general notes

Australian Resuscitation Council

The Australian Resuscitation Council (ARC) is a voluntary coordinating body which represents all major groups involved in the teaching and practice of resuscitation.

aims of the ARC

The aims of the ARC are to:

- foster and coordinate the practice and teaching of resuscitation
- promote uniformity and standardisation of resuscitation
- act as a voluntary coordinating body

Cardiopulmonary Resuscitation (CPR) skills performance has been shown to decline rapidly following initial achievement of competency. The Australian Resuscitation Council recommends that CPR and Defibrillation skills are reassessed at least annually.

workplace First Aid accreditation

Under the regulations, workplace First Aid accreditation is to be updated every three years, with CPR and Defibrillation requiring an annual update as previously detailed.
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course introduction

The aim of the Advanced Resuscitation Techniques course is to develop your skills and knowledge to use oxygen, airway management devices, and automated external defibrillators during resuscitation, and to administer oxygen to casualties.

You will develop knowledge and skills to enable you to demonstrate competence in the nationally recognised unit:

- **HLTFA404A Apply advanced resuscitation techniques**

course outcomes

By the end of this course, you should be able to:

- assess the casualty and develop a management plan
- check defibrillation equipment
- attach and operate a defibrillator
- recover and restore defibrillation equipment
- check resuscitation equipment
- resuscitate a casualty using oxygen
- use oxygen to provide therapy
- recover and restore oxygen equipment
- maintain an airway by:
  - using oropharyngeal airways (OP airways)
  - using suction

assessment

You will be assessed for competence in the following ways:

- completion of the ART workbook
- practical scenarios
This topic is a review of relevant first aid and resuscitation principles. This will assist participants to understand where the use of advanced resuscitation techniques, such as defibrillation, oxygen and advanced airway management techniques, will support and improve the care they can provide to a casualty.

Participants who require more information on this topic can find complete descriptions in the Australian Lifesaving Academy First Aid Training Manual 2nd Edition or the Surf Life Saving Australia Public Safety and Aquatic Rescue manual, 33rd Edition.

**first aid**

First aid is the initial care of the suddenly sick or injured until medical aid arrives or the casualty recovers. Medical aid, on the other hand, is professional medical treatment by a doctor, registered nurse, or ambulance paramedic.

**aims of first aid**

The aims of first aid are to:

- preserve life
- protect the unconscious
- prevent the condition from worsening and to relieve pain
- promote recovery

As a first aider you also aim to prevent:

- further damage to yourself, others and the casualty
- any harmful intervention

**legalities of first aid**

**duty of care**

Australian law does not impose a duty of care on any person to give assistance unless that person already owes a duty of care to the sick or injured person. A first aider at a work site has an implied duty of care, as does someone caring for children. There is no such clear duty for a volunteer, but once a person starts to act, that person becomes the caregiver and should stay with the sick or injured person until professional help arrives.

Always work within your training, following organisational procedures and manufacturers’ instructions for equipment where required.

**negligence**

Negligence is when someone who owes a duty of care has failed to provide a reasonable standard of care, which results in further injury.

Negligence is established if:

- the first aid officer owes a duty of care to the injured person, and
- the standard of care required by that duty was breached, and
- damage was caused by the breach

A court will look at all of the circumstances to determine what is reasonable in any given situation. Upon rendering assistance, a person is under the duty of care to do everything reasonable in the circumstances. A duty of care cannot be evaded by abandoning assistance halfway through.
**consent**

Before you provide any first aid to a casualty, you must gain their consent (*actual consent*). If the casualty is unresponsive and therefore unable to consent to treatment, it is presumed that they would have given you the consent if they were conscious (*implied consent*), so you can provide first aid to them.

With a casualty under 18 years old you need consent from the casualty’s parent/guardian; if they are not present and the injury/illness is life threatening you can provide first aid to them (*implied consent*).

If consent is refused you have to respect their decision and not treat them. If you proceed to apply first aid you may be charged with assault.

**documentation (record keeping)**

Documentation serves the following purposes:

- to assist the first aider in managing their casualty’s injuries or illnesses and being able to perform an accurate handover to ambulance personnel
- to be a legal record and statistical information

Organisations providing a first aid service will have first aid forms to assist in information gathering and reporting. (SLSA members should fill out an Incident Report form for all major first aid and resuscitation cases).

**confidentiality**

All information relating to a casualty’s injury or condition must be kept confidential. However, you must give all relevant information to medical personnel when they arrive.

**post traumatic (critical incident) stress management**

An unsuccessful resuscitation, not knowing the ultimate outcome, or even a successful resuscitation or emergency response can all take an emotional toll on the first aider. This is known as post traumatic, or critical incident, stress. If you, or a colleague, are experiencing stress after an incident, it is important that you seek support.

Assistance can be gained from:
- telephone counselling services
- your family doctor
- local community centres
- ministers of religion, etc

**first aid safety**

**infection control**

First aiders should always follow standard precautions when performing first aid. These include using the following barrier devices during first aid and resuscitation:

- gloves
- resuscitation mask
- safety glasses

**contaminated waste disposal**

First aid supplies and tools or other items that have come in contact with bodily fluids such as vomit or blood should be disposed of in clinical waste bags.
advanced resuscitation techniques training manual

Topic 1 – first aid and resuscitation review

chain of survival

The ‘chain of survival’ is a representation of basic management of emergency cardiac events. The best chance a person has of surviving an out-of-hospital cardiac arrest is if the following sequence of emergency care can be initiated as quickly as possible.

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Figure 1.1 – chain of survival

- early access
  the recognition of the emergency, and calling for urgent medical help as quickly as possible

- early CPR
  the manual life support system that delivers oxygen to the heart, brain and other vital organs to prevent the casualty from becoming hypoxic (lack of oxygen to the tissues, which causes them to start dying). CPR must be started as soon as possible, as it temporarily maintains a circulation sufficient to preserve brain function until specialised treatment is available

- early defibrillation
  the delivery of a precise electric shock to the heart by a defibrillator in an attempt to restore normal sinus heart rhythm. Defibrillation is, perhaps, the most important factor in influencing survival from a cardiac arrest

- early advanced care
  the intensive care facilities and the range of life saving drug therapies available can be administered in hospital and, in some cases, in the field

Research has shown that the chances of survival from an out-of-hospital cardiac arrest can be significantly improved if each of the links in the ‘chain of survival’ is initiated rapidly.

COMMUNICATION throughout the whole resuscitation process is vital

It is necessary that everyone involved knows what is happening, and who is doing what - TALK TO EACH OTHER
emergency action plan

There are many variables when dealing with emergencies. Knowing when to do what in a first aid situation, despite the variables, is the key to giving the casualty(ies) the best chance of a full recovery. In any first aid situation, the first aider must have an action plan. The plan of action for first aiders is known as the emergency action plan (EAP). The steps in the EAP are:

1. pause and plan
2. call for emergency assistance
3. primary assessment
4. secondary assessment
   - management of injuries
   - vital signs survey
   - history
5. ongoing management

pause and plan

The aim of pause and plan is to remind the first aider to remain calm, and to stop and think.

Any time that you are called to an incident, consider the following questions.

- is the area safe?
- do you have the appropriate first aid kit and equipment to manage the incident?
- how long could you be out in the elements?
- do you have a radio or mobile phone?
- are you likely to need assistance?
- do you need to call 000 before you attend the incident?

emergency assistance – 000

It is essential that emergency services are contacted as soon as possible.

The four Ps, Position, Problem, People and Progress can be used to remember the information that will need to be supplied to an emergency services operator or, when working as part of a first responder organisation such as surf lifesaving, via radio to your communications centre.

P - position
what is the exact location of the emergency?
the first aider should be ready to give the street address and suburb, or a description of the location such as the nearest intersection or landmark. It is also useful to pass on the telephone number they are calling from.

P - problem
what is the problem?
the caller should be ready to explain what has happened.

P - people
how many people are injured or sick?
the caller must be prepared to list the number of people involved in the incident including their gender, ages and signs of life.

P - progress
what has been done (progress) to assist the casualty?
the caller may be asked if he or she is with the casualty at the time and what treatment has been provided so far.
primary assessment

Primary assessment is the initial assessment of the scene and the casualty for dangers to the first aider, casualty and the bystanders, and for signs of life of the casualty. Primary assessment also includes cardiopulmonary resuscitation and defibrillation.

D - danger
make sure that there is no danger to yourself, casualty or the bystanders

R - response
assess the consciousness of the casualty

S - send for help
call an ambulance 000

A - airway
ensuring a clear airway is a key aspect of successfully resuscitating a casualty. The use of suction devices to clear foreign matter from the mouth and the use of oropharyngeal airways to assist in ensuring that the tongue does not block the airway, can assist in maintaining the casualty’s airway. These devices are an addition to good airway management; first aiders should continue to manage the airway ensuring head tilt and chin lift. When using an airbag during resuscitation, the jaw thrust method should be used to apply head tilt and chin lift and ensure a good seal between the resuscitation mask and the casualty’s face

B - breathing
rescue breaths using expired air during resuscitation will provide the casualty with approximately 16% oxygen in each breath.

Using an oxygen resuscitation device such as a bag-valve-mask resuscitator with a reservoir bag attached will provide up to 95% oxygen with each compression of the airbag. The benefit of this additional oxygen during CPR is invaluable and should be used during CPR whenever equipment and a trained operator are available.

C - compressions
CPR should be commenced if the casualty is not breathing or has effective breathing. Basic CPR skills are essential to ensure the best outcome for a casualty; these skills should not be neglected in favour of using other resuscitation devices. As an experienced first aider, other first aiders in your team may look to you for guidance. You will need to be confident in your resuscitation skills to be able to provide direction to your team. You may also be required to instruct bystanders in assisting with CPR to allow you to access and use the additional equipment in which you have been trained.

D - defibrillation
defibrillation should be administered as soon as possible. When working in a team, a first aider who is trained in the use of a defibrillator should be the operator. The operator of the defibrillator must take control of the team performing resuscitation as he/she will be responsible for the delivery of the shock and ensuring the safety of the rest of the first aid team.
secondary assessment

The secondary assessment is a systematic means of finding other conditions that were not apparent during the primary assessment. This further assessment should not be undertaken if life threatening conditions are still present.

Before conducting a secondary assessment, always:
- introduce yourself to the casualty and ask their name
- explain your intentions to the casualty
- seek consent to treat the casualty
- consider and respect the casualty’s privacy

management of injuries

After completing the primary assessment and having identified that the casualty is breathing, the first aider can begin managing other injuries. It is important to remember that CPR must not be interrupted to treat other injuries.

order of treatment

The control of major bleeding is seen as the first priority after the completion of the primary assessment. Then
- manage any major burns
- treat the casualty for shock
- stabilise any fractures
- treat any other injuries

vital signs

Vital signs are essential for not only establishing how well or sick the casualty is, but for monitoring trends in their condition and assessing the effectiveness of the treatment.

