid and uncontrollable stages that the body goes through. The first is cold shock. In this stage, the person will be gasping uncontrollably. This will last for approximately 1 minute so it is vital that the head is kept out of the water until breathing settles down. The second stage is cold incapacitation which can be expected in about 10 minutes. Due to the restriction of blood vessels and channelling of blood towards the core, the muscles lose function. Any important actions such as getting into the liferaft should be done in the first 10 minutes before muscle function is lost. The final stage is unconsciousness, which will happen after about 1 hour of cold water exposure.

Mammalian Dive Reflex

This is a physiological response in mammals to cold water immersion. Immediately upon facial contact with cold water the body will try to conserve energy by:

- Slowing down the heart rate
- Constricting blood vessels

This has been found to produce a positive effect with regards to cold water drowning as people can survive without oxygen for much longer in cold water. There was a case in 1999, where a 29-year-old Swedish woman, Anna Bågenholm spent 80 minutes trapped in ice and survived with full recovery from a 13.7°C core body temperature.

When providing first aid for victims of cold water drowning, it is important to remember that the casualty is not dead until they are warm and dead.

Hypothermia

Hypothermia is simply a lack of adequate body temperature to support normal life conditions. Normal core body temperature is about 37°C. It doesn't take much of a drop in temperature to be considered hypothermic as can be seen on the table below.

Classifications of Hypothermia	Core BodyTemperature	Patient's ability to rewarm without external heat source	Clinical presentation of Hypothermic Patient	
Normal	Above 35ºC	N/A	Cold sensation shivering	
Mild	35-32ºC	Good	Physical impairment • Fine motor • Gross motor	Mental impairment • Complex • Simple
Moderate	32-28ºC	Limited	**Below 32ºC shivering stops** **Below 30ºC consciousness is lost**	
Severe	Below 28ºC	Unable	Rigidity, Vital signs reduced or absent Severe risk of mechanically stimulated ventricular fibrillation (VF) (rough handling)	
	Below 25ºC	Unable	**Spontaneous ventricular fibrillation (VF)Cardiac arrest**	

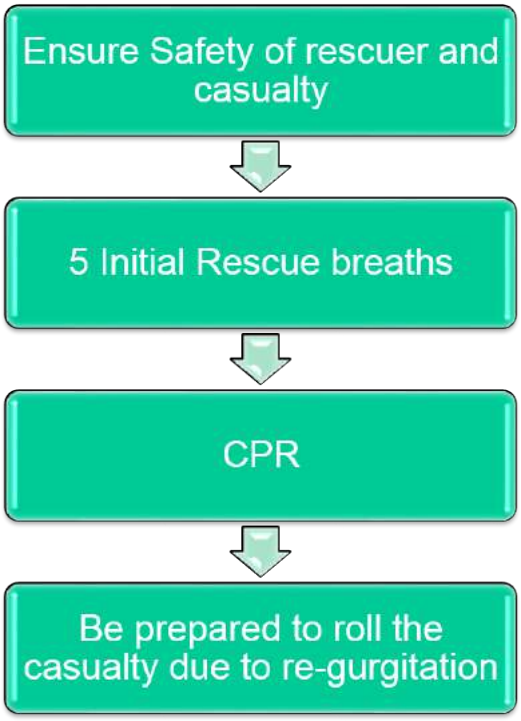
Treatment of Hypothermia

Mild	Moderate-Severe
• Call for Help • Warm the person slowly – Dry clothing, blankets – External heat may be applied to areas such as under arms • Give warm, high sugar drinks	• Call for Help • Handle gently. Rough handling can cause ventricular fibrillation • DO NOT rub the skin • Lay horizontally and gently remove wet clothing and cover with dry blankets or clothing • Gentle re-warming as with mild hypothermia • DO NOT place in hot bath or shower • NO oral food or drink

Drowning

Drowning is defined as Respiratory impairment from submersion/immersion in liquid. However, there are other complications that can occur for people that have been successfully retrieved from the water. With near drowning, the irritation caused in the lungs by water can lead to death. This is known as secondary drowning. Similarly, a person that has been revived, could die as a result of secondary drowning. This can occur up to 72 hours after the event. Any person that has been victim of near drowning should be monitored closely in hospital.

First Aid for Drowning



Lifesaving Appliances and PPE

Immersion Suits

Immersion suits or transit suits are often used in UK waters. They are essentially a dry suit with a neoprene seal at the neck and wrists. They will generally have gloves and a hood stowed inside a pocket. They have a thin boot which allows the wearer to wear normal work boots over top. This is beneficial when having to climb ladders or carry out other work tasks while wearing the suit. Some suits will have a removable thermal layer to improve functionality for cold water survival.

Survival Suits

These are a much thicker suit which provide greater protection in cold water. They are sometimes found on board vessels and offshore installations where the wearer will not be expected to work in the suit but simply carry out survival tasks in the water. As they are a much thicker suit, they are not functional for carrying out work tasks.

