Oxygen administration course

Student Guide

BSAC
Dive with us

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Introduction

Welcome to your BSAC Oxygen Administration course, and congratulations on choosing it for your rescue skills experience. Whether you have come from previous BSAC training or another agency, we are sure you will enjoy this course. Oxygen Administration training gives you the chance to make an even greater contribution to diver safety and rescue within your club or centre.

Your course instructor has a wealth of BSAC knowledge and will answer any questions you are bound to have as you go through the process. Much like other courses you will have done, there will be classroom or theory elements to learn, along with practical sessions. The theory elements can be completed as eLearning through the BSAC website. For the practical modules, you will meet up with other members at a local or regional venue. These course notes should be read in conjunction with the 'Safety and Rescue for Divers' publication.

You will learn skills that will establish you as a valuable member of the dive team and able to contribute to the effective management of diving emergencies. This includes refreshing your Basic Life Support (BLS) and Automated External Defibrillator (AED) skills. A large part of the course is about getting involved and having a go; the more you put into the course, the more you will get out of it. I am sure you will find the course interesting, challenging and fun. It is important that you turn up on time for the sessions, as your instructor will need to ensure that all the modules are covered and you have sufficient time to practice.

The Oxygen Administration qualification is also a requirement to qualify as a Dive Leader. Whether or not this is your current motivation for attending the course, it will put you in a good place for this progression.

Definition of an Oxygen Administrator

An Oxygen Administrator is defined as a person who is competent to:

- Provide Basic Life Support (BLS) in conjunction with an AED.
- Prepare, assemble and test a first aid oxygen administration unit safely.
- Select, test and fit an appropriate system/mask for delivery of oxygen to a diver casualty.
- Administer oxygen safely to a diver who is recognised as suffering from an illness or injury known to benefit from first aid oxygen.
- Support rescuers who are providing basic life support (BLS) to a diving casualty by safely administering oxygen to that casualty.
- Assist a Dive Manager by providing first aid oxygen, making a casualty assessment and/or completing a record of that assessment, actions taken and timeline.
- Provide a brief on the casualty to a third party, face-to-face or by radio/telephone, following a recognised process.
- Dismantle, clean down, dispose of single-use items and arrange for refilling and replacements following the use of the oxygen administration equipment.

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- **Complete, or assist with the completion of, a BSAC incident/accident report form after the event.**

The theoretical and practical training provided in the BSAC Oxygen Administration course meets the requirements of ISO 24801-3 (for Dive Leader) and ISO24802-2 (2014)(for Level 2 Scuba Instructor) for the emergency administration of oxygen.

Prerequisite

To attend this course, you will need to be familiar with Basic Life Support (BLS) skills, including the use of an Automated External defibrillator (AED).

BLS training is covered in the BSAC Sports Diver course or other agency equivalents.

For people who do not have previous BLS training, this can be gained by completing the BLS theory module (OAT0) and practical lesson (SP1).

Basic Life Support

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OAT0 - Basic Life Support

This theory session introduces you to the priorities of Basic Life Support (BLS), the use of an Automated External Defibrillator (AED), and the recovery position and casualty care.

Module objectives

This module will develop your knowledge of how to prioritise Basic Life Support actions. It covers the following topics:

- **Priorities of BLS**
- **Recognising cardiac arrest**
- **Chest compressions (CC) and rescue breaths (RB)**
- **The use of an Automated External Defibrillator (AED)**
- **Recovery position and casualty care**

Achievement targets

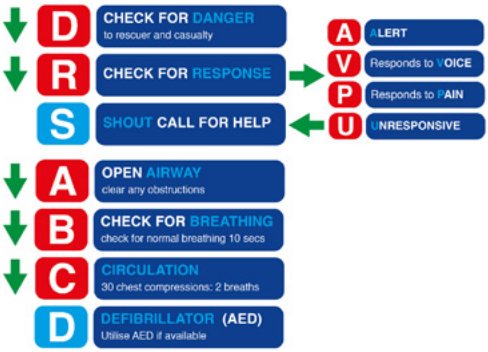
At the end of this module, you should be able to:

- **List, in order, the priorities of Basic Life Support (BLS)**
- **Explain what each of the priorities means and what action it requires**
- **Describe how to recognise cardiac arrest in a casualty**
- **Explain why the rescuer should not blow too hard when delivering Rescue Breaths (RB)**
- **Describe the rate and depth of Chest Compressions (CC) that will be effective**
- **Explain why it is important to place an unresponsive, breathing casualty in a recovery position**

Module Content

The Priorities of BLS – DR ABC

Implementing the priorities of BLS needs to be considered in the context of the normal diving situation where there are almost inevitably other divers around to help. The order of priorities can be remembered using DR ABC. Each of these initial letters will be considered in turn.



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Danger

Ensure the safety of

- **Yourself the rescuer(s)**
  If you allow yourself to be injured or killed, the casualty's chances of survival and recovery are likely to be reduced.

- **Bystanders**
  If others are not protected by ensuring they are out of any danger, then there may be more casualties to deal with. In the case of a diving incident, where other divers are still in the water, it will be necessary to manage their recall and exit to safety.

- **Casualty**
  Although the safety of the casualty must be considered and they should be removed from danger if necessary, this must not be done at the expense of others.

Dangers

- **Water**
  Water is a danger, so both rescuer and casualty need to be landed either to the safety of the shore or a boat. It is easy to underestimate the danger even to divers in equipment.

- **Boat propellers**
  When boat diving, particularly when responding to an unplanned event or emergency, it is important to be alert to the status of the engine and propeller. A rotating propeller can cause very serious injury to anyone making contact with it.

Response

Is the casualty responsive?

Quickly establish whether the casualty responds to voice when they are spoken to, give them an instruction or a controlled pain stimulus.

- **Ask loudly, Can you hear me? Are you OK? Open your eyes**
- **Squeeze the shoulder firmly**
  If a casualty is not responsive and not breathing normally, they are assumed to be in cardiac arrest.
  The emergency medical services (EMS) must be alerted while (or before) commencing chest compressions (CC). Do not delay moving on to the next actions unnecessarily.

If they do not respond to voice or pain stimulus treat them as unresponsive.

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Shout/call for help

Get support from your team/passers-by. It's a good idea to do this as soon as you are aware you have a problem to deal with. This way, you will be able to allocate tasks and reduce the load on yourself. If, in the event, you do not need the help of all those who respond to your call, you can simply thank them and let them carry on with other things.

- **Ensure they know you are dealing with a casualty and need their help**
- **The quicker you get help the better**
- **Allocate tasks:**
  - » Find/collect AED
    This can be time-consuming, so give someone directions and send them off while you continue to deliver whatever is necessary to the casualty. Whenever sending someone away, give clear instructions for them to report back to you on their return.
  - » Call emergency services
    Make sure that you, or someone else, has contacted or is contacting the emergency services before you start chest

compressions (CC). Send someone for help if possible. If there is no one else around and you do not have a radio or phone signal, it may be necessary to leave the casualty briefly to get help or an AED. If you have communication with the emergency services, switch to loudspeaker mode so that you can continue with BLS while briefing them.

» Set up and prepare the oxygen administration equipment

Ideally, you will have someone in the group who has been trained and is experienced in the use of oxygen in first Aid. Get them to prepare the equipment and, if appropriate, commence delivery to the casualty.

» Move casualty if necessary

In a diving situation, it is likely that BLS, including rescue breaths (RB) will have been initiated in the water by a lone rescuer. Once the casualty is out of the water, either on the shore or a boat, other members of the diving group will be available to help. This is where you, as a trained member of the group, will become a real asset.