Vital signs include:
- pulse rate
- breathing rate
- skin colour and temperature
- conscious state

signs and symptoms

Signs and symptoms are important tools that will help the first aider determine the casualty’s condition and aid in developing a treatment plan.

signs
Signs are evidence of an illness or injury that you can see or interpret using your senses

symptoms
Symptoms are what the casualty tells you about how they are feeling

history

A history is relevant information about a casualty’s previous injury/illness, and their present symptoms. You can obtain a history by:
- observing the scene
- listening to what is said by the casualty and bystanders
- asking questions

Appropriate questions can be remembered by the acronym SAMPLE:
S - signs and symptoms
A - allergies
M - medication
P - previous medical history (look for a MedicAlert bracelet or necklace)
L - last oral intake
E - event
ongoing management

After completing treatment of injuries and illnesses identified during the primary and secondary assessment, the first aider will need to decide if referral to hospital or other medical aid is required, and call 000 for an ambulance if necessary.

Once the decision has been made to refer the casualty to medical aid, ongoing observation and management of the casualty is important to ensure that the casualty’s condition is monitored.

Ongoing observation and management while waiting for medical assistance should include:

- reassess the casualty’s vital signs at regular intervals
- continue to identify actual or potential problems and plan appropriate care
- notify the ambulance service of any change to the casualty’s status, as appropriate
- hand over casualty to ambulance personnel

who should be sent to hospital?

Anyone to whom any of the following applies should be sent to hospital:

- has lost consciousness, even for a brief period
- has required either initial rescue breathing or CPR
- may have a secondary condition, such as a heart attack or a neck injury
- has a persistent cough or an abnormal skin colour
- may have inhaled any amount of fluid or gas

If none of the previous conditions applies, but if the first aider has any doubt about the casualty’s state of health, the casualty should be advised to seek medical advice as soon as possible.

hand over

If an ambulance has been called, the first aider should remain with the casualty until they can hand over to the ambulance paramedics.

First aiders should introduce themselves and the casualty to the paramedic and detail the following information using the EPIC principle:

**E - event**
what happened to the casualty

**P - problem**
what the presenting problem was
what you found out from vital signs and secondary assessment

**I - interventions**
what you did to assist the casualty (treatment and the effect this had on the casualty)

**C - current condition**
what their condition is now

Documentation must be completed and, where possible, a copy given to the ambulance paramedics.
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topic 2 – defibrillation

Knowledge of the circulatory system is necessary for effective operation of an automated external defibrillator (AED). The following circulatory system information is provided for revision.

the circulatory system

The circulatory system consists of the heart and blood vessels – arteries, veins and capillaries.

The right side of the heart receives deoxygenated or venous blood from veins through the body and pumps blood to the lungs. The left side of the heart receives oxygenated blood from the lungs and pumps it throughout the body’s arteries via the aorta (main output blood vessel of the heart).

![Figure 2.1 – blood circulation in the body](image)

Arteries circulate blood at high pressure, so their walls are thick and muscular. Major arteries are often located deep within the body tissue. Arterial blood is bright red due to its oxygen content. Serious blood loss can occur rapidly when someone is bleeding from an artery, because of the high blood pressure, which causes the escaping blood to spurt in time with the heartbeat. Arterial bleeding is unlikely to stop on its own accord.

Veins circulate blood at low pressure, so their walls are thin. Veins contain valves that prevent the backflow of blood. Many veins are located close to the skin (superficially), such as those visible under the skin on the feet, hands and forearms. Venous blood is dark red, due to its low oxygen content.

Capillaries are the smallest blood vessel and capillary networks link the ends of the smallest arteries with the smallest veins. Capillaries allow oxygen and nutrients to reach every cell in the body, and carbon dioxide and other waste products to be removed.

With the exception of the fingernails, toenails and hair, injury to any part of the body will cause damage to blood vessels, and result in some degree of bleeding (from minor bruising to major life-threatening bleeding).

For the organs and all parts of the body to receive adequate oxygen, normal heart function is essential to oxygenate blood and pump it throughout the body. When the heart stops, oxygen is not supplied to the body. The brain is highly susceptible to lack of oxygen (hypoxia) and damage may occur if blood supply is not restored within 3-5 minutes.
the heart

The heart sits in the middle of the chest behind the sternum, and extends somewhat to the left side. It is a strong muscular pump, about the size of its owner’s clenched fist. It has four chambers:

- two atria, which receive blood to pump to the ventricles
- two ventricles, one that pumps blood to the lungs (right), and another that pumps blood to the body (left)

In the average adult, the heart beats around 60 – 100 times per minute, sending about six litres of blood through well over 1,000 complete circuits of the body each day.

The heart contains several valves that are designed to ensure blood flows in one direction. It normally beats rhythmically, pumping blood throughout the body through a network of blood vessels comprising arteries, veins and capillaries.

Oxygen-rich blood passes from the lungs to the left side of the heart. It is then pumped to all the different parts of the body where oxygen is delivered to the body cells.

Oxygen-depleted blood is then returned to the right side of the heart and pumped to the lungs where it again becomes oxygenated. The blood then travels back to the left side of the heart, ready to make another journey around the body.

Just like any other muscle in the body, the heart also needs its own oxygenated blood supply. It receives this by a system of vessels called the coronary circulation, which supplies oxygenated blood to the heart muscle cells and directs the deoxygenated blood back towards the right side of the heart.

**Figure 2.2 – parts of the heart**

**Figure 2.3 – coronary circulation**
Cardiovascular disease

Cardiovascular disease (CVD) is the general name for a number of more specific diseases such as:
- heart disease
- vascular disease
- stroke

CVD is a major cause of death in developed countries. For example, it is estimated that in Australia one person dies every ten minutes due to some form of CVD. Of the different conditions, heart disease is responsible for approximately 20% of all deaths in Australia. In the USA more than 1,000 people die each day from sudden cardiac arrest, which is a major cause of death in people over 35 years of age.

causes

A major cause of cardiovascular disease is fatty deposits (plaque) accumulating inside the walls of the blood vessels. As these deposits increase, the inside of the blood vessels narrow so the blood flow is reduced.

Figure 2.4 – blocked artery

There are a number of causes or risk factors that increase the likelihood of a person developing CVD. These can be divided into two distinct groupings:
- non-preventable or non-modifiable factors - those which we have no control over
- preventable or modifiable - which can be affected by changes in lifestyle and/or through medication

Family history is a factor over which we have no control. A person’s risk is increased if a parent has died from CVD before the age of 60. Gender and age are again factors which we cannot alter. As we age, our chances of developing CVD increase. Up to approximately 70 years of age, males have a greater chance of developing CVD than females.

However, there are a number of risk factors that can be directly influenced. These include:
- smoking
- high cholesterol levels
- high blood pressure
- physical inactivity and
- being overweight

These factors hasten the development of CVD (and other medical conditions such as diabetes and emphysema). By not smoking, and through regular exercise and a healthy diet, the risk of developing CVD can be reduced.

Sometimes medications may be required to help control blood pressure and cholesterol levels. Medical advice should be sought to assess an individual’s CVD risk level and what steps, if any, need to be taken to lower that risk.

heart disease

One of the specific types of cardiovascular disease is heart disease. A manifestation of this is where a coronary vessel(s) becomes narrowed, resulting in a decrease in blood delivery through that vessel.
angina

Sometimes the heart has to pump faster and harder than usual, like when running to catch a bus. At such times, the heart muscle cells also require more oxygenated blood to meet the increased workload. If the coronary vessel has become too narrow to meet this extra demand, the oxygen-deprived heart muscle cells begin to cause chest pain and/or tightness. This condition is called Angina.

recognition of angina

- chest pain or tightness
  - may radiate to neck, jaw, shoulders or arms
- shortness of breath
- pale, cold and sweaty skin
- nausea

management of angina

Often symptoms of angina are relieved if the person rests and/or takes their medication. Common medications include a tablet that is placed under the tongue, or a mouth spray. These medications help to reduce the workload of the heart.

Management includes:

- assist the person into a position of comfort
- if the casualty has their own angina medication, assist them to take it
- loosen any tight clothing
- give reassurance
- provide supplementary oxygen if available
- do not leave the person unattended
- send for urgent medical assistance – call 000/112 on mobile – if:
  - someone has signs and symptoms as described above for the first time
  - an angina sufferer’s symptoms are more severe than usual
  - symptoms are not relieved by their usual dosage of medication

heart attack (myocardial infarction)

Sometimes a clot may form or lodge inside a coronary artery, totally blocking it. In this instance, no oxygenated blood can flow through to the affected heart muscle cells. This is called a Myocardial Infarction, or Heart Attack in layman’s terms. The signs and symptoms are similar to that of angina, but may be more severe, and are not relieved with rest or medication.

recognition of heart attack

- chest pain or tightness
  - may be gradual or sudden onset
  - often described as heavy, dull or crushing
  - may radiate to neck, jaw, shoulders or arms
- nausea or vomiting
- shortness of breath
- pale, cold and sweaty skin
- may appear distressed

management of heart attack

if responsive:

- send for urgent medical assistance – call 000/112 on mobile
- assist the person into a position of comfort
- give reassurance
- loosen any tight clothing
- provide supplementary oxygen if available
- do not leave the person unattended
- be prepared for possible sudden unconsciousness
if unresponsive:
- conduct a primary assessment and act accordingly
- provide supplementary oxygen if available

Medical terminology changes from time to time, and the term Acute Coronary Syndrome is now often used to describe angina and heart attack.

**cardiac arrest**

Sudden cardiac arrest is one of the leading causes of death in Australia, claiming the lives of 25,000 Australians each year.

Cardiac arrest is the cessation of normal circulation of the blood due to failure of the heart to contract effectively. A cardiac arrest is different from, but may be caused by, a heart attack where blood flow to the muscles of the heart is impaired.

**recognition of cardiac arrest**
- unconscious, unresponsive
- not breathing normally/regularly
- not moving in any way

**management of cardiac arrest**
- CPR
- defibrillation if a shockable rhythm is present

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**the electrocardiogram (ECG)**

The heart has two actions - a **mechanical action**, which is the pumping of the heart, and an **electrical action**, which controls the rhythmic beat of the heart.

The electrical impulse passing through the heart muscle can be mapped on a graph called an electrocardiogram (ECG). When a casualty’s heart is under stress or injured, changes in the electrical activity can be seen on an ECG.