Life Jackets

There are two types of life jackets found in the offshore industry, rigid and inflaable. The rigid life jackets are often found at muster stations on installations and accomodation vessels. More commonl, however, wokers will have an inflaable life jacket with a 275N rating. They will often have a spray hood, whistle, strobe light and integrated PLB (personal locator beacon)

Collective Lifesaving Appliances

These are appliances designed to save a number of people and include things such as liferafts, lifeboats and marine evacuation systems.

Transfers

Transferring from Dock to Vessel

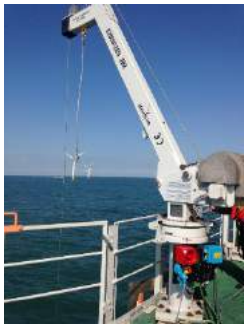
There will be different procedures used on each site for boarding the vessel and loading equipment. Typical procedure is to use a gangway but on some sites, it may be necessary to step across from the quayside. In some cases it may also be necessary to step across from vessel to vessel. This can make transfer of equipment challenging. Best practice is to pass items across rather than carry them across while stepping over.

Once on the vessel, any new personnel will need to do the vessel induction. This will address the basic safety rules for the vessel as well as the location of emergency equipment and any emergency peocedures. When on board or transferring to or from the vessel, it is important to always follow the instruction given by the crew.

Transferring from Vessel to Turbine

Transfers to and from the turbine are potentially dangerous due to conditions such as the sea state, swell and current. In recent years there have been some new transfer systems developed but the most common is still a basic step off from the bow of the vessel while it is pushed onto the turbine.

There will be different transfer procedures for each site which will be covered during induction. Each site will have a swell height limit for transferring which will generally be about 1.5 metres. The most common procedure is to attach to an inertia reel for fall protection while transferring. In other cases, a double lanyard may be used instead. When returning to the vessel in marginal conditions, it may be necessary to free climb the last 2 metres prior to stepping onto the vessel. This eliminates the potential for being caught by the fall arrest system if the vessel moves downwards and then struck when it comes back up. This does, however, create a risk of a small fall so it is important to be aware of the site rules prior to setting off. Once on the turbine, all tools and equipment will be lifted from the vessel using certified lift bags.



Man Overboard

Every person on board the vessel or installation must be aware of the procedure for dealing with a man over board to ensure rapid retrieval. The basic procedure will be:

1. Sound the alarm
2. Keep a visual on MOB
3. Throw flotation aid if available
4. Point to MOB as vessel comes around
5. Assist crew with retrieval equipment
6. If on the WTG, contact the vessel and control room immediately

There are a variety of types of equipment for retrieval of persons from the water including cradles, nets and slings. On the vessel, the crew will take the lead and others on board will be required to provide assistance.

Safety on Turbines and Installations

The basic safety rules will vary from site to site but the basic PPE requirements are generally the same and will include:

- Hi-Vis clothing
- Helmet
- Glasses
- Gloves
- Harness and fall arrest equipment
- Immersion Suit

A common mistake made by technicians is to remove the immersion suit and lifejacket and leave them at the base of the tower when working in the nacelle. The danger with this practice only becomes obvious in an emergency. If there is a fire at the base of the tower and technicians need to use the escape/rescue device, they will be entering cold water without a lifejacket or immersion suit.

All work will be controlled by a permit to work system or limitation of access. Technicians must only access areas of the turbine with correct authorisation. One person with the work party will be the competent person responsible for taking control of the turbine and handling any communication with the transfer vessel of control centre. All personnel must make themselves familiar with the contingency plan for the turbine including the location of emergency equipment.

SAR AND GMDSS

When a vessel or person is in distress at sea there are a number of systems in place to aid in rapid retrieval. In the UK, there are a number of agencies providing search and rescue services including:

- Coast Guard
- RNLI
- RAF
- SAR teams on accommodation vessels

The GMDSS (Global Maritime Distress and Safety System) is an internationally agreed-upon set of safety procedures, types of equipment, and communication protocols used to increase safety and make it easier to rescue distressed ships, boats and aircraft. It covers items such as:

- Alerting (including position determination of the unit in distress)
- SAR coordination
- Locating
- Maritime safety information broadcasts
- General communications
- Bridge to Bridge communications

Some common equipment used to aid in location and rescue of distressed persons and vessels are EPIRBS, SARTS and PLBs.

EPIRBs (Emergency Position Indicating Radio Beacons) is used to alert search and rescue services in the event of an emergency. It does this by transmitting a coded message on the 406 MHz distress frequency via satellite and earth stations to the nearest rescue co-ordination centre.

Some EPIRBs also have built-in GPS which enables the rescue services to accurately locate you to +/- 50 metres. EPIRBs will have a transmission time of at least 48 hours.