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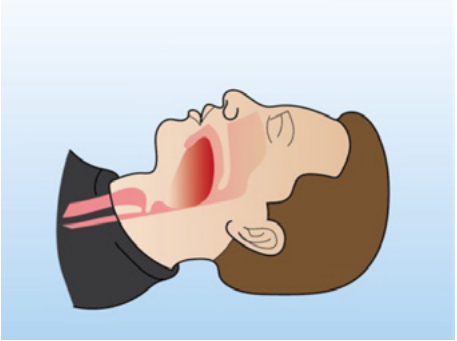
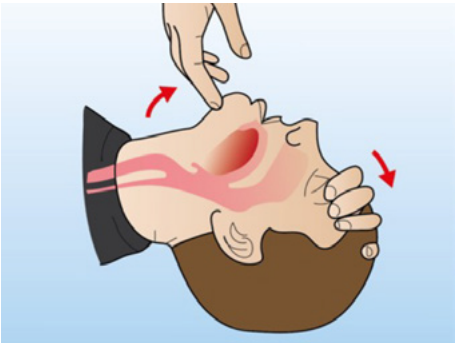
Airway

Clear the airway



- **Foreign objects**
- **Water and vomit**

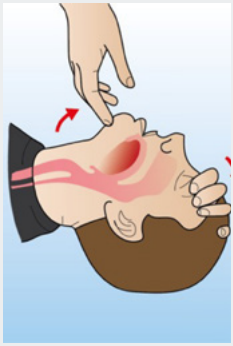
  Before tilting the casualty's head back, you should look inside the mouth. If there are any foreign objects, water or vomit in the mouth, clear them out quickly before head-tilt-chin-lift. Solids can be scooped out with a finger. Liquids can be drained by rolling the casualty carefully on one side. Vomiting or regurgitation often happens when someone has ingested water into the stomach.

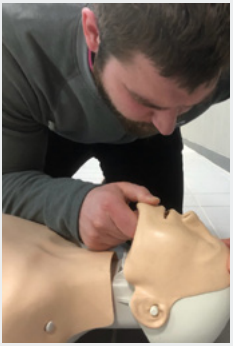


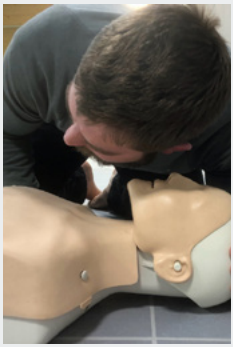
Head tilt chin lift

In an unconscious casualty lying on their back, the relaxed muscles of the tongue will allow it to sag downwards and block the airway. The head-tilt-chin-lift manoeuvre lifts the tongue of the unresponsive casualty out of their airway. This simple action applied to a casualty who has recently stopped breathing may be all that is required to start them breathing again.

Breathing







Check for normal breathing for up to 10 seconds. Normal means as you are breathing now. Take a moment to observe someone breathing normally. You should see, hear, or feel 2-4 rhythmical breaths in 10 seconds. If you are not sure, assume they are not breathing normally.

- **Look – watch for the rise and fall of the chest or abdomen (stomach).**
- **Listen – for the sound of air going in and out of the mouth and/or nose.**
- **Feel – against the cheek or eye, air coming out of mouth and/or nose, and place your hand light on the chest or abdomen to feel if there is any rhythmical movement.**
- **Compare with yours – a good way is to compare the casualty's chest and abdomen breathing movements with your own.**
- **2 – 4 rhythmical breaths – the average adult breathing rate is 12-20 breaths per minute. 10 seconds is 1/6th minute, so 2-4 breaths should be observed in that period. If not, they are not 'breathing normally', and they should be assumed to be in cardiac arrest.**

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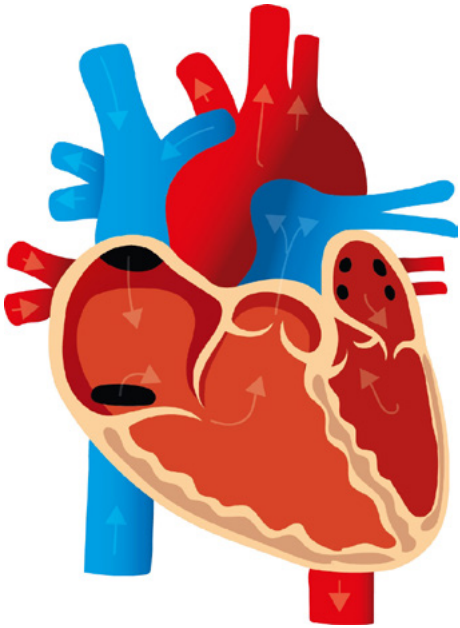
- **Noisy? – when listening for breathing, gurgling or other signs of a compromised airway may be heard. Act quickly to clear the airway and turn the casualty on their side to drain fluids. Very common is the sound of snoring as they breathe; this most often indicates the head-tilt-chin-lift is not adequate. Gently apply a little more tilt until the snoring stops.**
- **Agonal breathing/gasps – in cardiac arrest, the casualty's body will still make isolated and irregular attempts at breathing, which are referred to as agonal gasps or breathing. Your instructor may show you a video of a casualty in cardiac arrest to illustrate the range of movement you may witness.**

Recognising cardiac arrest

If the casualty is NOT responding and NOT breathing normally, assume they are in cardiac arrest and commence cardiopulmonary resuscitation (CPR).



Cardiac arrest is diagnosed if a casualty is unresponsive and not breathing normally. BLS encompasses RB and CC (CPR) and is vital to maintain the viability of

the casualty by keeping organs and tissues oxygenated while they are taken to advanced care.

Before commencing CPR, the EMS must be called. The rescuer should do this or ensure that someone else is doing or has done this. EMS bring with them advanced life support skills, current experience, a defibrillator and drugs and equipment, which may improve the chances of successful resuscitation.

- **Administer Chest Compressions (CC) and Rescue Breaths (RB)**
  Once the casualty is recovered to a boat or onto land, DR ABC should be considered again. Are the rescuer, other members of the group and casualty safe? Is the casualty responsive? Is their airway clear and open? If it is, are they breathing normally? If not, they are in cardiac arrest and CC and RB must be administered. 30 compressions: 2 breaths by one rescuer. If other trained people are available, plan for them to take over CC and RB after two minutes to reduce fatigue and ensure good quality CPR.

- **Utilise the AED if available**
  When an AED is available, it should be integrated into the BLS without unnecessary delay. The AED will detect an ineffective heart rhythm and is the most successful way of resetting the heart to beating effectively and pumping blood around the body. Giving good quality CC and RB (CPR) is vital to the casualty's survival, so it is important for the person integrating the AED not to interrupt the person doing CPR.

- **Drowning casualties – initial 10 RB (may have been done in water by rescuer)**
  With a drowning casualty start with DR ABC, then give 10 RB. These may have been done by the initial rescuer, particularly if they

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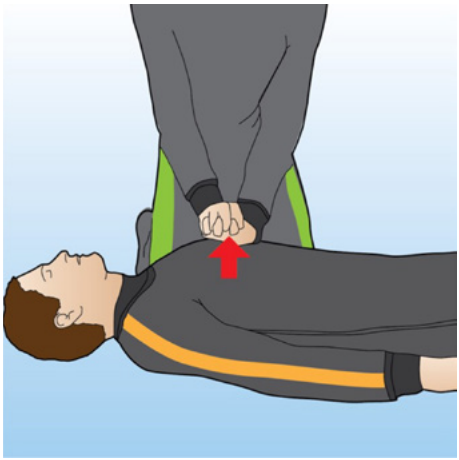
are waiting for a boat to pick them up. In this case, they should not be repeated, and the rescuer can continue on to the standard 30:2 combination of chest compression and rescue breaths.