The AED measures this activity through electrode pads placed on the casualty’s chest, and recognises life threatening arrhythmias, such as ventricular fibrillation and pulseless ventricular tachycardia.

**the electrical action of the heart**

The electrical impulses that cause the muscle cells in the heart to contract originate in specialised pacemaker cells.

The main pacemaker (the sinoatrial, or SA node) is situated in the wall of the right atrium. An electrical impulse spreads from the pacemaker through the walls of the atria, causing the muscle cells of the atria to contract and force blood into the ventricles. The electrical impulse continues down the conduction pathway to the atrioventricular (AV) node where it is momentarily slowed to allow time for the atria to contract before it spreads through the ventricles, which contract. This contraction expels blood from the heart to the lungs (from the right ventricle) or throughout the rest of the body (from the left ventricle).
sinus rhythm

Sinus rhythm is the normal rhythm of a healthy heart, and the AED will not recommend, or allow, a shock if a normal sinus rhythm is detected.

Figure 2.6 - sinus rhythm

ventricular tachycardia

Ventricular tachycardia (VT) is a fast heart rhythm, that originates in one of the ventricles of the heart. The heart rate will vary between 100-200 beats per minute. Ventricular tachycardia can be life-threatening, because it may lead to ventricular fibrillation, asystole and cardiac arrest.

Figure 2.7 - ventricular tachycardia

signs and symptoms of ventricular tachycardia

- fainting
- pale/grey skin colour
- sweating
- nausea
- difficulty breathing or shortness of breath
- very rapid pulse or no pulse
- palpitations - the casualty will feel like their heart is racing
- light-headedness or dizziness
- angina or some type of chest pain

normal heart rates

infants/newborns: 100 – 160 beats per minute
children: 70 – 120 beats per minute
adults: 60 – 100 beats per minute

cardiac rhythm and arrhythmias

AEDs are designed to detect life threatening arrhythmias, such as ventricular tachycardia and ventricular fibrillation, and to recommend defibrillation. Therefore, first aiders do not need experience in rhythm recognition - although normal sinus rhythm and some common arrhythmias are shown on the following page. Some AEDs have a display screen and manual over ride function for use by trained health professionals.
management of ventricular tachycardia

In less severe cases, no treatment may be necessary and the heart will convert to normal (sinus) rhythm spontaneously. Prolonged cases of ventricular tachycardia may deteriorate into pulseless VT, which requires defibrillation. If an AED detects pulseless VT, it will recommend a shock.

ventricular fibrillation

Ventricular fibrillation (VF) is an abnormal, irregular heart rhythm with very rapid uncoordinated fluttering contractions of the ventricles of the heart. VF is most commonly associated with heart attacks. This is a life threatening arrhythmia that results in collapse with cardiac arrest.

asystole

A life threatening cardiac condition characterised by the absence of electrical and mechanical activity in the heart. **CPR is the only treatment.** The AED will not recommend a shock if this rhythm is found.

management of asystole

- perform CPR

Figure 2.9 – asystole

defibrillation

Defibrillation is the most effective method of reverting the heart to its normal (sinus) rhythm by delivering an electric shock to the heart using a defibrillator.

A common cause of heart attack is ventricular fibrillation or ventricular tachycardia.

Early access to defibrillation, when combined with starting effective CPR as early as possible, provides the best chance of survival for a casualty suffering cardiac arrest (heart stops beating).

Defibrillation of the heart by first aid personnel has become possible with automated external defibrillators.
In Figure 2.10 - comparison of survival rates from sudden cardiac arrest showing the difference made by defibrillation, the graph illustrates the percentage of survival over time for different scenarios:

- **No Treatment**: 0% survival
- **Delayed Defibrillation**: 2% survival
- **Early CPR, Delayed Defibrillation**: 8% survival
- **Immediate Phone Call, Early CPR, Delayed Defibrillation**: 20% survival
- **Immediate Phone Call, Early CPR, Early Defibrillation**: 40% survival
- **Immediate Phone Call, Early CPR, Early ALS**: 60% survival

Figure 2.11 - probability of survival after delay to defibrillation shows a 7% to 10% reduction in chances of success each minute.
automated external defibrillator

The automated external defibrillator (AED) is a portable device able to recognise shockable rhythms in a casualty having a cardiac event (VT or VF) and deliver an electric shock to revert the heart back to its normal rhythm.

The AED delivers an electric through electrode pads applied to the casualty’s chest. This process stops the heart’s abnormal electrical activity, restoring normal sinus rhythm and cardiac function.

The AED is biphasic (a system having two phases). The electrical current is triggered and goes from one pad to the other then returns. The shock delivery is preset at 150 Joules each way, with a total of 300 Joules for the shock. One shock is delivered, followed by a pause of two minutes for recovery, checks and resuscitation, as required. The AED will analyse the heart rhythm again after the two minutes; if a further shock is required, the AED will prompt to deliver it.

Indications for the use of an AED are:
- the casualty is unresponsive
- the casualty is not breathing
- the casualty has no signs of life

General application of electrode pads is for people over eight (8) years of age, or minimum 25 kg
- for children under eight (8) years of age or under 25 kg, only devices having an infant key system or paediatric pads/settings should be used
- defibrillators are not to be used on infants under one year of age, or under 10 kg

**different AED machines have different protocols for shock delivery**
- Some have set joule settings,
- others have variable joule settings, and some measure impedance and calculate the joules needed
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When connected to a casualty’s chest, the AED will:

- prompt specific actions
- analyse the electrical activity of the casualty’s heart (ECG)
- advise to shock, if an appropriate arrhythmia is detected
- deliver a shock when activated by the operator
- advise to recommence CPR if no shockable arrhythmia is detected

**AED operator responsibilities**

It is the responsibility of the AED operator to apply and operate the AED, and to ensure the safety of bystanders and other first aiders. To do this, the AED operator must take control of the resuscitation team, directing team members and bystanders to ensure the safe operation of the AED.

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**do not operate the unit in an unstable environment, e.g. moving vehicle, stretcher**

**this may prevent it from performing a valid assessment of the ECG signal**

---

**pre-operational checks**

All modern AEDs have a self check mechanism to ensure that they are operational. This check usually includes making sure that there is a sufficient level of charge in the battery and that all electronic components, including the automatic self-check, are functioning correctly.

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**defibrillation safety**

All defibrillation units must meet Australian Standards, and in some instances, be approved for use by various organisations.

First aiders must operate the AED safely. Safety considerations include, but are not limited to, the following:

- the operator must be trained/certified in the use of the defibrillator
- the AED operator is in charge of coordinating the resuscitation attempt, and instructs other team members
- any metallic jewellery should be removed from the casualty
- the casualty should not be lying in or on anything wet
- if in wet conditions (e.g. rain), the chest should be wiped dry before positioning pads
- contact between the pads and any metal surface should be avoided
- only use equipment, e.g. pads, batteries, compatible with the unit
- operators and bystanders must have no contact with the casualty during analysis and delivery of the shock
- the AED should not be operated in an explosive environment (e.g. where gases or fumes might be present)
- do not operate the unit in close proximity to mobile phones, radios
- oxygen flow should be directed away from the casualty
applying electrode pads

Before applying the pads:

- make sure that the skin is clean and dry
- do not use alcohol wipes
- if the chest is excessively hairy, remove hair with razor or shears

positioning electrode pads

Correct positioning of the pads is essential for successful defibrillation to take place. The optimal position is indicated on the pads, on the packaging they come in, and on the AED itself:

- place the sternum pad to the right of the sternum (breastbone) below the collarbone and above the right nipple
- place the apex pad to the left of the sternum, with the upper edge of the pad below and to the left of the nipple

 Imamplanted devices

If the casualty has an implanted pacemaker or defibrillator, make sure that the pads are at least 2.5cm away from the implanted device.

A pacemaker is a small device that is implanted under the skin of the chest to help control abnormal heart rhythms. The pacemaker uses electrical pulses to prompt the heart to beat at a normal rate. Most modern pacemakers are roughly the size of a 50 cent piece, and approximately three times as thick. The battery life of most pacemakers today is 5-8 years.

Figure 2.14 - implanted pacemaker

A defibrillator implant is a tiny device that is implanted under the skin of the chest to detect abnormal heartbeats. When a person’s heart beats too quickly or starts to beat erratically, this electronic device sends a power boost to the heart. The energy gives the heart muscle enough strength to get back on track.

Figure 2.15 - implanted defibrillator
operating the defibrillator

- confirm that the casualty needs defibrillation, i.e. that the casualty is unresponsive, not breathing and has no signs of life
- always check that conditions are safe for the use of an AED
- turn on the defibrillator

![Figure 2.16 – turning on the defibrillator](image)

- follow the prompts, i.e. remove clothing from chest, remove pads from case (follow other protocols as required, i.e. remove hair, wipe away moisture etc)
- apply pads to the casualty’s chest when prompted

![Figure 2.17 – applying pads to casualty’s chest](image)

- respond to the unit’s prompts, i.e. cease CPR, don’t touch the casualty
- press the flashing orange button when prompted, checking that everyone is clear and that it is safe to deliver a shock
- maintain basic life-support protocols

![Figure 2.18 – staying clear while delivering shock](image)

post-defibrillation care

If the defibrillation has been successful:
- leave the pads on the casualty
- check for breathing

If the defibrillation has **not** been successful:
- leave the pads on the casualty
- continue CPR until relieved or unable to continue

If the casualty is breathing, check for a response
- leave the pads on the casualty
- if they are responsive, reassure them and make them comfortable
- if they are not responsive, place them in the lateral position

If the casualty is **not** breathing
- leave the pads on the casualty
- continue CPR

**do not use pads after their expiry date**

**all pads are single use only**
skill maintenance

AED skills should be practiced on a regular basis. Skills should be assessed annually, to maintain currency.

accessories

Other items that should be kept with the defibrillation unit include:
- face shield
- gloves
- razors / shears
- gauze wipes (or similar)
- spare electrode pads (optional)

Other items, subject to use and environment:
- resuscitation mask
- space blanket
- pen and paper
- chamois or towel

post-defibrillation equipment maintenance

After every use, the defibrillator should be cleaned of sand or other debris, and tested as per the manufacturer’s instructions. Single-use items such as electrode pads and gloves should be disposed of and replaced from stores in the first aid room. All other equipment should be cleaned and disinfected and replaced in the kit.

AED equipment storage and maintenance

- store in an easily accessible place
- do not store in direct sunlight or in damp conditions
- check regularly (minimum weekly)
- check that the date of the electrode pads is current, and that they are still sealed
- check that the indicator light is flashing rhythmically
- if the AED ‘chirps’, press the information (i) button and follow the prompts
  - battery is low - replace
  - pads are faulty – replace
- deal with other minor faults as per manufacturer’s guidelines
- confirm the AED has passed the self check

major fault reporting

- report to supervisor
- write a note in the Incident Report Book
- contact manufacturer or reseller
Today in Australia, public access defibrillators are becoming more widely available, and training in their use is easily accessed. AEDs are easy for members of the public to use and are seen in airports, train stations, stadiums and shopping centres.