A **search and rescue transponder (SART)** is a self-contained, waterproof transponder intended for emergency use at sea. These devices may be either a **radar-SART**, or a GPS-based **AIS-SART** (automatic identification system SART). The radar-SART is used to locate a survival craft or distressed vessel by creating a series of dots on a rescuing ship's radar display. A SART will only respond to a 9 GHz X-band (3 cm wavelength) radar. It will not be seen on S-band (10 cm) or other radar. Shipboard Global Maritime Distress Safety System (GMDSS) include one or more search and rescue locating devices.

A **Personal Locator Beacon (PLB)** works in exactly the same way as EPIRBs by sending a coded message on the 406 MHz distress frequency which is relayed via the Cospas-Sarsat global satellite system. However, there are some differences. A PLB is much smaller and designed to be worn on a person and in many cases, registered to that individual. They are used at sea and on land for location of missing persons. Many lifejackets used offshore will have a PLB built in. A PLB will have a transmission time of 24 hours.

Practical Training

The practical sessions in this module will cover important details to improve safety while working offshore as well as improving chances of survival in an emergency at sea. The practical sessions will cover:

Sea Survival

- Correct donning and use of LSAs and PPE
- Sea survival techniques
- Safe entry into the water from a height
- Heat Escape Lessening Posture (H.E.L.P.)
- Individual swimming techniques
- Collective swimming techniques
- Collective techniques to prevent hypothermia
- Techniques to enhance chances of being spotted
- Evacuation from WTG by descent into the water
- Liferaft
    - Ability to enter a life raft
    - The ability to right a capsized life raft
- The fitting of a helicopter lifting sling, subsequent lifting and (simulated) entry into a rescue helicopter

Transfers

- Safe transfer of self and equipment from dock to vessel
- Safe transfer of self and equipment from vessel to WTG and back using:
    - Twin fall arrest lanyards
    - SRL
- Safe transfer from vessel to vessel while making way
- Man overboard
    - MOB procedures
    - Recovery from water by own assistance
    - Assisted recovery from water
    - Recovery from water by means of cradle and rescue net

GLOBAL WIND ORGANISATION

Belay ROPE ACCESS Training for a job less ordinary...

Basic Safety Training

Working at Height

Foreword

The Global Wind Organisation (GWO) is an association of Wind Turbines owners and manufacturers with the aim of supporting an injury free work environment in the wind industry.

The Basic Safety Training standard was created to establish consistent and recognisable basic training for the industry.

The BST includes five elements:

- First Aid
- Manual Handling
- Fire Awareness
- Working at Height
- Sea Survival

The standard describes the requirements for Basic Safety Training in the wind industry that are recommended by GWO. Where national legislation sets higher requirements for the training, the Training Provider shall incorporate these requirements in the training programme.

The GWO Basic Safety Training does not include any Technical Safety Training such as working with electricity, equipment with stored energy etc. Additional training may be required due to company or country specific requirements.

GWO recommends a company specific Basic Safety Introduction and Technical Safety Training as additional training.

Learning Objectives

The Working at Height module is designed to ensure that:

a) The Delegates are able to demonstrate knowledge of hazards and risks associated with working at height, specific to a wind turbine generator (WTG)

b) The Delegates are able to demonstrate understanding of current national legislation regarding working at heights

c) The Delegates are able to demonstrate correct identification of PPE, including identification of European/Global standard markings e.g. harness, hard hat, lanyards, etc.

d) The Delegates are able to demonstrate the knowledge and skills to correctly inspect, service, store and correct fitting of the relevant PPE, e.g. harness, fall arrest lanyards, guided type fall arrest lanyards and work positioning lanyards

e) The Delegates are able to demonstrate correct use of the relevant PPE, e.g. harnesses fall arrest lanyards, guided type fall arresters and work positioning lanyards. This includes correct identification of anchor points and correct ladder conduct

f) The Delegates are able to demonstrate correct use of evacuation devices

g) The Delegates are able to demonstrate how to approach rescue situations in WTGs and use rescue equipment efficiently

Introduction

Falls from height account for a significant amount of workplace incidents around the world each year. While changes to legislation have made some improvement, there are still a large number of serious injuries annually. The wind industry in Europe has worked hard to implement standardised training for all workers in the industry with the aim of eliminating injuries and incidents related to falls from height.

Legislation and Standards

Health and safety in the UK

The Health and Safety Executive (HSE) is the national independent watchdog for work-related health, safety and illness. HSE is an independent regulator and act in the public interest to reduce work-related death and serious injury across Great Britain's workplaces.

ACOPs and Guidance

HSE publish guidance and approved codes of practice (ACOPs) to assist employers to meet their legal obligations in relation to the regulations.

Guidance: HSE guidance provides advice to help you understand how to comply with the law; explanations of specific requirements in law; specific technical information or references to further sources of information to help you comply with your legal duties

ACOPs: ACOPs describe preferred or recommended methods that can be used (or standards to be met) to comply with regulations and the duties imposed by the Health and Safety at Work etc Act

If employers are prosecuted for a breach of health and safety law, and it is proved that they have not followed the relevant provisions of the ACOP, a court can find them at fault unless they can show that they have complied with the law in some other way.