Basic Life Support – CC



Chest compressions (CC) pump blood around the body. Combined with rescue breaths (RB) which oxygenate the blood, this will temporarily keep all the cells in the casualty's body oxygenated until the heart is restarted. This may increase the likelihood of a successful outcome when a defibrillator is available.

To administer chest compressions (CC), kneel alongside the casualty or, where space is limited, at their head facing down their body. Leaning over the casualty, place the heel of one hand in the centre of the casualty's chest. Place the heel of the other hand on top of the first hand and interlock the fingers if possible. Our shoulders should be vertically over the centre of the casualty's chest. With arms locked straight at the elbows, press down hard on the sternum 5-6 cm. Then take the weight off so that the chest rises back up all the way but do not lift the hands off the chest. These compressions are repeated at a rate of 100-120 times per minute. Not more than two compressions per second. Establish a steady rhythm.

Your instructor will demonstrate the positioning and the rhythm of chest compression.

- **Place heel of hand in centre of chest**

- **Place heel of other hand on top of first hand**
- **Straight arms – press down on sternum 5-6 cm**
- **Repeat at 100-120 times/min (not more than 2 per second)**
- **Ensure full release of pressure, without lifting hands off chest**
- **Establishing a rhythm**

Basic Life Support – RB

After 30 CC, administer two rescue breaths (RB).

Rescue Breaths (RB)

The air normally inspired into the lungs contains approximately 21% oxygen.

- **Exhaled air can sustain life**
  Some 4% is consumed by the body in metabolism, resulting in our exhaled air still containing approximately 17% oxygen. This means that the exhaled air contains adequate oxygen to sustain life and blowing exhaled air into a non-breathing casualty's lungs will also flush carbon dioxide out.

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Ventilate gently for 1 second – do not exhale forcefully or for too long, as any excess air (over the half litre needed to fill the lungs of an adult) will go into the stomach. This may push the stomach contents up into the airway and cause an obstruction.

Monitor effectiveness

To deliver an effective RB, the mouth should make a seal over the casualty's mouth or nose. Usually, the nose when in the water and the mouth when out of the water. Then pinch the nose closed if blowing into the mouth or seal the mouth with thumb and first finger if blowing into the nose. Alternatively, place an oronasal resuscitation (pocket) mask over the mouth and nose and blow into the mask. This isolates the rescuer from direct contact with the casualty's face.

Watch the chest rise and fall as the casualty is ventilated. Use this to dictate the rate of ventilations. Feel for any resistance to inflation of casualty's lungs and listen to the sound being made, particularly the casualty's exhalations. It may be that the head-tilt-chin-lift has relaxed, and the tongue dropped back into the casualty's airway. A snoring noise may be heard on exhalation. Monitor for changes in the casualty's facial colour. A deterioration in colour indicates CC and RB might not be effective. In the diving situation, the cold environment may have a significant effect on the casualty's appearance, and so this indicator should be used with caution.

With a casualty in cardiac arrest, movements of the face, mouth, neck/throat and limbs are often seen. Do not be distracted by them, continue with BLS. Gasping, rasping, and agonal breathing (struggling

to breathe or gasping) are not normal breathing so BLS should be continued until the casualty starts to breathe normally.

- **Sight - chest rises**
- **Feel - unobstructed**
- **Sound - quiet**
- **Appearance - improves**

Continue BLS until qualified help comes

Only stop CC and RB when the casualty starts breathing normally again. Otherwise, continue until emergency medical service (EMS) assistance arrives. When EMS arrive do not stop but continue until they tell you they are ready to take over.

- **Or casualty is breathing normally**
- **Or you are exhausted**

Two rescuers

EMS will want you to give them a brief on what has happened and what you have done for the casualty. EMS bring advanced skills and experience together with drugs and additional equipment.

- **Change over delivering CC:RB every 2 minutes**
  It may be that you get exhausted and are physically unable to continue. Changing over the person delivering CPR every two minutes helps to avoid fatigue. This fits nicely with the use of an AED where, after a period of two minutes, the device will instruct everyone to stay clear of the casualty while it is analysing the electrical rhythm of the heart.

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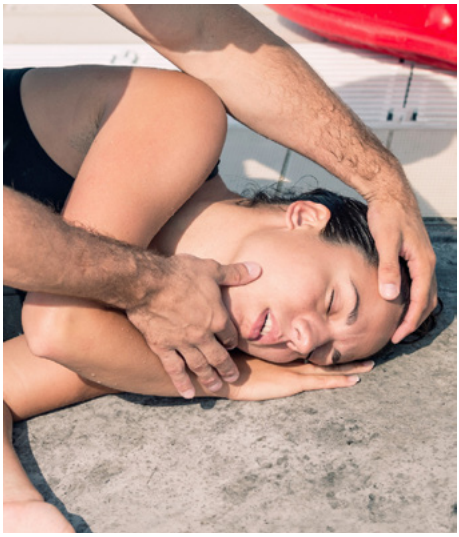
Regurgitation



Regurgitation of the stomach contents occurs because the muscles in our body relax when we are unresponsive. There is a muscle at the top of the stomach, which normally stops the contents going back up the throat (oesophagus) to the mouth. In an unresponsive casualty lying flat, this can allow the stomach contents to flow back up the oesophagus and pool at the back of the throat and mouth. The casualty will not necessarily vomit (caused by muscular contraction) in the normally expected sense. If regurgitation is not detected, RB can then push this fluid into the lungs. It is important to monitor the sounds of the exhalations to detect regurgitation of stomach contents.

- **Not normally muscular, like vomiting**
- **Relaxing muscles allow return of stomach contents, assisted by chest compressions**
- **Remain alert and ready to act quickly**
- **Monitor exhalation sounds – gurgling?**

Regurgitation action

If you do detect regurgitation, roll the casualty quickly onto their side, making sure you protect the head. This allows fluids to drain from the upper airway if the mouth is angled downwards. As soon as you can, make sure the airway is clear, roll them onto their back and continue

BLS.

- **Supporting the casualty's head**
- **Quickly roll them away from you**
- **Allowing stomach content to drain from upper airway and mouth**
- **Scoop out any remaining solids**
- **If they are not breathing normally**
- **Roll them back over, protecting head, and continue CC and RB**

Basic Life Support – AED

Use an Automated External Defibrillator (AED) if you have one. This will analyse the electrical output of the casualty's heart. If it finds an ineffective electrical rhythm, which it may be able to correct, it will allow you to shock the casualty. This has the potential to get the casualty's heart running effectively again.

AED use

Always switch on the AED first and follow the voice instructions. The first instruction is most often 'apply pads to patient's bare chest'. The casualty's chest must be naked and dry. If the chest, is very hairy it may need to be shaved. The AED pack should contain a piece of towel and a safety razor to enable you to do

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this. Peel off the backing and apply the sticky electrode pads as per the diagrams, usually on the AED and pads themselves. If the pads are not making, good contact the AED will tell you to ‘check pads’. The problem is most often with the pad on the right chest. You will need to remove it dry or shave the chest and re-attach the pad.