The limited data available on the effectiveness of such PAD programs have showed an improvement in survival to discharge from hospitals. This is consistent with some other studies where AEDs were used as part of a first responder program.

The evidence to date indicates that early defibrillation provided within a PAD program improves survival from cardiac arrest occurring outside hospitals.

The Australian Resuscitation Council supports the implementation of PAD programs and recommends that defibrillation should preferably be undertaken by trained lay people or health professionals.

### AED PROMPTS

AED prompts may vary, depending on the make and model, but they are usually similar to those shown below

<table>
<thead>
<tr>
<th><strong>FUNCTIONS</strong></th>
<th><strong>EXAMPLES OF PROMPTS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Attaching electrodes to casualty</td>
<td>‘Attach electrodes’</td>
</tr>
<tr>
<td>Initiating analysis of ECG</td>
<td>‘Press to analyse’</td>
</tr>
<tr>
<td>Warning that charging is taking place</td>
<td>‘Charging’ - with rising audible tone</td>
</tr>
<tr>
<td>Warning not to touch casualty during shock</td>
<td>‘Stand clear’  ‘Do not touch casualty’</td>
</tr>
<tr>
<td>Initiating shock</td>
<td>‘Shock advised’  ‘Press to shock’  ‘Push flashing button’</td>
</tr>
<tr>
<td>Stating that a non-shockable rhythm is present</td>
<td>‘No shock advised’  ‘Check for signs of life’  ‘If no signs of life commence CPR’</td>
</tr>
<tr>
<td>Warning that ECG signal is unsatisfactory</td>
<td>‘Check electrodes’  ‘Motion detected’</td>
</tr>
</tbody>
</table>

There may be prompts for maintenance, such as battery condition and the need for recharging or replacement.
Use of Automated External Defibrillator

Casualty collapse

Call 000/112
Access AED

Turn on AED

Respond to audible prompts from AED

AED analyses heart rhythm

Advised to shock
(Respond to audible prompts from AED)

No shock advised

Stand clear

Press button to shock

Shock

Check for signs of life

No signs of life

CPR
2 minutes

Signs of life present

Follow basic life support

Hand over to medical personnel upon their arrival for advanced life support
**topic 3 – oxygen administration**

Knowledge of the respiratory system is necessary for effective resuscitation. The following respiratory system information is provided for revision.

**the respiratory system**

The respiratory system consists of upper and lower tracts. A clear, open airway is the single most important factor for successful resuscitation.

![Figure 3.1 – respiratory system](image)

**upper respiratory tract**

The upper respiratory tract includes the nostrils, nasal cavity, mouth, pharynx (throat) and larynx (voice box).

The throat is a common passageway for food and air. It starts from the cavity at the back of the mouth and nose and extends down to where it divides into two separate tubes, the trachea and the oesophagus. The trachea (windpipe), allows air to pass to and from the lungs. It sits in the front of the throat and begins at the larynx and vocal cord, extending down toward the lungs. The oesophagus, sits behind the trachea and carries food and liquids to the stomach (or back from the stomach to the throat during vomiting or regurgitation).

**lower respiratory tract**

The lower respiratory tract consists of the trachea and the bronchi, which divide into two to enter the right and left lung. The primary bronchi then divide into progressively smaller bronchi, bronchioles and, finally, alveoli (terminal air sacs). The trachea and bronchi are kept open by C-shaped rings of strong connective tissue (cartilage), making them semi-rigid tubes (rather like the vacuum tubing used to clean out swimming pools). These rings hold open the trachea and bronchi, allowing airflow to and from the lungs.

![Figure 3.2 – lungs](image)

The lungs fill most of the chest cavity, which is separated from the abdomen by a large sheet of muscle known as the diaphragm. The lungs are spongy, elastic organs consisting of the bronchial tree, alveoli (air sacs) and blood vessels.

When we breathe in, air containing oxygen moves (diffuses) into the lungs through to the alveoli. The alveoli are surrounded by tiny blood vessels (capillaries). The interface between those two structures is known as the respiratory membrane, and it allows the exchange (diffusion) of gases.
Oxygen diffuses from the alveoli into the blood in the capillaries, while carbon dioxide diffuses from the blood to the alveoli. Carbon dioxide is a waste product of metabolism (burning of the body’s energy systems) and is expelled as we breathe out.

**breathing**

Breathing is the act of moving air into and out of the lungs. Inhalation is the breath in. It is an involuntary muscular action caused by contraction of the muscles that lift the ribs while the diaphragm is pulled down and flattened. This combined action increases the size of the chest cavity and sucks air into the lungs.

Exhalation is the breath out. When the muscles of inspiration relax, the elastic recoil of the lung tissues pushes air out of the lungs.

The air we breathe in contains approximately 21% oxygen. About 5% of this is used in the body, so the air we breathe out contains 16% oxygen.

On average, an adult takes 12-15 breaths per minute. The average amount of air taken in one breath is about half a litre, and is called the tidal volume. In children and infants, the breathing rate is faster and the tidal volume is smaller.

The breathing control centre is located at the base of the brain in the brainstem. It acts like a metronome (timing mechanism), sending out regular impulses that control the rate and depth of breathing (both inspiration and expiration). The breathing control centre must have a good supply of oxygen, otherwise it will become damaged, fail to function properly and breathing will stop.
respiratory noises

In a healthy person there should be no audible sound as they breathe in and out. Where a casualty has some respiratory distress, this may be accompanied by noises. Noises can include cough, inspiratory/ expiratory wheeze, stridor or wet gurgling noises. A casualty in severe respiratory distress may make no sound at all.

cough

A sudden expulsion of air from the lungs (with a characteristic noise), may be associated with mild airway obstructions, or inflammation of the upper and/or lower airways.

wheeze

A whistling sound when breathing in or out, most commonly encountered by first aiders treating casualties with asthma and may also be associated with other chronic obstructive airways diseases.

stridor

A louder or harsher sound than a wheeze, may be associated with a partial airway obstruction.

gurgling

A broken irregular sound similar to moving water, may be associated with fluid or mucus in the lower airways.

no sound

No vocal sound, even with a casualty showing an effort to breathe. A casualty with a complete airway obstruction may make no sound, the effort to breathe may also take in the use of accessory muscles.

airway obstruction

An airway obstruction (blockage) can be either partial or total. The more the airway is blocked, the more the casualty is in danger of losing consciousness. Causes of airway obstructions include swelling of the throat tissues and choking (an object lodged in the airway).

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### ASSESS SEVERITY

1. **INEFFECTIVE COUGH**
   - SEVERE AIRWAY OBSTRUCTION
     - UNCONSCIOUS
       - CALL AMBULANCE (000/112)
       - COMMENCE CPR
     - CONSCIOUS
       - CALL AMBULANCE (000/112)
       - GIVE UP TO 5 BACK BLOWS
       - IF NOT EFFECTIVE – GIVE UP TO 5 CHEST THRUSTS
   - EFFECTIVE COUGH
     - MILD AIRWAY OBSTRUCTION
     - ENCOURAGE COUGHING
       - CONTINUE TO CHECK CASUALTY UNTIL RECOVERY OR DETERIORATION
       - CALL AMBULANCE (000/112)
**oxygen**

The body requires a constant supply of oxygen:

When the body does not receive enough oxygen, cells start to die and the body functions slow down. It is essential to be able to recognise breathing difficulties and to provide immediate first aid including supplementary oxygen to treat the casualty.

Oxygen is used to assist in the resuscitation of a non-breathing casualty and as therapy for a breathing casualty (e.g. someone with smoke inhalation, or asthma).

**insufficient oxygen**

Insufficient oxygen can result from:

- airway obstruction
  - foreign material or vomit
  - tissue swelling (allergic reaction)
  - incorrect head position during unconsciousness (a casualty slumped forward in the seat of their vehicle after a car crash)
- trauma (head injury)
- drugs (e.g. heroin, which slows down breathing to the point where a casualty may stop breathing)
- near drowning
- asthma
- damage to nerves and/or muscles connected to respiratory system, caused by:
  - spinal cord damage
  - chest injuries
  - some poisons and venom

**symptoms of insufficient oxygen**

- cyanosis (bluish discoloration of skin)
- headache
- decreased reaction time
- impaired judgement time
- euphoria
- visual impairment
- drowsiness
- light-headed or dizzy sensation
- tingling in fingers and toes
- numbness
- respiratory noises
Casualties likely to benefit from oxygen include those with the following conditions:

- unconsciousness
- shock
- head injuries
- heart attack and heart conditions
- severe injury of any type
- heat stroke
- blood loss
- respiratory distress
- asthma
- poisoning
- gas, smoke or capsicum spray inhalation
- chest conditions (casualty not able to breathe deeply enough, and thus at risk of hypoxia)
- abdominal injuries
- eye injuries
- fractures
- all other injuries – helps to reduce the extent of tissue damage
- after resuscitation
- no signs of life

**hypoxia**

Hypoxia is a result of insufficient oxygen being available to the lungs and a reduction of oxygen entering the blood, with a consequent reduction of oxygen pressure in the lungs. Hypoxia is seen in casualties suffering from chronic obstructive airways diseases (COAD), neuromuscular or lung diseases.

**administration of oxygen**

There is a variety of oxygen equipment available to assist spontaneously breathing casualties and provide oxygen to non-breathing casualties. It is important that you are familiar with the general characteristics of this equipment. Whatever device is used, it is always important to explain to the casualty what it is and why it is necessary.

Bag-valve-mask systems are preferred by many first aiders as they can feel the movement of the bag, indicating the condition of the airway, and the presence or absence of breathing. The bag-valve-mask system delivers approximately 100% oxygen to the casualty when connected to an oxygen supply, with a flow rate of 14 – 15 litres per minute (lpm).

Bag-valve-mask resuscitators may be used for casualties with severe respiratory distress, unconscious casualties, and those who have been exposed to carbon monoxide inhalation.

**oxygen cylinders**

Medical oxygen cylinders are normally identified as black metal cylinders with white shoulders, and clearly labelled as medical oxygen. If it is a new (2009 onwards) medical oxygen cylinder, it will be white or cream all over.