Health and Safety at Work Act 1974

This legislation forms the foundation for health and safety in the UK. It sets out duties which employers have towards their employees and members of the public. It also sets out duties which employees have to themselves, their colleagues and the public. Many other regulations have been passed to support these regulations over the years.

Employer's duties

- Ensure the health, safety and welfare of their employees at work
- Provision of safe plant and equipment
- Ensure safety and avoid risks to health associated with articles and substances
- Provision of information, instruction and training to ensure the health safety of employees
- Maintain a safe place of work
- Provision of a safe and healthy work environment with adequate welfare facilities

Employees Duties

- Employees and the self employed have a duty to take reasonable care for the health and safety of themselves and any other people who might be affected by their acts or omissions
- Cooperate with employers and others to enable them to comply with their statutory duties
- Must not intentionally or recklessly misuse anything provided in the interest of health and safety

Management of Health and Safety at Work Regulations

These regulations supplement the requirements of the Health and Safety at Work Order. More detail is given regarding the requirements of employers to manage health and safety. A systematic approach must be employed to identify and mitigate hazards in the workplace. Formal risk assessments and method statements play an important role in this. The regulation also requires a system to monitor safety and health of employees and of the management system itself. More detail is provided regarding information, instruction and supervision of workers and the issues surrounding young workers and expectant mothers are covered.

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)

These regulations require the immediate reporting of specific accidents, ill health and dangerous occurrences to the enforcing authority. Fatalities, over 7 day injuries, major injuries, diseases and dangerous occurrences must be reported to your company's nominated person who will notify the HSE where appropriate. It is also recommended that near misses be reported to help companies prevent future accidents. The following must be reported to HSE:

- Workplace deaths
- Specified Injuries
- Injuries resulting in +7 days incapacitation
- Occupational disease
- Dangerous occurrences (specified list)
- Gas incidents

PPE Regulations 2002 and PPE at Work Regulations 1992

These regulations are often misunderstood as being different version of the same regulation. In fact, they are quite different.

The PPE at Work Regulations deal with the provision of PPE to employees in the workplace. This regulation deals with the requirement for employers to assess risks and provide suitable equipment to employees.

The PPE Regulations deals with the manufacture and supply of PPE in the European Union. It covers approval processes, quality control, CE marking and the need for independent testing against appropriate EN standards. PPE is categorised as category 1, 2 or 3.

Category 1 (simple) PPE provides protection from minor risks such as a pair of work gloves.

Category 2 (intermediate) PPE provides a higher level of protection such as steel toe cap boots, safety helmets and fire retardant overalls.

Category 3 PPE provides protection from mortal danger. This equipment must be independently inspected by a notified body to ensure a high level of quality. Examples include fall protection equipment and breathing apparatus.

Lifting Operations and Lifting Equipment Regulations (LOLER)

LOLER applies to all lifting equipment and requires:

1. Lifting equipment to be suitable, strong, stable and marked with a safe working load.

2. Load and lifting attachments to be strong and stable.

3. Lifting operations to be supervised and safely conducted.

4. Inspection, test, thorough examination – minimum (6monthly) or devised by a competent person.

5. Documents, record keeping and evidence.

Fall protection and rescue equipment that is used to raise, lower and suspend a worker is subject to the requirements of LOLER as well as the PPE Regulations.

Work at Height Regulations

A place is '**at height**' if (unless these Regulations are followed) a person could be injured falling from it, even if it is at or below ground level.

Employers are required to:

- Assess risks
- Follow the hierarchy of control
- Plan and organise work at height, including planning for rescue of a suspended worker
- Ensure workers are competent
- Use appropriate equipment
- Inspect and maintain equipment

Hierarchy of Control

1. **AVOID** work at height where reasonably practicable
2. **PREVENT** falls by working from existing safe places of work or use of PPE
3. **MINIMISE** the consequences of a fall

When selecting the most appropriate type of protection, a preference should be given to collective protection systems over personal protection. Collective protection systems are those which protect multiple workers simultaneously and require less user competence in order to be effective. Examples include safety nets, guard rails and scaffolding.

Types of Personal Fall protection

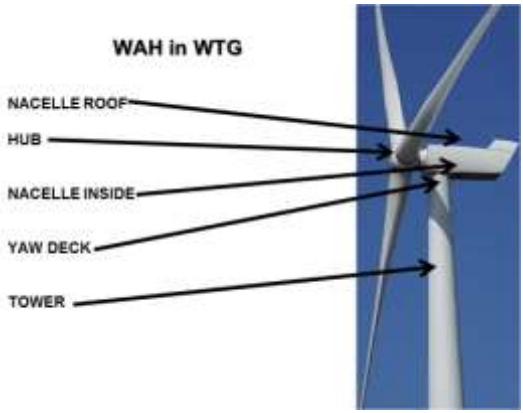
Work restraint – Systems utilising a lanyard and harness to prevent the worker from reaching the fall hazard

Work Positioning – Systems that position a worker at height and enable hands free to carry out tasks. Work positioning systems must be backed up by a secondary system such as a fall arrest system

Rope Access – rope access systems are very similar to work positioning systems. They utilise a two-rope system to provide work positioning and a secondary safety system.