When the pads are in place and plugged in, the AED will analyse the casualty for a ‘shockable rhythm’, which is a particular type of electrical output from the heart. These are rhythms which produce ineffective contractions of the ventricles and do not pump blood out from the heart. You can find out more about this in the full AED course. Once the pads are in place, the next AED instruction will be ‘analysing casualty, stay clear of the casualty’. It is important that no one is touching the casualty during the analysis. If they are, the AED may detect a normal heart rhythm and not allow you to shock the casualty, losing an opportunity to restart their heart.

When the AED detects a shockable rhythm, it will then instruct ‘shock advised, stay clear of the casualty’. Again, make sure no one is in contact with the casualty. A separation of 0.3m is recommended. An illuminated (usually red or orange) button on the AED will flash and make an audible warning sound. When everyone is clear of the casualty, the AED operator should call out ‘shocking stay clear, I’m clear, everyone is clear’, before pressing the shock button.

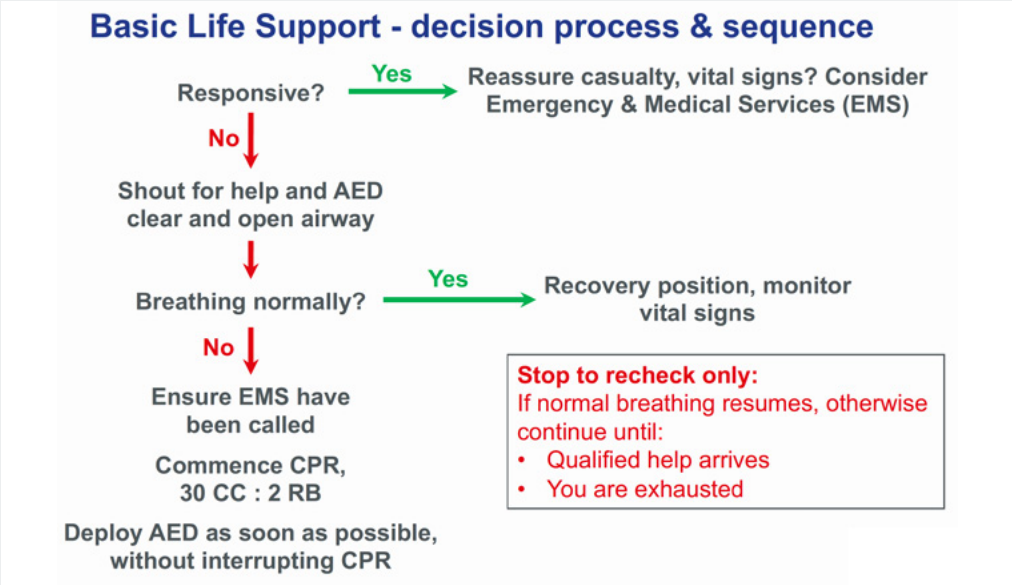
- **Switch on AED**
- **Follow AED voice instructions**
- **AED pads must make a good contact with the casualty’s skin (dry and shaved)**
- **Casualty’s chest must be naked and dry**
- **Casualty's chest may need to be shaved and dried**

Safety

- **Ensure oxygen is removed from casualty before an AED shock is given**
  When using oxygen in support of BLS, it is important to ensure the oxygen mask is removed from casualty before an AED shock is given. The oxygen unit and mask should be at least 1m clear of the casualty and AED before shocking. There is a possibility that the electric shock may result in a spark and this has a risk of enhanced combustion of clothing, hair etc.

- **Ensure nobody is touching the casualty when AED is analysing rhythm or delivering a shock**

Basic Life Support - decision process and sequence



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Recovery position – two kinds

A recovery position is one in which the airway of an unresponsive casualty who is breathing normally is protected from obstruction by the tongue, and fluids will drain by gravity. Whichever position is used, the casualty must be moved gently, with particular attention being paid to protecting the head and neck. Unlike simulated casualties, someone who is unresponsive will be very 'floppy', and it is easy to cause unnecessary additional injury to them.

There are two positions that are effective, but placing an unconscious breathing casualty in one of them is more important than the specific position used. Maintaining an open airway and normal breathing is paramount. You will see demonstrations of the alternative techniques.

- **The 'how' position**

  This is the most commonly used position. With the casualty lying on their back, kneel alongside their chest on whichever side you are most comfortable with or can access. The casualty's closest arm is placed in the 'how' position. Their far leg is bent at knee and used as a lever to roll casualty towards you. Grasp the casualty's far hand, palm-to-palm, and bring their arm over their chest towards you. Then put the back of their hand underneath the casualty's closest cheek. As the leg is used to roll the casualty towards you, support their head with your hand until they have rolled over and

into position. Watch their head all the time and protect it while you move them.

They will now be in position with the upper arm and leg providing support and stopping them from rolling flat onto the chest. The head will rest on their hand, keeping their arm locked as a triangle. The head should be tilted gently back with the mouth open so that any fluids can drain freely. In a moving boat, a bag of equipment or similar can be packed behind the casualty to minimise movement.

- **More stable position**

The added stability of this second position may be of benefit when the casualty is subject to the motion of a boat. The casualty's closest arm is placed underneath the casualty's nearest buttock. The remainder of the positioning is as already explained above. The lower arm is pulled out from under the buttock to the back with the palm uppermost. Circulation in this arm should be checked regularly, particularly in more heavily built casualties. Their head placed on their hand, angled downward to ensure drainage of any fluid as described previously.

When in a recovery position, regularly check the casualty for normal breathing and any change in their level of consciousness. If the casualty is in a recovery position for more than 30 minutes, carefully roll them onto their back and put them into a recovery position on the other side.

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Casualty care

Tender loving care (TLC)

- **Reassure at all times**
  The rescuer's attitude often significantly affects the casualty's response and wellbeing. The casualty should always be reassured and treated with tender loving care (TLC). This is true even for unresponsive casualties, many of whom will still be aware of conversations going on around them. Assume that the casualty can hear what you are saying and be positive and encouraging.

- **Protect from elements**
  Protect the casualty from elements; when going into shock, they will be cooling down. This applies even on hot days. Equally, shield them from direct sunlight and be aware of any signs of heat illnesses.

- **Casualty records**
  Whenever possible, the rescuer or another member of the group should note down the incident history. The time and main events, i.e. signs of the problem and first aid actions applied. A written record with approximate timings can assist in the subsequent treatment of the casualty by qualified medical personnel. The BSAC casualty assessment and incident procedure form and slate is a very useful aid and recording tool.

- **Friends or family contact**
  Depending on the circumstances, the rescuer may need to contact friends and family about the incident. Where the emergency services are involved, it is best to do this in conjunction, or after consultation, with the emergency services who are responding to your incident. In the more serious situations, they will allocate trained personnel to this task.

Post incident support and considerations

- **Support required**
  Even relatively minor incidents can be quite stressful and upsetting. If the rescuer, friends or family need any additional support, BSAC HQ staff will be able to advise.
- **BSAC Incident Report**
  After the event, a BSAC incident/accident report (available from HQ or completed online on the BSAC website) should be filled in while all the details are fresh in everyone's minds. This is a confidential reporting system which enables BSAC to maintain a comprehensive database of incidents. In addition to incident reports, other data is obtained from other rescue agencies and press reports. The reporting system is essential to ensure that people learn from situations in which others find themselves. By receiving feedback on incidents and 'near misses' from the system, BSAC can review safe diving guidelines and training programmes if necessary.
- **Successful rescues**
  There is a tendency to consider incidents to be only those events where the outcome is adverse. Reports for successfully resolved incidents are just as important as for those that are unsuccessful. As much, if not more, can be learned from them. Feedback is an important part of maintaining the safety record of our sport.