The most commonly used oxygen cylinders are:

- **C size** cylinders = 400 to 490 litres of useable oxygen
- **D size** cylinders = 1640 litres of useable oxygen
- **Special** cylinders = approximately 200 litres of useable oxygen
‘Portable’ oxygen resuscitators commonly use the C size cylinder. Smaller cylinders such as C size cylinders have two indexing holes on the cylinder stem, called a pin index, for correct location of the regulator on to the cylinder. These index holes prevent non-medical oxygen regulators being used by mistake. Engage the cylinder on to the two protruding pins on the regulator’s inlet face.

**care of oxygen cylinders**

Oxygen cylinders may be stored upright or on the side using appropriate brackets, and:
- in a cool, dry, ventilated area below 45°C
- away from busy traffic areas
- clear from sand and dust contamination
- away from oil or grease
- uncovered
- in a designated no-smoking area and not near naked flames
- with no pressure showing on the gauge

When the cylinder is almost empty (1/4 or less full), close valve, remove from oxygen equipment, mark cylinder as ‘empty’ or ‘MT’ and store away from full cylinders. Empty cylinders should be returned for refilling without delay.

**safety precautions**

**DO NOT**
- drop, drag, roll or slide cylinders (if fractured, the pressure released will turn the cylinder into a high-powered missile)
- use oxygen near artificial heat sources
- allow smoking near oxygen equipment
- use oxygen if there is any danger of fire or open flames
- direct oxygen output towards the defibrillation area
- allow petroleum-based grease or oil to come in contact with supply devices on cylinder stem
resuscitation equipment

It is important for those trained in the use of oxygen resuscitation units to ensure that they are familiar with the components and operation of the unit(s) in use at their location.

There are two main types of resuscitation kits:
- stand-alone or standard
- integrated - oxy-viva (different units will have different components)

components of resuscitation kits

1 protective case
   houses all the relevant equipment. It may be a soft bag or hard plastic case, or a metal case for oxy-viva. In oxy-vivas, it incorporates the oxygen cylinder itself

2 medical oxygen cylinder
   a cylinder, usually made of spun aluminium, that holds the gas known as medical oxygen
   a) plastic dust seal
      covers the oxygen outlet and indexing pin holes
   b) heat warning tag
      indicates if the cylinder has been subjected to heat
   c) cylinder keyway valve
      allows the operator to turn on the oxygen
   d) oxygen outlet
      opening for oxygen to be delivered to the regulator
   e) locating pin holes(indexing)
      distinctive size holes for attaching the regulator to the cylinder
   f) information label
      information about contents, size, maker/supplier of cylinder, and hazard rating

Figure 3.6 - standard resuscitation equipment

Figure 3.7 - oxy-viva resuscitation kit

Figure 3.8 - components of a medical oxygen cylinder
3 **cylinder cradle**
provides support for the oxygen cylinder in an oxy-viva unit

4 **external cylinder connection (oxy-viva)**
allows larger oxygen cylinders to be attached. It is important to remember that when an external cylinder is in use, a small cylinder or the yoke plug should be firmly in place to prevent oxygen leaking. This connection is not found on all units

5 **regulator**
regulates the oxygen flow
   a) **thumb screw**
      helps to secure and maintain the cylinder in position
   b) **yoke**
      the connection for the oxygen cylinder. In some instances, it is part of the case (oxy-viva); otherwise, it may be attached as part of the regulator
   c) **locating pins (indexing)**
      distinctive size pins positioned in the yoke, so that the operator can locate the oxygen cylinder correctly
   d) **sealing washer (Bodok)**
      fits in the yoke to prevent leakage from the cylinder joint
   e) **cylinder keywheel/spanner**
      used to open or close the cylinder valve
   f) **contents gauge**
      indicates the amount of oxygen in the cylinder
   g) **oxygen outlet nipple**
      tubing fits onto nipple, to allow delivery of oxygen from regulator to bag-valve-mask
   h) **regulator knob**
      allows oxygen flow to be adjusted

---

6 **tubing**
depending on the unit, there will be either one or two tubes, usually clear and/or green in colour

7 **OP airways**
help maintain a clear airway

8 **airbag**
used for inflating a casualty’s lungs by squeezing it, which supplies oxygen from an oxygen reservoir bag

9 **oxygen reservoir bag**
attached to the airbag and stores oxygen to ensure that maximum oxygen is delivered to the casualty

---

*Figure 3.9 - components of a regulator*
10 resuscitation masks
each unit should contain at least one adult and one child-sized resuscitation mask, and a pocket mask
  a) pocket mask case
  protection for pocket mask
  b) pocket mask
  can be used instead of resuscitation mask
  c) elastic strap
  holds mask securely onto face
  d) one way valve and filter
  diverts filtered air away from the rescuer
  e) mouth piece
  opening to allow rescue breaths to be administered

11 patient filter (optional)
inserted between the resuscitation mask and the patient valve on the airbag. This filter stops any vomit, blood or saliva from entering and clogging the patient valve during resuscitation. The patient filter is single use only

12 therapy masks
each unit should contain at least one adult and one child-sized therapy mask. These masks may be the therapy type or the non-breather type of mask

13 glass marker or chalk
used to mark on the cylinder, the volume of oxygen in the cylinder

14 gloves
used for personal protection

15 pens, pencils and paper
used for taking notes and recording casualty’s progress

16 sealing washer (Bodok)
spares (and case) for the regulator

The equipment below may also be part of an oxygen resuscitation kit

- automatic oxygen-powered resuscitator
  these devices deliver oxygen under high pressure to inflate lungs of casualties who are not breathing
- suction
  helps the operator to remove fluids from the casualty’s mouth

all oxygen resuscitation kits must meet Australian Standards - look for the Australian Standards number on the oxygen cylinder and valve
maintaining resuscitation equipment

general care of equipment

- oxygen units should be kept clean and free of sand, debris and foreign materials
- to ensure correct operation, equipment must be checked before starting operational duties each day, and after any use (including training sessions)
- whenever the oxygen equipment shows defects that may cause it to operate incorrectly, the units must be taken out of service immediately and repaired by the manufacturer
- the oxygen equipment should be serviced at least every 12 months, or according to the manufacturer’s instructions

pre-use/maintenance check

Before using any oxygen equipment (including masks, airway and suction equipment), it should be checked for faults and defects in accordance with the manufacturer’s instructions, industry standards and regulatory requirements:

- check therapy masks for cleanliness and serviceability (should be in a sterile sealed bag)
- check the condition of the resuscitation mask cuffs for fit, perishing or cracks
- ensure that there is a sufficient supply of various size OP airways and that they are sealed in their original packing
- check in the case for:
  - glass marker or chalk, for marking the amount of oxygen in the cylinder
  - pens, pencils and paper for keeping records
  - gloves, for personal protection during emergency care
  - spare sealing washers (Bodok), to replace defective or missing seals

after-use maintenance and restoration

most airbags and masks are single use and disposable
if not, follow the instructions below

bag-valve-mask

After every use, the airbag and mask should be disassembled, cleaned, disinfected, reassembled and tested in sequence:

- disassemble and wash all the parts in warm soapy water
- rinse in fresh running water
- soak all contaminated parts in a solution of 6:1 (water and bleach) for 10-15 minutes, then rinse
- allow to air dry and reassemble
- test all parts of the equipment after drying and before storage to ensure that the equipment is ready for use the next time it is needed

oxygen equipment

Whenever oxygen equipment has been used:

- prepare it again for immediate use – check regularly; turn cylinder on and off again to check contents
- discard oxygen equipment consumables marked for single use, i.e. oxygen masks
- replace disposable components
- clean and sterilise non-disposable components
- wipe regulator carefully with damp cloth
- check that the seal (Bodok) between the regulator housing and cylinder yoke is in the correct position
servicing equipment

Oxygen regulators and flow valves require annual servicing. The manufacturer’s recommendations for servicing should be followed.

The equipment technical inspection tag should be affixed to the equipment, and the date and equipment reference number clearly identified on the tag/label.

major faults

A major fault is any fault that cannot be repaired through basic maintenance (e.g. cleaning and replacement of spare or missing parts that are routinely stocked in the first aid room) and that affects the safety or ability to use the equipment properly. All major faults should be logged in the appropriate organisational logs.

assembling resuscitation equipment

oxygen cylinder and regulator

1 select an appropriate size medical cylinder to suit apparatus to be used. Only medical oxygen, which is filtered and purified when the cylinder is filled, should be used:
   - select a full cylinder, ensuring that a plastic dust seal is in place over the oxygen outlet hole
   - make sure the plastic seal is intact
     - the plastic seal, which also covers the indexing pin holes, enables full cylinders to be distinguished from used ones, and minimises dust entry into the oxygen outlet
     - the seal should be left in place until the oxygen cylinder is required
   - check the heat warning tag before the cylinder is fitted to the oxygen equipment
     - reject any cylinders with melted or deformed tags
     - contact the fire service and the company which supplied the cylinder

2 before ‘cracking’ (opening) the cylinder, completely remove the dust seal from the full cylinder

3 to ‘crack’ a cylinder:
   - place the oxygen keywheel/spanner on to the keyway at the end of the oxygen cylinder
   - advise bystanders and casualty(ies) that the cylinder is about to be cracked (to avoid frightening them)

material safety data sheets (MSDS)

every organisation should have an MSDS for each hazardous substance (including oxygen) that is stored on the premises
- kept in a central folder, or
- with the hazardous substance

MSDS contain information on how the substance should be stored and what to do if poisoning occurs
• place one hand halfway down the cylinder for stability; point the oxygen outlet hole away from yourself and anyone else – the oxygen jet can cause a nasty friction burn
• turn the key slowly and gently anti-clockwise until the oxygen flow is heard, then turn it quickly back to the off position, to clear dust or other contaminants from the oxygen outlet

Alternatively, you can crack the cylinder by turning the handle on the cylinder valve

4 check that the sealing washer (Bodok) on the yoke is present and is not damaged or dirty
• replace missing or damaged sealing washers, otherwise the equipment is inoperable and cannot be used

5 insert the cylinder into the regulator yoke ensuring that the inlet and outlet holes are aligned
• tighten with the yoke thumb screw

6 turn on the regulator, slowly open the cylinder valve with the cylinder key wheel/ spanner. (This reveals the amount of oxygen available in the cylinder)

7 listen for leaks
• the rubber (Bodok) seal is the first location to check for oxygen leaks
• replace seal if necessary

8 check the oxygen tubing for cracks or other damage
• check the flow of oxygen from the cylinder through the tubing
• check that there is no odour from the oxygen being expelled from the tubing

9 check the airbag (as described in the following section)

10 close the cylinder valve
• drain oxygen from the system by operating the delivery system
• check that the needle on the contents gauge falls to zero

11 mark the cylinder with the contents, time and date

12 general care of the case and optional equipment includes:
• keeping the whole unit clean and free from sand, sea water, oil and grease
• checking additional equipment, e.g. suction, automatic oxygen-powered resuscitators
**bag-valve-mask resuscitator**