Fall Arrest – Systems attached to the user's harness which allow a fall to occur but reduce the consequences by reducing impact force and preventing impact with the ground.

All fall arrest systems must limit the arrest forces to no more than 6kn. (8kn in North America)



Fall Arrest Considerations

Impact force

Forces created in the arrest of a fall can very quickly exceed safe levels for the average worker. In most parts of the world, it is accepted that the maximum arrest force permitted is 6kn (roughly 600kgf). All fall arrest system are required to have a design function that limits the force to less than 6kn. As mentioned with lanyards, there are bad practices that can result in arrest forces higher than this level so it is important to always follow manufacturer's recommendations.

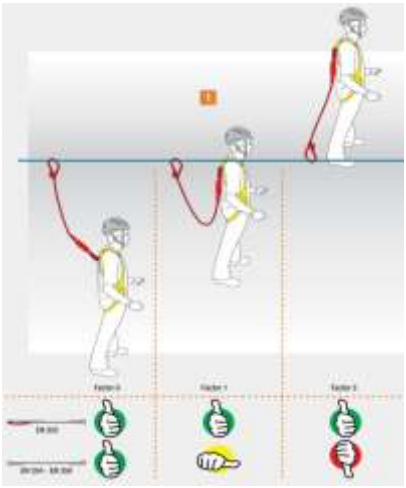
In North America, 8kn is the maximum permissible arrest force however, shock absorber standards require a maximum 4kn for fall factor 1 and 6kn for fall factor 2.

Fall Factor

Fall factor is a term used to describe the relative severity of a fall. The two key variables are free fall distance and length of rope or lanyard. Lanyards meeting EN standards are designed for a worst case scenario factor 2 fall, however, best practice is to try work in factor 1 or better.

Note: Some North American lanyards are only designed for a factor 1 fall and are not suitable for situations such as working on the nacelle roof while attached at foot level.

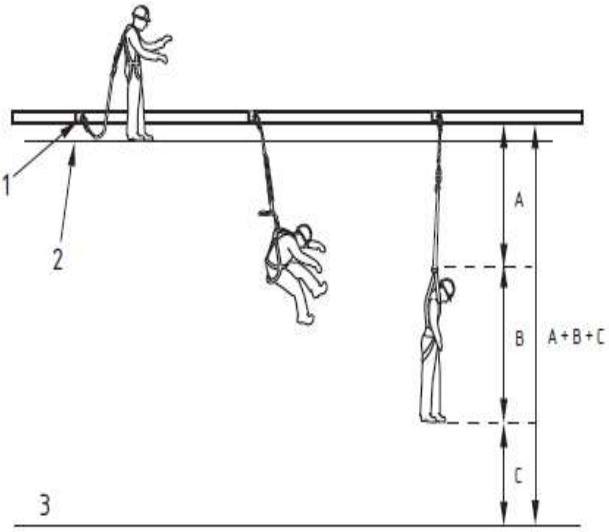
$$Fall\ Factor = \frac{\text{Free fall distance (m)}}{\text{Lanyard(rope)}length\ (m)}$$



Clearance

With any fall arrest system, an assessment must be made regarding the required clearance below the work area to avoid the potential for striking the ground or obstructions below. Most manufacturers will provide a recommended clearance which will be based on a worst case scenario. Having an understanding of the variables involved will help make an informed decision for various applications. The main variables that affect clearance are:

- Lanyard length
- Shock absorber deployment
    - This varies depending on user weight and fall factor
- Body height



This example is based on a 2-meter lanyard in a factor 2 fall:

A = lanyard length + Shock absorber deployment (2m + 1.75m)

B = Body height including harness stretch (2m)

C = Safety Clearance (1m)

Total Clearance = 6.75m

To reduce the required clearance there are to key improvements that can be made.

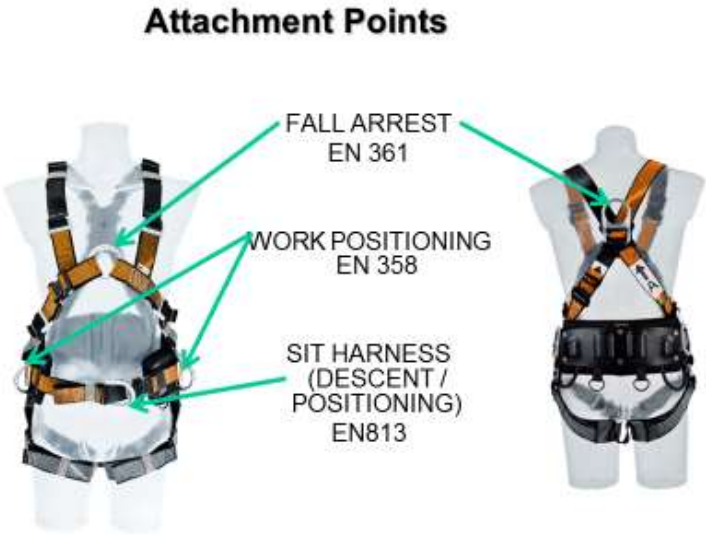
1. Reduce the length of lanyard – less free fall distance will result in smaller shock absorber deployment.
2. Anchor higher or further from the edge – This moves the start point for the measurement further from the ground or obstructions. This will also reduce free fall distance which results in smaller shock absorber deployment.