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Feedback important

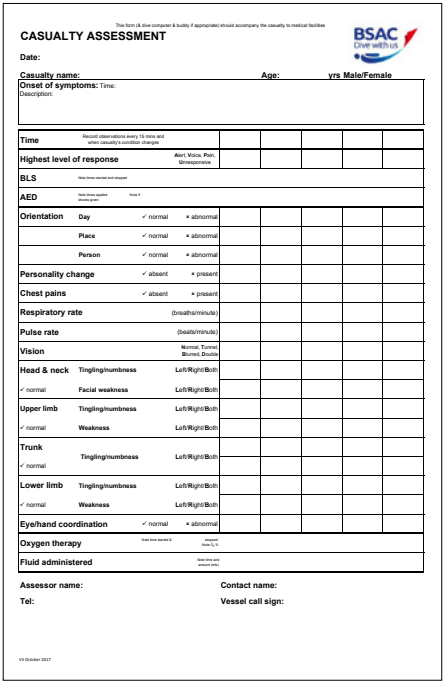
- **Part of maintaining safety record of our sport**
  A summary report is published annually, which is analysed to determine trends or common causes, to monitor the effectiveness of BSAC training or to indicate where revisions or additions to our training procedures are required.

Briefing and hand over to emergency and medical services

Key points IMIST:

- **Identification: name and age**
  First name, family name and how they prefer to be addressed (either familiar or nickname). Their age and date of birth.

- **Mechanism of injury/illness**
  What has happened to them and the events leading up to their injury or illness. For example, in a diving situation, a rapid and uncontrolled ascent, or that they had eaten a particular food.



This form (& dive computer & buddy if appropriate) should accompany the casualty to medical facilities

CASUALTY ASSESSMENT

BSAC Dive with us

Date:

Casualty name: **Age:** **yrs Male/Female**

Onset of symptoms: Time:
Description:

Time	Record observations every 15 mins and when casualty's condition changes						
Highest level of response			Alert; Voice; Pain; Unresponsive				
BLS	Note times started and stopped						
AED	Note times applied; shocks given	Note if					
Orientation	**Day**	✓ normal	× abnormal				
	Place	✓ normal	× abnormal				
	Person	✓ normal	× abnormal				
Personality change		✓ absent	× present				
Chest pains		✓ absent	× present				
Respiratory rate			(breaths/minute)				
Pulse rate			(beats/minute)				
Vision			Normal; Tunnel; Blurred; Double				
Head & neck	**Tingling/numbness**		Left/Right/Both				
✓ normal	**Facial weakness**		Left/Right/Both				
Upper limb	**Tingling/numbness**		Left/Right/Both				
✓ normal	**Weakness**		Left/Right/Both				
Trunk	**Tingling/numbness**		Left/Right/Both				
✓ normal							
Lower limb	**Tingling/numbness**		Left/Right/Both				
✓ normal	**Weakness**		Left/Right/Both				
Eye/hand coordination		✓ normal	× abnormal				
Oxygen therapy		Note time started &	stopped; how L/ %				
Fluid administered			Note time and amount given				

Assessor name: **Contact name:**

Tel: **Vessel call sign:**

V3 October 2017

- **Injuries or complaint**
  What is their primary complaint, that which is causing them most discomfort or anxiety?

- **Signs and symptoms**
  Symptoms: how do they feel? Nauseous, short of breath, dizzy etc.
  Signs: what do you observe or can measure? For example, they sound confused, look very pale, their pulse is rapid and weak and their breathing shallow and rapid.

- **Treatment given**
  What first aid action has been taken, and how have they responded to it? For example, we got them to lie down on their back and breathe 100% oxygen on demand. They started to feel less confused, and their pulse and breathing became less rapid.

Use BSAC casualty assessment slate as prompt/ record

Quiz 1

How is cardiac arrest recognised?

What can be done to lift the tongue of an unresponsive person out of their airway?

Answers on page 105

Go back

Summary

This module developed or refreshed our knowledge of Basic Life Support (BLS)

- ✔ **Recognising cardiac arrest**
- ✔ **The BLS algorithm**
- ✔ **Priorities of BLS**
- ✔ **The use of an AED**
- ✔ **The recovery position**
- ✔ **Casualty care**

End of module quiz

1. What are the key points of IMIST?
2. How much oxygen is there in exhaled air?
3. What does AED stand for?
4. What does the B stand for in DR ABC?
5. What does the V stand for in AVPU?
6. After opening the airway we check for normal breathing for not more than_____?
7. What is the sequence of BLS?
8. To reduce fatigue, how often should rescuers doing BLS change over?
9. How deep should chest compressions be on an adult casualty?
10. What is the most commonly used recovery position?

Answers on page 105

Oxygen administration in first aid

Go back

OAT1 - Oxygen administration in first aid

This module provides an introduction to the oxygen administration course and those taking part, both as staff and the other students.

Aim

This course is designed to give students with little or no prior knowledge:

- **Experience of using oxygen in first aid**
- **Instruction in the safe and effective use of oxygen systems in a variety of situations**
- **Way of increasing the effectiveness of first aid treatment for diving illness or injury**
- **Confidence to treat a diving-related illness or injury, either on a boat or on dry land**

Learning objectives

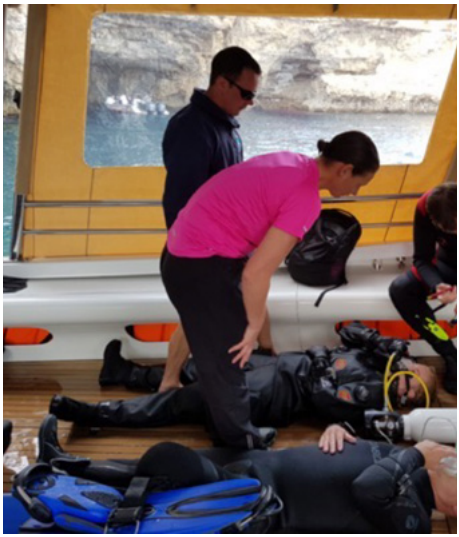
At the end of the course, you should be able to:

- **Name the principal components of first aid oxygen equipment**
- **Safely assemble and test an oxygen unit**
- **Explain the key safety issues when using oxygen equipment**
- **Describe four types of mask/delivery system and when they are used**
- **List and describe the situations in which a diver will benefit from breathing oxygen**
- **Effectively deliver oxygen to a casualty who is unresponsive and not breathing normally**
- **Effectively administer oxygen to a breathing casualty**

Go back

Casualties

Incident statistics show that the majority of casualties will be:



- **Breathing**
- **Conscious**
- **Suffering from decompression illness**

Most casualties will need the use of a demand valve or a non-rebreathe mask for maximum oxygen concentration. Fortunately, the incidence of casualties requiring oxygen in basic life support is much lower.

It is very important to understand that people holding the BSAC Oxygen Administration qualification should ONLY administer oxygen to other divers. This provides the safeguard that someone who is fit to dive is less likely to suffer an adverse response to high partial pressures of oxygen.

Efficacy of resuscitation techniques

Statistics collected from BSAC incident reports show that the success rates of Basic Life Support (BLS) skills are dramatically improved by combining CPR with oxygen and an AED.