*(airbag)*

1. Check the airbag for leaks and direction of airflow:
   - Block the patient valve with the thumb or hand and compress the bag under reasonable pressure
   - Check that air does not leak out of the rear valve, the bag or the patient valve
   - Release the thumb or hand, when the bag should compress and refill rapidly

2. Check the exhalation function of the yellow disc membrane on patient valve:
   - Place the oxygen reservoir bag over the patient valve and inflate it fully by squeezing the airbag
   - Squeeze the reservoir bag gently. The yellow disc membrane will lift (during resuscitation, the casualty exhales through this disc membrane)

3. Check the overflow valve of the oxygen reservoir:
   - Inflate the reservoir bag and connect it to the reservoir valve
   - Compress the reservoir bag rapidly and watch the disc in the valve lift. (This membrane ensures that the reservoir bag cannot be overfilled with oxygen)

4. Check the air-intake membrane which is located in the rear valve of the airbag:
   - Inflate the reservoir bag as described above and connect it to the airbag
   - Compress the airbag two to three times. The airbag will draw in air through the air-intake membrane, and the reservoir bag will empty
   - When empty, the airbag should still operate, drawing in air through the outer intake valves

*Figure 3.11 – components of a bag-valve-mask resuscitator*

**bag-valve-mask resuscitators may vary slightly by manufacturer**
breathing casualties

administering oxygen therapy

Oxygen therapy is the administration of oxygen to a conscious or unconscious breathing casualty. Oxygen therapy increases the level of oxygen in the casualty’s bloodstream. It has the potential to relieve pain and calm the casualty, and helps them to breathe if they are having breathing difficulties.

Oxygen therapy can be delivered to a casualty who is injured or who is having breathing difficulties via:

- a therapy mask or nasal cannula with a selected and controlled oxygen flow rate
- a rebreather mask (therapy mask system with a reservoir bag attached) and connected to an oxygen cylinder
- an oxygen powered resuscitator, a demand valve system which automatically supplies approximately 100% oxygen as the casualty breathes in. This method of delivering oxygen is for information only and should only be used by trained operators

Oxygen therapy must be administered at an appropriate flow rate for wellbeing of a casualty. To ensure this, it is important to continue to monitor the casualty through the procedure.
**Therapy Mask (Face Mask)**

![Therapy Mask Image]

The simple universal plastic therapy mask can deliver up to 60% oxygen depending on the flow rate and the speed and depth of the casualty’s breathing. Exhaled air is vented through the holes on each side of the mask.

As a general guide a flow rate of 8-15 litres per minute (lpm) should ensure adequate oxygen delivery to the casualty. A flow rate under 8 lpm with quick respirations, may not be enough to fully ‘flush’ out the carbon dioxide in the therapy mask and therefore may have a negative effect on respiration.

1. **Connect the therapy mask to the oxygen unit**
2. **Turn the oxygen regulator on to a flow rate of 8-15 lpm**
3. **Turn on the oxygen**, which allows the oxygen to flow through the mask
4. **Introduce the mask to the casualty explaining the benefits and effects**
5. **Hold the mask to the face, gradually adjusting the elastic around the casualty’s head and pinching the soft metal nose band**
6. **Observe the casualty’s respiration**

**Figure 3.13 – Using a Therapy Mask**

- If a conscious casualty does not want the mask on their face:
  - They can hold the mask in front of their face, or
  - The tubing can be removed from the mask and the oxygen flow directed toward the mouth and nose from the tube

**Figure 3.12 – Therapy Mask**

When oxygen administration is being given and there is more than one casualty, a new mask should be used for each casualty to ensure that neither the first aider nor the casualties are placed at risk of cross infection.

**Therapy masks are single use only**

---

**Topic 3 – Oxygen Administration**
**rebreather mask**

A partial rebreather mask is similar to a therapy mask; however, the side ports are covered with discs to prevent room air from entering the mask. This mask is called a rebreather because it has a soft plastic reservoir bag connected to it that conserves the first third of the casualty's exhaled air while the rest escapes through the side ports. This is designed to make use of the carbon dioxide as a respiratory stimulant. The casualty will receive oxygen at a rate of 40-70% at 5-15 lpm.

![Figure 3.14 – non rebreather mask with reservoir](image)

1. mask
2. elastic strap
3. soft metal nose band
4. side ports with one way discs
5. oxygen nipple connection
6. one way valve
7. reservoir bag

**Using a rebreather mask on a breathing casualty**

1. choose appropriate size rebreather mask (large or small face)
2. attach oxygen to the nipple on the reservoir bag
3. turn the oxygen regulator on to a flow rate of 5-15 lpm for a partial rebreather, or 15 lpm for a non-rebreather
4. turn on the oxygen (reservoir bag will inflate)
5. hold the mask with one hand; as the casualty breathes in, they will automatically receive approximately 65% oxygen until the end of inhalation
6. hold the mask to the face, gradually adjusting the elastic around the casualty’s head, and pinching the soft metal nose band
7. check that the mask is firmly applied, and that the casualty is comfortable

![Figure 3.15 – using rebreather mask](image)

A non-rebreather mask is also similar to a therapy mask but has multiple one-way valves in the side ports. These valves prevent room air from entering the mask but allow exhaled air to leave the mask. It has a reservoir bag like a partial rebreather mask but the reservoir bag has a one-way valve that prevents exhaled air from entering the reservoir. This allows larger concentrations of oxygen to collect in the reservoir bag for the casualty to inhale. The casualty will receive oxygen at a rate of 60-90% at 15 lpm.
two-pronged nasal cannula

Figure 3.16 – two-pronged nasal cannula

The two-pronged nasal cannula is made from plastic tubing with two plastic tips that sit at the base of the nostrils. It will deliver oxygen concentration of 30% to 40% with an oxygen flow rate of approximately 3-5 lpm.

The nasal cannula is a useful means of oxygen delivery when low to moderate oxygen concentrations are required. It is mainly used for chronic airway disease casualties who are feeling slightly short of breath. Anyone who has acute shortness of breath needs high concentrations of oxygen.

do not use higher flow rates as this will not increase the delivered oxygen concentration but will cause irritation of the nasal mucosa

using a two-pronged nasal cannula on a breathing casualty

1. connect the nasal cannula to the oxygen unit
2. turn the oxygen regulator on to a flow rate of 3-5 lpm
3. turn on the oxygen, which allows the oxygen to flow through the nasal cannula
4. introduce the nasal cannula to the casualty explaining the benefits and effects
5. insert the prongs of the nasal cannula into the casualty’s nostrils and loop the tubing around each ear
6. tighten the tubing with the toggle underneath the casualty’s chin
7. observe the casualty’s breathing to make sure the cannula is not irritating the nostrils

Figure 3.17 – using two-pronged nasal cannula
**demand valve resuscitator**

*Figure 3.18 – demand valve resuscitator*

In breathing casualties, inhalation triggers the demand valve and oxygen automatically flows at approximately 100% until inhalation is complete. Expired gases pass into the atmosphere. This is useful for casualties with severe respiratory distress, unconscious casualties and those who have been exposed to carbon monoxide inhalation.

In non-breathing casualties a manual override is used to inflate the lungs. This is operated by depressing a button. Excess lung pressure is prevented by a pressure relief valve.

1. turn the oxygen regulator on to flow rate of 15 lpm
2. turn on the oxygen cylinder valve
3. check contents gauge for adequate supply
4. place face mask firmly over nose and mouth ensuring an airtight seal. As the casualty breathes in, the resuscitator will automatically supply approximately 100% oxygen until the end of inhalation
5. the casualty exhales through the mask – no need to remove the mask

*Figure 3.19 – using a demand valve resuscitator*

**using a demand valve resuscitator on a breathing casualty**

*this method of delivering oxygen is FOR INFORMATION ONLY and should only be used by trained operators*
**non-breathing casualties**

**resuscitation with oxygen**

Oxygen may be given to a non-breathing casualty via:
- a pocket or resuscitation mask, with the oxygen being delivered directly into the mask

or
- a hand powered, bag-valve-mask system with a reservoir bag attached and connected to an oxygen cylinder

or
- an oxygen powered resuscitator; demand valve system with a manual override button for inflating the lungs

A number of different facemasks are approved for use in mouth to mask resuscitation. Some of these have oxygen ports that allow the oxygen therapy tubing to be connected.

Research has shown that adding oxygen during mouth to mask resuscitation can increase the oxygen received by the casualty from 16% to 50% (16% is the oxygen content of expired air). If the therapy setting of 8 lpm is used, the concentration of oxygen in the casualty’s lungs will be almost 45%, but if the resuscitation setting of 14-15 lpm is used and the seal is effective, the concentration for the casualty will be greater (i.e. >50%). It is recommended that the higher setting be used if there is enough oxygen available for the time resuscitation is expected to last. If not, the flow of 8 lpm is satisfactory.

---

**a full ‘C’ cylinder (440-490 litres) will operate for approximately 30 minutes, with continuous use of airbag (and oxygen) at 14-15 litres per minute**
**mask with oxygen**

*Figure 3.20 – pocket mask with oxygen nipple*

Oxygen aided resuscitation involves delivering oxygen through a resuscitation mask or pocket mask that may have an oxygen port nipple fitted to it. The oxygen tubing is fitted to the nipple, or is placed between the mask and the casualty’s cheek, or into the mask’s opening.

As a general guide, a flow rate of 8-15 lpm should be adequate oxygen delivery to the casualty.

**using a mask with oxygen on a non-breathing casualty**

If using a pocket mask with an oxygen port nipple:

1. connect the oxygen delivery tube to the nipple on the pocket mask
2. turn on the oxygen regulator to 8 or 15 lpm
3. turn on the oxygen at the bottle
4. use chin lift or jaw support to hold the pocket mask over the casualty’s mouth and nose
5. place lips over the aperture and blow in as when delivering rescue breaths

*Figure 3.21 – using a pocket mask with oxygen nipple*
If using a resuscitation mask or a pocket mask without an oxygen port nipple:

1. turn on the oxygen regulator to 8 or 15 lpm
2. turn on the oxygen at the bottle
3. place the mask over the casualty’s mouth and nose, then place the oxygen tubing between the casualty’s cheek and the mask, or into the mask’s opening

**Figure 3.22 – using a resuscitation mask, with oxygen tubing between the cheek and the mask**

4. use chin lift or jaw support to hold the pocket mask over the casualty’s mouth and nose
5. place lips over the aperture and blow in as when delivering rescue breaths

**Figure 3.23 – using a resuscitation mask, with oxygen in the mask’s opening**

**Bag-valve-mask resuscitator**

Bag-valve-mask systems are preferred by many first aiders as they can feel the movement of the bag, indicating the condition of the airway, and the presence or absence of breathing.