Equipment

Harness

When selecting a harness for any type of work there are some things that should be considered including:

- Attachment points required



- Compatibility with other equipment (lifejackets, lanyards, fixed fall arrest systems)
- Proper fit for the individual
- Suitability for the user (size and weight, gender)
- Relevant standards for work area (CE/EN, ANSI, CSA, AS/NZ)

Note: On some harnesses, the front waist attachment is permitted to be used for attachment to EN353-1 fixed fall arrest systems. This does not mean it is suitable for fall arrest lanyards or any other type of fall arrest system. Always refer to manufacturer for compatibility of attachments and proper use.

Vertical Fall Arrest Systems

Inertia Reels

Inertia reels provide a flexible option for fall arrest in climbing applications such as fixed ladders on ladders and other structures. They are commonly used as the fall arrest system when climbing the ladder on the transition piece on offshore turbines. They are preferential to lanyards due to:

- Quick activation
- Smaller clearance requirement
- Hands free operation

There is a risk of excessive swing falls if not used properly. Most manufacturers will recommend the user stay directly under the device with a maximum deviation of 15-30 degrees.

The force limiting function takes place inside the housing of the unit. Many devices will not properly limit the fall arrest force when used for leading edge protection. Refer to the manufacturer for proper use.

Inertia reels have a complex arrangement of moving parts and are generally required to be serviced annually by an authorised service technician.

Fixed Vertical Fall Arrest Systems

EN 353-1 rigid fall arrest systems

These typically utilise a rigid rail and mobile fall arrest device to provide hands free operation and very short arrest distances.

Concerns about EN353-1 standard

Due to a number of accidents in recent years, the test requirements of the standard were found to be insufficient. As a result EN353-1 has become a non-harmonised standard. In order to facilitate the continued free trade of goods in the EU, an interim standard has been accepted to ensure suitability and safety of devise. Devices supplied in the EU must conform to EN353-1 as well as the additional test requirements of VG11 report CNB/P/11.07. The 353-1 standard is expected to be amended and accepted in 2015-16.

EN353-2 flexible fall arrest systems

Similar to the rigid systems, these provide a safe hands free operation with minimal arrest distances. They generally utilise an 8mm diameter wire rope and compatible fall arrest device, often referred to as a slider.

Note: While most devices utilise the same size wire, it is important that you only use the fall arrest device that is intended for the wire system. The entire system, including wire, anchorage, intermediate connections and fall arrest device are tested to the standard as a unit. Only if the manufacturer specifies it can a different fall arrestor be used.

Fixed systems should have an inspection and specification label which will indicate the maximum number of climbers and the inspection details. These systems should be inspected annually by a certified inspection technician.

Fall Arrest Lanyards

Fall arrest lanyards come in a wide variety of lengths and configurations. Selection should be based on the work type, work area, and in some cases, site specific client requirements. Fall arrest lanyards are last in the hierarchy of control as they permit excessive fall arrest distances which could result in injury to the climber.

Single Lanyards

These lanyards have limited capability as they do not permit vertical or horizontal progression. They can be beneficial as they lanyard attachment when moving from a fixed vertical system to a platform on the turbine.

Y Lanyards

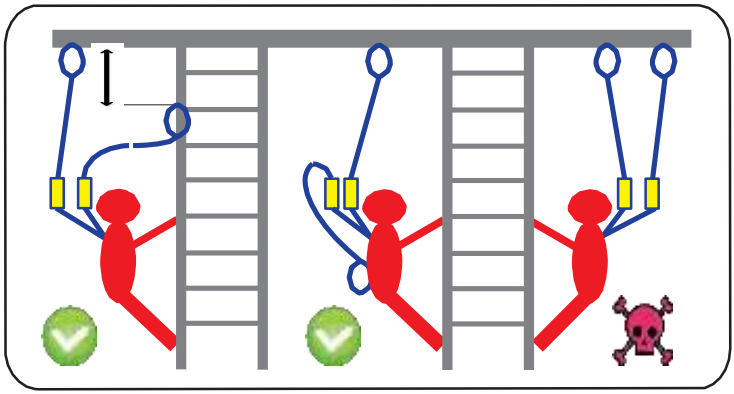
These are the most common lanyards used in many industries. The benefit of them is they provide the ability to progress vertically and horizontally on structures while maintaining 100% attachment.

Caution: If one of the connectors is attached to an anchor point, the second connector must not be attached to a fixed point on the harness. This could result in the shock absorber not functioning properly which could produce dangerously high impact forces.