Outcomes from incidents requiring Basic Life Support skills (BSAC Diving Incident Report 2018, page 8)

Technique	Reported use (number of incidents)	Successful outcome	Success rate
CPR [1]	84	13	15%
Oxygen enriched CPR [1]	23	5	23%
AED use [2]	20	6	30%

Course outline

The course comprises a combination of 5 theory lessons and 3 dry practical lessons which cover the following topics:

- **Oxygen administration equipment**
- **Diving illness and injury**
- **Basic Life Support (BLS)**
- **Casualty assessment**
- **Oxygen administration for Non-breathing casualty**

Go back

- **Breathing casualty**
- **Theory assessment**
- **Review**

Each of these modules is considered in turn. They have been developed to provide progressive learning when they are delivered in the sequence indicated.

Summary

- **Introductions**
- **Aim of the course and learning objectives**
- **Casualties that might be encountered**
- **Course outline**

End of module quiz

1. What method(s) of administering oxygen will be needed for the majority of divers who require oxygen treatment?
2. Who can a holder of the BSAC Oxygen Administration qualification administer oxygen to?

Answers on page 106

Equipment and its use

Go back

OAT2 - Equipment and its use

Module objectives

This module will introduce you to the oxygen administration equipment likely to be encountered in the diving environment and familiarise you with each component. It will also make you aware of the hazards of working with high pressure oxygen and how to minimise them.

There are many different types of oxygen administration equipment available.
This module explains the configuration of oxygen administration equipment appropriate to recreational diving and explains some operating considerations.

Module content

- First aid oxygen administration equipment suitable for use by divers
- Individual components and their function
- Precautions to take when using oxygen administration equipment
- Safe preparation, assembly, testing and use of the equipment
- Procedure to be followed after use and equipment maintenance

Learning objectives

At the end of this lesson, you will be able to:

- Describe the configuration of oxygen administration equipment most suitable for use by recreational divers
- Identify the key characteristics of each of the components

Go back

- **Explain the precautions to take when using oxygen administration equipment**
- **Safely assemble and test the oxygen administration equipment, in preparation for use**
- **Describe the procedure to be followed after use and equipment maintenance requirements**

First aid oxygen equipment

There are many types of first aid oxygen equipment available on the market, most of which is designed for use on dry land. Oxygen equipment used for diving must be suitable for a diving casualty and be sufficiently robust for use in an environment where it may get wet, sandy and salty.

Oxygen administration equipment comprises:

- **Oxygen cylinder**
- **Oxygen regulator**
- **Oronasal resuscitation/pocket mask**
- **Demand valve and mask**
- **Non-rebreathe/Hudson mask**
- **Bag valve and mask**

- **Manual or automatic resuscitator**
- **Storage case**

Oxygen cylinders

Oxygen cylinders commonly contain gas at approximately 200 bar, but this may be up to 300 bar or less. Both the pressure and oxygen bring their own hazards, which need to be mitigated. High pressure gas of any kind may cause serious injury if released very quickly.

- **Come in a variety of sizes and with different valve fittings**
- **Traditionally 2.5 litres ('D' size) to 5 litres are conveniently portable**
  The cylinder needs to be of a size that is portable, and this will limit the volume of oxygen available to the casualty. It is always a trade off, but it is important to make a realistic assessment of the requirements for a particular dive plan.
- **May give 20 - 30 minutes duration**
- **Traditional, 2 - 3 litre capacity cylinders, when full, may only last around 20 - 30 minutes for a single casualty or 10 - 15 minutes with two casualties.**

Go back

If the casualty, or casualties, cannot be handed over to the emergency services in that time, then it is likely that a larger cylinder, or more than one, is required.

Colour coding - (British and European standard)

In Europe and the UK, medical oxygen cylinders are colour-coded white (white body and shoulder).

- **White shoulder**
- **White body for medical gas (black still common)**

UK standard pillar valve connections

- **Two pin index holes**
- **Female outlet, no O-ring**
  This 'pin index' connection is designed to prevent two potential problems: oxygen being delivered into an unsuitable (not in oxygen service) regulator and the wrong gas being attached to an oxygen regulator.

Built in regulators

Some cylinders come with built-in first-stage regulators, making them much simpler to operate and quicker to deploy when required. The examples show different cylinder capacities commonly available in this configuration.

- **CD Size (2 litre)**
  These are normally pressured to 230 bar, so contain a maximum of 460 litres of oxygen.
- **ZX Size (10 litre)**
  These are normally pressured to 300 bar, so contain a maximum of 3000 litres of oxygen.
- **Integral cylinder valve and regulator**
  This is just one manufacturer's model.

CD Size (2 litre)

ZX Size (10 litre)


Integral cylinder valve and regulator

Go back

Regulators

An oxygen regulator is very similar to a scuba diving regulator but is not designed to go underwater. It fits to the oxygen cylinder, either directly or through a pillar valve, and reduces both the pressure and flow. This allows the oxygen to be breathed via a demand valve or supplied as a constant flow to a mask.

For diving first aid, the regulator should have outlets for both the demand valve and constant flow. On many regulators, the constant flow can be set and this is normally between 1-15 litres per minute.

Oxygen regulators need to be periodically maintained to the manufacturer's specifications with oxygen-compatible components and kept very clean. This is known as being kept in 'oxygen service'.

Inlet

- **Usually up to 200 bar**
- **Two index pins, male inlet with sealing washer**
- **DIN 477 threaded**

Outlet pressure

- **Fixed 4 - 10 bar to demand valve**

Simple pressure gauge

To enable the operator to quickly check the status of the oxygen cylinder. They often only have a very basic scale showing 'full', ¾, ½ and ¼ full. Alert the Dive Manager if the cylinder is less than completely full when the system is initially checked before a dive. It is good practice to get cylinders refilled if they are not showing as full, as the duration of the oxygen supply will be calculated on the assumption that the cylinder is full. During use, the operator can monitor remaining oxygen and be prepared to switch cylinders if necessary.

Outlets capable of supporting:

- **Demand valve (100 to 160 litres/min. flow rate)**
- **Constant flow 15 litres/min (ideal)10 litres/min. (minimum)**

These features will become more familiar during the practical modules of the course.

Choice of delivery

- **Four types of oronasal mask are used for delivering oxygen**

  Oronasal masks (those which make a seal over the mouth and the nose) are used because they are more comfortable and better tolerated than a mouthpiece by a person who is not feeling well, is feeling nauseous or is at a reduced state of responsiveness.

Go back

- **The type used depends on the status of the casualty**
  The choice of delivery system is explained in detail below but can be broadly divided into unresponsive and not breathing normally and breathing normally.
- **Unresponsive and not breathing normally – in support of BLS**
- **Breathing normally – whether or not responsive**




The simplest method for supplying oxygen to a casualty who is not breathing when Rescue Breaths (RBs) are being delivered as part of cardiopulmonary resuscitation (CPR) is through an oronasal resuscitation (pocket) mask. To enable this, it is important to ensure that the masks have an oxygen inlet, as not all oronasal resuscitation (pocket) masks do. With a constant flow of 15 litres/minute, this may enrich our RBs with up to 40% oxygen.

The demand valve (DV) and mask is the most effective way of delivering oxygen to a breathing casualty and will provide close to 100% oxygen. The DV is very similar to the second stage of a scuba diving regulator, though often not designed to be used under water. An important difference is that it is fitted with an oronasal mask, rather than

a mouthpiece. This reduces the likelihood of nausea and of air being breathed through the nose and may allow the casualty's breathing to be monitored more closely.

Another option for the casualty who is breathing is the non-rebreathe or Hudson mask. This is similar to an oronasal resuscitation mask but has a bag attached to it which acts as a reservoir for oxygen and a system of one-way valves to ensure the casualty does not rebreathe their exhaled air. At a constant flow of 15 litres/minute, this will supply as much as 90-95% oxygen to the casualty. These are single-use and relatively inexpensive, so it is recommended to have at least two in an oxygen kit.