**Figure 3.24 – bag-valve-mask resuscitators**

if oxygen is being used on a child, the paediatric airbag (if available) should be used and squeezed with one hand

- when the child’s chest is seen to rise, stop squeezing the bag

bag-valve-mask resuscitators not specifically manufactured for exclusive use on infants should not be used on infants
using a bag-valve-mask resuscitator with oxygen on a non-breathing casualty (two-person operation)

1. kneel at the head of the casualty
2. check, clear and open the airway with jaw thrust
3. insert an oropharyngeal airway (if available)
4. choose appropriate size face mask (large or small face) and place on the casualty’s face (narrow part over bridge of nose)
5. check that the mask is firmly applied with a good seal, and that jaw thrust is maintained
6. attach reservoir bag to airbag
7. attach oxygen to the nipple on the airbag
8. turn the oxygen regulator to 15 lpm
9. turn on oxygen (reservoir bag will inflate at 15 lpm to maintain a full reservoir)
10. place the airbag onto the mask’s opening
11. hold mask with one hand; gently squeeze bag with other hand and watch for chest to rise (do not over inflate the lungs)

12. the person conducting compressions should advise when reaching 30th compression
13. release the airbag and allow it to refill ready for the next ventilation
14. check constantly that equipment is functioning and the technique is correct
15. maintain backward head tilt and ensure a proper seal between the mask and casualty’s face is maintained
16. ensure that the casualty’s chest rises with each inflation and falls as air exits the lungs

*Figure 3.25 – using a bag-valve-mask resuscitator with oxygen*
using a bag-valve-mask resuscitator without oxygen on a non-breathing casualty (two-person operation)

Bag-valve-mask systems may also be operated without connecting to an oxygen cylinder in non-breathing casualties. In this case, the reservoir bag is not attached, so oxygen from the atmosphere is pulled into the airbag.

To use a bag-valve-mask resuscitator without oxygen:

1. kneel at the head of the casualty
2. check, clear and open the airway using jaw thrust
3. insert an oropharyngeal airway (if available)
4. choose appropriate size face mask (large or small face) and place on the casualty’s face (narrow part over bridge of nose)
5. check that the mask is firmly applied with a good seal, and that jaw thrust is maintained
6. attach the airbag to the mask’s opening
7. hold the mask with one hand; squeeze the airbag with the other hand and watch for the chest to rise; then release the airbag, and watch for the chest to deflate (do not over inflate the lungs)

8. person conducting compressions should advise when reaching 30th compression
9. check constantly that equipment is functioning and your technique is correct

Figure 3.26 – using bag-valve-mask with no oxygen
demand valve resuscitator

In non-breathing casualties a manual override is used to inflate the lungs. This is operated by depressing a button. Excess lung pressure is prevented by a pressure relief valve.

using a demand valve resuscitator on a non-breathing casualty

1. kneel at the head of the casualty
2. check, clear and open airway
3. insert an oropharyngeal airway (if available)
4. follow steps 1-5 as for breathing casualty
5. press button on the demand valve resuscitator until chest commences to rise, then release and wait until lungs deflate (do not over inflate)
6. check constantly that equipment is functioning and that your technique is correct

ensure that you DO NOT over inflate the casualty’s lungs. The pressure from a demand valve may cause injury to the lungs if they are over inflated
two first aiders – with oxygen equipment

When CPR is required and two first aiders are present or a second person arrives, and oxygen equipment is available, a changeover of operators when required will minimise fatigue particularly for the first aider performing compressions. When it is determined that the casualty has no signs of life:

- ensure that an ambulance has been called
- first aider one starts CPR
- first aider two sets up oxygen equipment
- first aider one continues performing compressions
- first aider two takes over breaths using oxygen equipment
- first aider one or two indicates their readiness or need to change every two minutes
- change over smoothly with minimal interference to the resuscitation procedure
- ensure that the change of operator is done approximately every two minutes to minimise fatigue

Continue CPR with the use of oxygen until:
- the casualty shows signs of life
- more qualified help arrives
- you are both physically unable to continue

If the casualty shows signs of life, place the casualty in the recovery position, provide oxygen therapy, monitor vital signs and manage any injuries while waiting for the ambulance.

Figure 3.29 – two first aiders administering CPR and oxygen
topic 4 - oropharyngeal airways

Oropharyngeal airways (OP airways) are curved plastic devices that assist in the maintenance of an adequate airway in the unconscious casualty by keeping the airway clear and the tongue in place. The OP airway by itself does not replace correct airway management practices and should only be considered as a tool to assist in the management of a casualty’s airway.

Figure 4.1 – types of oropharyngeal airways

characteristics of oropharyngeal airways

OP airways are a plastic device characterised by a rigid flange and a hollow curved tube. The OP airways have a flange (top flattened end) that, when properly inserted, rests against the casualty’s lips. This flange does not interfere with an adequate seal from a facemask.

Inside the OP airway and protruding slightly past the flange is a coloured bite block, which may on occasions fall out or be cracked or missing in defective airways. The bite block prevents a recovering casualty biting down hard and obstructing their airway. There have been recorded events where the OP airway minus the bite block has been bitten through by a casualty having a spasm during recovery.

Figure 4.2 – different sized oropharyngeal airways

OP airways come in various sizes allowing for insertion into different-sized casualties. The smallest OP airways are approximately 5 cm long and the larger OP airways are over 10 cm. The bite block also assists with size recognition as there are different colours for different sizes.

care of oropharyngeal airways

The OP airway must be stored in a sterile state, preferably in a clear plastic bag. The OP airway should be easily accessible in the first aid kit, oxygen unit and first-aid rooms. It should be checked for deformities such as cracks and scratches, and if such deformities exist, it should be disposed of.

After an OP airway has been used with a casualty, the contaminated OP airway should be disposed of in a safe manner in an infectious waste bag, preferably with attending ambulance or medical personnel. If this is not possible, the contaminated OP airway should be placed in an infectious waste bag and stored in a safe place until proper disposal can be organised; usually this can be organised through the local hospital.
when to insert an oropharyngeal airway

The use of an OP airway is optional during casualty management. Having decided to use the OP airway, first aiders should take less than 15 seconds to correctly size and insert it into the casualty’s mouth. Whether the OP airway is used or not, the management principles of DRSABCD do not change.

The OP airway should be inserted into the unconscious breathing casualty’s mouth after the casualty has been rolled onto their side.

choosing the appropriate size oropharyngeal airway

To obtain the correct size OP airway, place it against the side of the casualty’s jaw line. The flange of the OP airway will extend from the centre of the casualty’s lips.

The curve of the OP airway is then run sideways along the casualty’s jaw. The correct size OP airway is the one that closely reaches the angle of the casualty’s jaw.

The OP airway can also be inserted during CPR while the casualty is on their back. In this case, first aiders should cease CPR and quickly insert the OP airway and then continue CPR.

OP airways are inserted using the ‘rotation’ method. This method is not recommended for infants or children under the age of eight because the roof of the mouth is still soft and easy to damage.

using an oropharyngeal airway

precautions to take when inserting an oropharyngeal airway

- ensure that there is adequate head tilt prior to insertion of the OP airway
- ensure that the OP airway does not push the tongue backwards and block the casualty’s airway
- do not force the OP airway into the mouth; the airway should slide in easily
- ensure that the casualty’s lips (both top and bottom) are not caught between the teeth and the OP airway

sizing of an OP airway can be effectively carried out while it is still in a sterile plastic bag

an OP airway should not be inserted during delivery of external cardiac compressions this may impede the successful insertion of the airway and cause unnecessary injury to the casualty
inserting an oropharyngeal airway

OP airways must be inserted only into deeply unconscious or non-breathing casualties. Insertion of an OP airway into a conscious casualty may induce vomiting, gagging, aspiration and may also lead to damage or dislodgement of teeth.

An OP airway must be lubricated prior to insertion. This can be done using moisture on the casualty’s lips or by using clean water. It is particularly important to apply lubricant to the convex or outer surface of the curved tube portion.

The OP airway can be inserted into the casualty’s mouth while they are on their back or in the lateral position, using the following rotation method:

1. with the casualty on their side, visually check the casualty’s airway and manually clear if necessary
2. measure and choose an OP airway of the correct size
3. remove the OP airway from the packet and lubricate using moisture on the lips of the casualty or with water
4. tilt the casualty’s head backwards; open the casualty’s mouth with one hand using jaw support (or jaw thrust, if necessary)
5. hold the OP airway by the flange with the tip pointing upwards towards the roof of the casualty’s mouth
6. insert the OP airway into the casualty’s mouth above the casualty’s tongue to approximately one-third of its length
7. while gently inserting the OP airway, rotate it 180° until the tip points downwards, at the same time sliding it over the casualty’s tongue into the back of the pharynx until the flange is touching the lips

Figure 4.4 – inserting the airway, tip towards roof of mouth

Figure 4.5 – rotating the airway 180°
8 the OP airway should slip easily into place. If it is difficult, stop, re-position the casualty’s lower jaw and tongue before trying again. Never force an OP airway into position, as this may damage the casualty’s mouth, teeth, and upper airway and could cause additional airway obstruction.

Figure 4.6 – airway fully inserted

Figure 4.7 – airway fully inserted, showing tongue held in position

a correctly inserted OP airway will greatly facilitate the maintenance of a clear airway

If the casualty shows any signs of rejecting the OP airway, remove it immediately. In most cases the casualty may spit it out or push it half way out with their tongue. The OP airway can be easily removed by sliding it out of the mouth with its natural curve.

Do not attempt to rotate the OP airway on removal as this is unnecessary and may cause damage to the mouth and throat.

Oropharyngeal airways should not be used when the following is present:

- if the casualty is conscious or semi-conscious. Insertion of an OP airway into a conscious casualty may induce vomiting, gagging, aspiration and teeth damage
- if a correct size is not available
- if there is a large amount of fluid in the casualty’s mouth
- if the casualty is under eight year of age. Insertion of OP airways by the ‘rotation method’ should not be used in children under eight due to the risk of damage to the mouth and throat

unless specifically trained, first aiders should not attempt to insert an OP airway into children under the age of eight
**INSERTION OF OROPHARYNGEAL AIRWAY FLOWCHART**

1. **Check for Danger**
   - danger present → manage danger
   - no danger

2. **Check for Response**
   - no response → manage casualty’s injuries
   - response present

3. **Check Airway**
   - is it clear?
     - no → roll casualty onto their side
     - yes → head tilt
     - manually clear airway

4. **Insert Oropharyngeal Airway**
   - hold by flange, with the tip pointing towards roof of mouth
   - insert the OP airway into the mouth about 1/3 of its length above the tongue
   - rotate 180° while continuing to insert
   - insert until flange rests against the casualty’s lips
   - ensure that lower lip is not pinched between teeth and oropharyngeal airway

5. **Check if breathing and signs of life**
   - no → continue casualty management
     - check for gag reflex
     - maintain head tilt and jaw support

**Topic 4 – Oropharyngeal airways**
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**topic 5 - suction**

Clearing the airways is the first life-saving measure taken when respiration (breathing) is disrupted. Ventilation can be effective only after residual secretions have been removed from the casualty’s respiratory tract. This can be achieved by using manual ‘finger sweeps’ with the casualty in the lateral position, or by using a suction device. These devices help to safely and simply remove secretions from the person’s mouth and airway.