V Lanyards

These lanyards are relatively new and are an attempt to deal with the dangerous issue mentioned above for Y lanyards. Each leg of a V lanyard has its own shock absorber which means the unused connector can be attached to a fixed point on the harness.

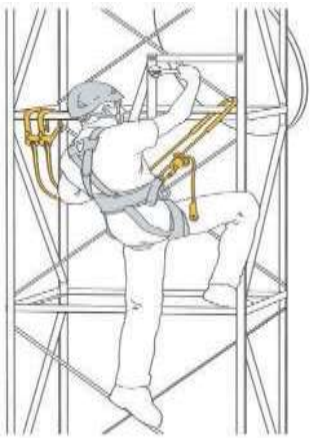
Caution: If both connectors are attached to the structure, they should not be attached at the same level. Attachment at the same level will produce double the arrest force.



Work Positioning Lanyards

Work positioning lanyards are a very valuable accessory to have on a climbing harness. They provide the ability to secure the climber to the structure which will free up the hands for a variety of work or rescue tasks. In is essential that when attached to the structure with a work positioning lanyard, the climber is also protected by a fall arrest system.

Daily climbing in the turbine will rarely require the use of a work positioning lanyard and as a result, many technicians will leave them in the kit bag. They are, however, an essential piece of equipment for many rescues and should always be on the climber's harness.



Evacuation and Rescue Devices

Each wind turbine will generally be equipped with an evacuation and rescue device. Some sites will have two separate kits. One for evacuation only and another for rescue applications. The kit is generally stored in the nacelle but this can vary on different sites. It is important to be familiar with the location as well as the type and operation of the equipment.

Devices that are stored in a bag will need to undergo a thorough examination every 6 months in the UK and annually in other regions. Those stored in a vacuum sealed bag within a box can be inspected at intervals between 5-7 years.

Operation - Evacuation

For evacuation purposes, the device will control the rate of descent to a speed of 0.6-0.9 metres per second depending on the make, model and body weight of the user(s).

1. Prior to use ensure the rope is properly bagged and doesn't have any knots
2. Attach lanyard to anchor point prior to opening hatch
3. Attach connector on the rope to the front chest attachment to avoid dropping
4. Open hatch
5. Drop the rope bag through the hatch looking for any knots in the rope
6. If using a rescue/evac device, ensure rope is not running over the friction hook
7. Perform a quick function test to ensure safe operation
8. Disconnect lanyard from anchor point
9. While holding the slack rope, sit into the system and control descent through the hatch opening
10. Once clear of the hatch, let go of the slack rope. Be aware that the connector from the ground will be moving up as you descend. It may be beneficial to lightly hold the slack rope away from your body while descending.

Operation – Rescue

During rescues, more control of descent speed is required to minimise risk of injury to the casualty. Passing the rope over the friction hook on the device will provide the suitable control of the load. During lifting, there is also a locking cleat to capture progress.

1. Prior to use ensure the rope is properly bagged and doesn't have any knots.
2. Attach rescue device to a suitable anchor, allowing for room to accommodate the lift.
3. Attach the connector to the chest attachment of the casualty's harness.
4. Remove excess slack by pulling on the slack end of the rope.
5. Run the slack rope over the friction hook and into the locking cleat.
6. Begin to turn the lift wheel, ensuring the rope is moving in the correct direction. Turning in the wrong direction can damage the rope and or the device.

7. Lift the casualty until enough slack is created to permit disconnection from the fall arrest system. Pull slack through the cleat as it develops.
8. Disconnect the casualty from fall arrest and work positioning systems.
9. Hold the slack rope firmly and pull it out of the locking cleat, ensuring it remains over the friction hook.
10. Slowly lower the casualty to safety. It may be beneficial to have a second rescuer move down the tower with the casualty to manage first aid and obstructions.

Alternate abseil technique

The device may also be used in an abseil technique with the device upside down. This is beneficial where there is only one rescuer and he/she must go down the tower with the casualty.

1. Attach the main device connector to the rescuer's chest harness d-ring.
2. Attach the connector on the short rope to a suitable anchor.
3. Pass the slack rope under the friction hook and into the locking cleat.
4. Clip a karabiner around the fixed rope going to the anchor and the slack rope exiting the locking cleat.
5. Descend until within reach of the casualty and secure the device by passing the rope into the locking cleat.
6. Make a connection from the main device connector to the casualty's chest d-ring. This can be done with a short anchor sling or work positioning lanyard.
7. Turn the wheel to lift the casualty and disconnect from fall arrest and/or work positioning systems.
8. Hold the slack rope firmly and pull from the locking cleat.
9. Descend slowly, controlling speed with the hand on the slack rope. If there is a need to stop, simply pass the rope into the locking cleat.