Bag Valve and Mask (BVM) and Manual or Automatic Resuscitators are an option for those branches, centres or organisations that have this equipment and where the instructor is suitably qualified and experienced. Both pieces of equipment require additional training beyond the scope of many branches and centres. These will only be included in the course if the equipment is available and the instructor has the qualification and experience.

Unresponsive & Not Breathing	
Pocket Mask	16%
Pocket Mask + O2	40-50%
Bag Valve Mask	>90%
Manual/Automatic Resuscitation System	100%

Breathing Normally	
Demand valve mask	100%
Pocket mask + O2	40-50%
Non-rebreathing/ Hudson	>80%

Go back

Oronasal resuscitation mask/ pocket mask

These are normally used to enhance rescue breaths during CPR, but if nothing else is available can also be used to give oxygen to a breathing patient.

Central ventilation orifice

- **May be fitted with a porous splash guard**
- **May be supplied with an optional non-return / exhalation valve**

Both these devices provide a degree of protection from direct contact with the casualty, stomach contents, body fluids and exhaled air but cannot be relied upon to protect the user from infection.

Transparent material

The inside of the mask will often fog up when the casualty exhales, so that it can be seen that they are breathing, This also enables the breathing rate to be monitored and recorded.

Generally, have inflated face seal

The soft cushion of an inflated face seal, or a flange similar to that on a diving mask, ensures an airtight seal on the casualty's face.

Connection for constant flow oxygen tubing

Not all masks are fitted with this, so it is important when purchasing masks that this feature is included.

Tabs for attaching head strap

This enables the rescuer to fit the mask without constantly having to hold it in place. When actively administering RB, the rescuer will need to hold the mask in place to ensure an effective seal on the face.

Demand valve and mask

A demand valve provides oxygen on demand to a breathing casualty.

- **Similar to the operation of a diver's demand valve**
- **As the casualty breathes in, oxygen is supplied to them**
- **When they stop inhaling, the flow stops**

Can be capable of flow rates of up to 160 litres / min.

Fitted with oronasal mask

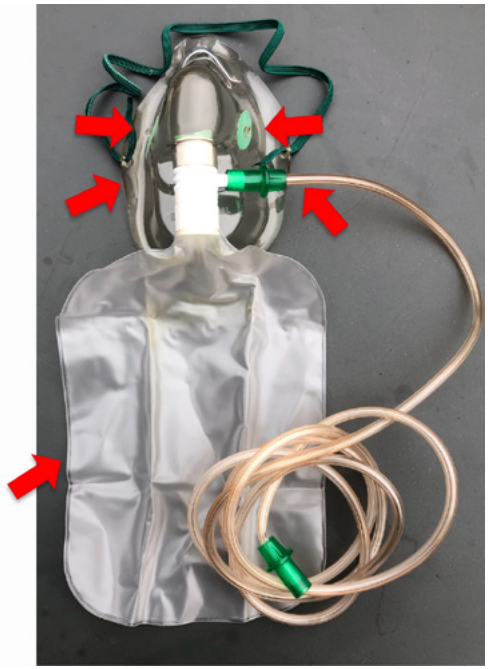
For the reasons explained above, an oronasal mask is preferable to a mouthpiece.

- **Inflated or flange face seal**
- **Available in a range of sizes**

Go back

Non-rebreathe mask

Non-rebreathing, also known as Hudson, masks provide a high concentration of oxygen (80%) to a casualty who is breathing so are a very useful option on a dive site.



Parts:

- **Oxygen tubing**
- **Reservoir bag**
- **Mask**
- **Exhaust ports**

Before use, the reservoir bag needs to be filled. This is achieved by turning on the constant flow from the oxygen cylinder and placing a thumb over the one-way valve at the top of the reservoir bag.

During use, it is important to monitor the bag and ensure that it doesn't empty. There should always be at least one third of the bag inflated. If the casualty's breathing is such that the bag collapses completely, then the flow rate to the mask needs to be increased. If this happens, then it should be refilled using the same technique as when initially filling the bag, and the constant flow rate increased.

Bag valve and mask (BVM)

These provide an excellent means of providing high percentage oxygen to a casualty. In addition, they provide distance between casualty and rescuer and remove the need for exhaled air RBs. However, they do require an added level of awareness to prevent inadvertently harming the casualty and will only be included in the course where the instructor is qualified and experienced in their use.

Features:

- **A two-person technique for ventilation**
  This is a two-person device, with one operator opening the casualty's airway and holding the mask on the casualty's face while the second gently squeezes the bag. An experienced operator may be able to deliver effective ventilation on their own using the BVM.

- **Mechanical ventilation by squeezing bag**
  A gentle squeeze of the bag, sufficient to deliver 500ml of gas to the casualty's lungs. Aggressive squeezing or excessive volume may cause gas to inflate the stomach and result in regurgitation and airway obstruction.

- **With oxygen at 15 litres/minute = High O_2**
  With 15 litres/minute the reservoir bag should not deflate to less than 1/3rd volume.

Go back

- **Makes ventilation practical from over casualty's head in restricted spaces**
  This device provides greater flexibility with the positioning of the rescuer, who does not need to be alongside the casualty's head. In confined areas such as a small boat, this can be very useful so that CC and RB can be delivered from over the casualty's head.

Used with oxygen can supply >90% to casualty

Manual/automatic resuscitation valves

These are NOT covered within this course as they require additional training from instructors who are qualified and experienced in the use of the specific unit and mode of operation. Where branches or centres have such equipment and instructors, and it is appropriate for members to receive training in their use, then that training may be added to the practical modules.

Storage cases

A storage case is a surprisingly important piece of equipment.

If the oxygen administration equipment is not adequately protected, and particularly in a salt water environment, it will deteriorate rapidly. A robust and watertight container will save the equipment from damage and ensure that it will function when needed. If this container will have

the gas cylinder stored in it, it must be fitted in case the cylinder or regulator leaks.

Ideally, the equipment should be stored in a fully assembled state, which will reduce the amount of time to deploy it and also reduce the chance of incorrect assembly. This is not always practical, and in such situations, the equipment should require the minimum amount of assembly to enable its use.

Casualty care – breathing normally

- **Advise casualty that oxygen may improve their condition**
- **Ensure appropriate size of mask**
- **Have casualty breathe from mask and ask how it feels. Adjust mask and flow rate if necessary**
- **Listen to breathing rate. Monitor and record breaths per minute**
- **You may notice mask fogging on the inside of the mask on exhalation**

Go back

Precautions in use

- **Fire**

  Because oxygen will make things burn faster, it is important to be alert to the surroundings in which you are using it. In an open boat or space, oxygen will usually disperse quickly, but in a poorly ventilated, closed space, it may build up and create a significant risk.

  It is often forgotten that the gas being discharged or exhaled from oxygen masks will be more than 95% oxygen.

  In an enclosed space, such as a classroom or boat cabin, care should be taken that there are no naked flames or other ignition sources (e.g. electric element heaters). Windows should be open for ventilation and to allow a breeze to pass through. Be particularly careful in the winter when there is a tendency to close all windows and doors to keep the heat in and to have heating systems operating.

- **Care**

  Always visually inspect and test equipment before use. This should be done before deploying it on a dive site and immediately before use in an incident where it is going to be given to a casualty.

  Keep equipment regularly maintained. Always comply with regulations and manufacturer's recommendations.