**suction devices**

Types of suction devices include:
- manual (hand or foot operated)
- battery or electric powered
- oxygen powered (vacuum bottle)

**suction device components**

While there are many variations to suction devices based on the type and the manufacturer, there are six components common to most suction devices. These are:

1. **suction catheter**
   a plastic tube which is inserted into the casualty’s mouth to suction out any foreign material. Suction catheters are single use only and should be disposed of in clinical waste containers

2. **collection jar**
   fluids and foreign material suctioned from the casualty are collected in the jar. Collection jars are usually single use with the jar being disposed of along with the contents in clinical waste containers

3. **jar cap and connection port**
   the jar cap and connection port keep the contents in the collection jar and include the fittings to connect the suction catheter and the device which provides the suction power
suction checks

Before using any suction device
- ensure that the device is clean and that all components are available, including:
  - suction catheter
  - collection jar
  - collection jar cap
  - suction tubing (if required)
  - suction device
- operate the manual suction device or turn on suction for powered devices
- test for suction against the thumb or finger by placing it over the vacuum port (the port should stick to the thumb or finger)

using a suction device

Suction is only used in an unconscious casualty or a semiconscious casualty, where they cannot cough or swallow.

The principles of use are similar for all types of suction devices:
- the use of suction devices may require that appropriate infectious disease precautions be taken. Precautions should be taken during use, cleaning of the device and disposal of the device or parts used, as well as any contents
**procedure for using a suction device**

- put on sterile gloves
- check the suction device for correct operation
- remove the suction catheter from its sterile packaging and attach it to the suction tubing
- measure the distance from the side of the lips to the angle of the jaw and place your fingers that distance from the catheter tip. This will ensure that the catheter does not extend past the casualty's back teeth

![Figure 5.6 – correct sizing of suction catheter](image)

- open the mouth, and insert the catheter into the lower cheek of the casualty (if in the lateral position), ensuring that the catheter is inserted no further than the point marked by the operator’s finger
- rotate the catheter within the casualty’s cheek, ensuring that the action is smooth and gentle to prevent damage

![Figure 5.7 – using suction](image)

- use the suction device trigger to remove excess fluid (saliva, blood, stomach content) from the mouth

Hypoxia (lack of oxygen) is always a risk when suction is used. For this reason, manual suction should only be on for 15 seconds at a time, with a break of at least five seconds between operations. Powered suction devices should only be used for five seconds before a five second break, due to their constant suctioning action.
post-use maintenance of suction units

After using a suction device:
- dispose of disposable jars in a suitable manner
- flush reusable jars with clean cold water, and rinse with antiseptic solution
- ensure that all unit components are disassembled and thoroughly cleaned as per ARC guidelines

trouble shooting

There are a number of reasons why suction equipment can fail or not operate correctly. If experiencing problems, check the following:
- is the suction tubing blocked?
- is the contents bottle full or cracked?
- is the seal missing or perished?
- is the unit not turned on?
- is the oxygen supply exhausted
- is the battery flat
topic 6 – pulling it all together

Throughout the course of the ARTC, you have learnt the following:

- assess the casualty and develop a management plan
- check defibrillation equipment
- attach and operate a defibrillator
- recover and restore defibrillation equipment
- check resuscitation equipment
- resuscitate a casualty using oxygen
- use oxygen to provide therapy
- recover and restore oxygen equipment
- maintain an airway by:
  - using oropharyngeal airways (OP airways)
  - using suction

Each of these skills can be used in isolation with one operator, or can be used by a number of operators at the same time during an incident.

The critical factor to remember is that in training and refresher programs there is a need to build in initiative to simulate real life experiences as much as possible.

Often in training the defibrillator is introduced last, however in some instances a person with equipment such as a defibrillator may arrive first to a scene. Accordingly they need to make decisions to the use of the equipment available to achieve the best result.

With scenario training you can gain experiences which will be valuable when required to put in to real life practice.

The fact that a person with a defibrillator may arrive first, second, third or fourth to a scene is irrelevant - the critical factor is that the operator can quickly and efficiently apply the defibrillator and continue with other essential life support measures.

Similar situations may be applicable to other equipment and operators.

Communication is a key factor in any incident, as noted within the chain of survival. The ability to communicate during an incident will ensure more effective management and understanding and therefore assist in delivering the best outcome for the casualty.
Chronic Obstructive Airways Diseases (COAD) include emphysema, chronic bronchitis and other airways diseases. COAD is an ongoing illness, the casualty will be aware of their condition and, subject to having enough breath to speak, will be able to tell you of their condition.

In healthy people, high carbon dioxide levels are a stimulus to breathe. COAD casualties, who chronically have high carbon dioxide levels, lose this reflex and instead their breathing control centre relies on low levels of oxygen in their body to stimulate them to breathe.

Due to their body relying on low levels of oxygen to stimulate breathing, casualties with COAD are normally treated with low levels of oxygen (e.g. two litres per minute). If the higher concentrations of oxygen commonly available in first responder oxygen equipment (eight litres per minute or more) are used to treat a COAD casualty it may cause them to underbreathe.

NOTE: Any casualty presenting with breathing difficulties should be treated with oxygen. Supplemental oxygen administration must take precedence over the concern that a casualty may underbreathe due to being administered high oxygen concentration levels.
# Appendix 2 – Respiratory Status Assessment (Adults)

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Mild Distress</th>
<th>Moderate Distress</th>
<th>Severe Distress (Life Threat)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Appearance</strong></td>
<td>calm, quiet</td>
<td>likely calm, may be mildly anxious</td>
<td>may be distressed, anxious</td>
<td>distressed, anxious, fighting to breathe, exhausted, catatonic</td>
</tr>
<tr>
<td><strong>Speech</strong></td>
<td>clear and steady, sentences</td>
<td>speaks in sentences</td>
<td>speaks in short phrases only</td>
<td>speaks in words only or unable to speak</td>
</tr>
<tr>
<td><strong>Breath Sounds</strong></td>
<td>usually quiet no wheeze</td>
<td>may have a cough asthma: mild expiratory wheeze</td>
<td>may have a cough asthma: expiratory wheeze, may also be inspiratory wheeze</td>
<td>may be unable to cough asthma: expiratory wheeze, later may also be inspiratory wheeze and, if severe, may be no breath sounds</td>
</tr>
<tr>
<td><strong>Respiratory Rate</strong></td>
<td>12-16 per minute</td>
<td>16-20 per minute</td>
<td>tachypnoea (&gt;20)</td>
<td>tachypnoea (&gt;20) bradypnoea (&lt;6-8)</td>
</tr>
<tr>
<td><strong>Respiratory Rhythm</strong></td>
<td>regular even cycles</td>
<td>asthma: may be slightly prolonged expiratory phase</td>
<td>asthma: prolonged expiratory phase</td>
<td>asthma: prolonged expiratory phase</td>
</tr>
<tr>
<td><strong>Breathing Effort</strong></td>
<td>little with small chest movement</td>
<td>may be slight increase in normal chest movement</td>
<td>marked chest movement and may be some use of accessory muscles</td>
<td>marked chest movement with accessory muscles, intercostal retraction and/or tracheal tugging</td>
</tr>
<tr>
<td><strong>Pulse Rate</strong></td>
<td>60-100 per minute</td>
<td>60-100 per minute</td>
<td>tachycardia 100-120</td>
<td>tachycardia (&gt;120) bradycardia late sign in severe cases</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>normal</td>
<td>normal</td>
<td>may be pale and sweaty</td>
<td>pale and sweaty, may be cyanosed</td>
</tr>
<tr>
<td><strong>Conscious State</strong></td>
<td>alert</td>
<td>alert</td>
<td>may be altered</td>
<td>altered or unconscious</td>
</tr>
</tbody>
</table>

This table represents a graded progression from normal to severe respiratory status. These criteria need to be taken in context with:

- the casualty’s presenting problem
- the casualty’s prescribed medication
- repeated observations and the trends shown; and
- the casualty’s response to management
### appendix 3 – perfusion status assessment

<table>
<thead>
<tr>
<th>1 Perfusion – definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>the ability of the cardiovascular system to provide tissues with an adequate blood supply to meet their functional demands at that time and to effectively remove the associated metabolic wastes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 Perfusion – first aid observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>skin: colour, temperature, moistness</td>
</tr>
<tr>
<td>pulse rate</td>
</tr>
<tr>
<td>conscious state</td>
</tr>
</tbody>
</table>

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<tr>
<th>3 Perfusion – criteria (adult)</th>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>SKIN</th>
<th>PULSE</th>
<th>CONSCIOUS STATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADEQUATE PERFUSION</td>
<td>warm, pink, dry</td>
<td>60-100/min</td>
<td>alert and oriented in time and place</td>
</tr>
<tr>
<td>BORDERLINE PERFUSION</td>
<td>cool, pale, clammy</td>
<td>50-100/min</td>
<td>alert and oriented in time and place</td>
</tr>
<tr>
<td>INADEQUATE PERFUSION</td>
<td>cool, pale, clammy</td>
<td>&lt;50/min, or &gt;100/min</td>
<td>either alert and oriented in time and place, or altered</td>
</tr>
<tr>
<td>EXTREMELY POOR PERFUSION</td>
<td>cool, pale, clammy</td>
<td>&lt;50/min, or &gt;110/min</td>
<td>altered or unconscious</td>
</tr>
<tr>
<td>NO PERFUSION</td>
<td>cool, pale, clammy</td>
<td>absence of palpable pulse</td>
<td>unconscious</td>
</tr>
</tbody>
</table>

### special notes

Other factors may affect the interpretation of the observations made, for example:
- the environment, both cold and warm ambient temperature may affect skin signs
- anxiety may affect pulse rate
- the many causes of altered consciousness or unconsciousness (i.e. other than poor cerebral perfusion – respiratory hypoxia, head injuries, hypoglycaemia, drug overdoses etc)