Equipment Management and Inspection

All equipment must be managed from the point of supply to the end of service life. The proper management of equipment will include:

- Records and documentation
- Pre-use inspection
- Thorough examination or detailed inspections
- Maintenance and servicing
- Quarantine and removal from service

Records and documentation

Proper record keeping will ensure traceability of all equipment from purchase to end of service life. An accurate inventory should be kept of all equipment detailing:

- Serial numbers
- Date of manufacture
- Date of first use
- Inspection date

Pre-use inspection

Each user of personal protective equipment should inspect the equipment prior to each usfor any obvious defects or damage. This is not the same as a thorough examination carried out by a competent person. It is a quick check for obvious defects.

Thorough Examination (Detailed Inspection)

In the UK, there are a number of conflicting requirements for the examination of equipment. This has caused a great deal of confusion, particularly when it comes to equipment which could be classified as lifting equipment.

EN365 provides manufacturers with requirements for information to be contained on user's instructions. The standard suggests an inspection interval of at least 12 months.

LOLER requires that any lifting equipment used to lift persons must undergo a thorough examination at least 6 monthly.

HSE Industry guidance note INDG367 states that textile equipment used in arduous environments should undergo a detailed inspection 3 monthly or more often.

It is important to note that the LOLER and HSE requirements are unique to UK jurisdictions. Most other regions will be 12 monthly. Always refer to local legislation. Common best practice in the UK is to use a 6 monthly interval for thorough examinations.

Maintenance and Servicing

One of the best ways to maintain PPE is to keep it clean and stored appropriately. Most textile items can be washed in water temperatures of about 30 degrees with a neutral PH soap. Equipment should be hung to dry at room temperature and then stored in a cool dry area away from UV light or harmful chemicals. Hardware components should be cleaned with fresh water and lubricated to maintain moving parts.

Any major servicing of equipment must only be done by authorised service technicians.

Quarantine and Removal from Service

There must be a procedure in place to deal with quarantine and removal of defective items from service. Equipment could be removed for a number of reasons such as:

- Awaiting service or thorough examination
- Damaged or defective
- Involved in a fall
- Exceeded recommended lifespan set by manufacturer
- Any doubt regarding the safety of equipment

Lifespan of equipment will vary with each manufacturer. There are some that specify 5 years while others specify that it is indefinite, subject to inspection by a competent person.

Once equipment has been removed from service, it is important to ensure that it cannot be placed back into service. It may be necessary to destroy the equipment to prevent others from simply removing it from the bin and using it elsewhere.

Rescue Considerations

Safety

The most important thing to consider in any rescue or emergency situation is the safety of the rescuer and the casualty, in that order. It is very tempting to take shortcuts to facilitate a rapid rescue. Historically, a large number of rescuers across many industries are hurt and even killed attempting rescue. Consider the root cause of the incident. Is the casualty hanging unconscious due to electrocution? Have we isolated the hazard to make the area safe for rescuers?

Suspension Trauma

Suspension trauma is known by a few different names including suspension intolerance, orthostatic intolerance and suspension syncope. It is a situation where circulation is insufficient, resulting in a loss of consciousness.

Under normal circumstances the circulation of blood around the body is supported by a few different functions. Primarily, the heart pumps the blood out the rest of the body. The return of blood from the extremities, however, is helped by subtle muscle contraction combined with one-way valves in the veins. When standing upright, gravity is holding the blood in the legs. Small muscle contractions help to move the blood back to the core.

When the body is upright and there is a lack of muscle contraction, the blood will pool in the lower extremities, resulting in reduce blood volume in the core. If the circulation problem is not corrected the brain will attempt to correct the problem by causing a loss of consciousness. This generally results in the casualty moving to a horizontal position which overcomes the problem caused by gravity. If, however, the casualty is suspended in a harness, the loss of consciousness will not result in a change of position. If rescue does not happen quickly, the casualty could die from hypoxia.

Treatment

The priority for rescue is to correct the circulation problem as soon as possible. If the casualty's position can be improved before lifting and lowering, the chances of survival will increase. Upon reaching the ground, the recommendation is to follow standard first aid treatment protocols. In the past, there were concerns about placing the casualty in a horizontal position as it was being compared to a crush injury. A recent HSE research report found that there isn't sufficient medical evidence to support this concept. It is still worthwhile mentioning to advanced medical responders that the casualty was suspended for a period of time so that tests can be carried out in the hospital.

Treatment of Suspension Trauma

The casualty should be rescued from the position of suspension as quickly as possible

Encourage conscious casualties to keep legs moving while suspended

Conscious casualty

Unconscious breathing casualty

Unconscious not breathing

Other considerations for Rescue

- Communication
- Calling for assistance
- Suitable anchor points
- Protection of rope from sharp edges
- Protecting the casualty from further injury
- Spinal Injuries
- Use of stretchers
- Enclosed spaces such as the hub
- Helicopter evacuation from the roof
- Psychological support after an incident

Once a procedure has been established for rescue, it is important to carry out drills to ensure the plan is effective and that rescuers are familiar with it. This will provide opportunity for improvement and ensure rapid and safe evacuation and rescue can be carried out by all personnel.