- **Modifications**

  Do-it-yourself equipment or modifications are dangerous.

  Do not use non-standard equipment - risk of confusion.

Quiz 1

What is a typical 2.5 litre oxygen cylinder size known as?

What is the flow rate when a demand valve is being used?

Answers on page 106

Summary

Equipment suitable for diver use:

- ✔ **Gas cylinders**
- ✔ **Regulator**
- ✔ **Delivery options and masks**
- ✔ **Storage case**

Be aware of the hazards and precautions to take when using oxygen

Only use equipment produced by recognised specialists

Ensure equipment is kept clean and well maintained

When diving, keep equipment assembled ready for instant use

Go back

End of module quiz

1. How much oxygen can a ZX cylinder hold?
2. Approximately how long will a typical 2-3 litre cylinder last when used for a single casualty?
3. What colour codes are used for medical oxygen cylinders in the UK and Europe?
4. What is the volume and normal pressure of a CD size cylinder?
5. What is important when using a regulator with 100% oxygen?
6. What is the simplest method to supply oxygen to a casualty who is not breathing?
7. How does a demand valve oxygen system work?
8. What concentration of oxygen can a casualty expect to receive from a non-rebreathe (Hudson) mask?
9. How should the reservoir bag on a non-rebreathe (Hudson) mask be inflated?
10. What are the key precautions that must be taken when using oxygen?

Answers on page 106

Diving illness and injury

Go back

OAT3 - Diving illness and injury

This module explores diving illnesses and injuries which are shown to benefit from the administration of oxygen. Do not worry if you are not sure what the diver is suffering from; it will be very unlikely you will do them any harm by getting them to breathe oxygen.

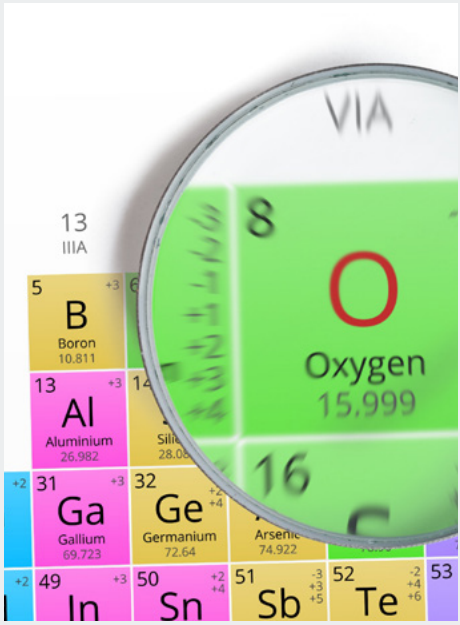
Our role is to give first aid, preserve life and prevent worsening in the first instance. Then to ask the casualty about what happened (mechanism) and how they feel (symptoms) and observe the signs, so that information can be passed to an appropriate medical specialist and help them in making their initial diagnosis. There is more about the questions and recording information in module OAT4.

Module content

What is oxygen?

Conditions:

- Decompression illness (DCI)
- Burst lung
- Drowning
- Immersion pulmonary oedema (IPO)
- Shock
- Carbon monoxide poisoning
- Carbon dioxide poisoning



Signs and symptoms

First aid and benefits of oxygen

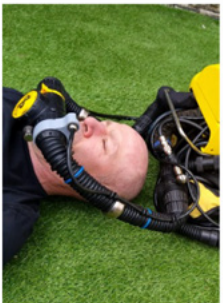
Other options and what to avoid

Go back

Learning objectives

At the end of this lesson, you will be able to:






- **List the diving illnesses and injuries where the casualty may benefit from first aid oxygen**
- **Briefly describe the mechanism, signs and symptoms associated with each condition**
- **Describe the first aid action to be taken in each case, including the role of oxygen**
- **Identify other sources of oxygen enriched gas, such as nitrox and rebreathers**
- **Explain when the use of aspirin and Entonox may be appropriate**

Oxygen and the diver

Oxygen comprises 21% of the air we breathe, and our body needs oxygen to keep it alive. During basic life support (BLS) training, three barriers to providing oxygen were considered; an obstructed airway, not breathing normally and the heart not pumping effectively. This module examines additional barriers and other problems.

Oxygen is critical to support life

- **21% oxygen (by volume) in the air around us**
  At atmospheric pressure, this equates to an oxygen partial pressure (PO_2) of 0.21 bars absolute. Humans can not tolerate significant deviations from this. At a lower PO_2, we will become hypoxic, which can lead to unconsciousness and, ultimately, death. At a higher PO_2 (>0.5 bar absolute) there is the risk of hyperoxia which is also extremely undesirable.

- **An essential component of metabolism, the process which goes on in every living cell in our bodies**
  The cells in our bodies will cease to function if they do not get oxygen and glucose. They will be unable to produce the energy required for metabolic processes in the cells. Some cells are more vulnerable to reduced levels of oxygen than others, for example, the brain.

Go back

- **Carried from lungs to cells in the blood stream**
  - » Primary means - combined with the haemoglobin (98%)
  - » Secondary means - dissolved in the blood plasma (2%)
- **At increased partial pressures, more oxygen will dissolve**
- **Plasma's capacity to transport additional**
- **oxygen is utilised in oxygen administration**

At surface (atmospheric) pressure, 98% of oxygen is carried in chemical combination with haemoglobin in the red blood cells. At this PO_2, oxygen dissolves very poorly in the water of plasma and in the red blood cells. At increased PO_2, oxygen will dissolve more readily into solution in water, so that the blood will have additional oxygen-carrying capacity. The distance oxygen will diffuse from capillaries also increases with raised PO_2, so administering 100% oxygen will reoxygenate parts of the body that might otherwise become hypoxic and cease to function.

Decompression illness (DCI)

Decompression illness (DCI) is a condition where gas bubbles form, or are introduced into, the tissues of the diver's body. This is either gas coming out of solution too rapidly and forming bubbles in the tissues (evolved gas), including the blood, or the bubbles being forced into the lung capillaries as a result of trapped gas expanding in the alveoli.

Although often linked to poorly conducted dives with inadequate decompression and rapid ascents, DCI may occur where a diver has carried out a well-controlled dive. Whenever a person has been diving or subjected to changing pressures, then there is a possibility they might suffer DCI.

The main causes of decompression illness are believed to be the following;

- **Inadequate elimination of nitrogen from the body during ascent. Bubbles may form in blood and other body tissues (evolved gases)**
- **Physical damage to the alveoli due to overpressure. Gas expanding on ascent introduces bubbles of gas (emboli) into the blood (escaped gases)**
  Patent foramen ovale (PFO) may allow bubbles to pass from venous to arterial circulation. Thus otherwise harmless bubbles in the venous circulation may pass over to the arterial circulation, where they may cause injury by reducing circulation and, therefore, the delivery of oxygen to cells.

Symptoms

Signs and symptoms are very varied. If a diver is feeling or behaving differently after a dive, one should suspect DCI and take appropriate action. Any signs and symptoms arising during the ascent from depth (particularly in the latter stages), on arrival at the surface or for up to 48 hours after a dive could be DCI. Some of the more commonly experienced signs and symptoms include limb pain, loss of sensation or power in the limbs, skin rashes, breathing difficulties, loss of balance, nausea and vomiting, memory loss and change in behaviour.

Go back

- **Denial!**
  It may be difficult for the casualty to accept that they have DCI. Divers with DCI are often heard to say ‘It was a perfect dive’ or ‘I didn’t do anything wrong’, and both these statements may be accurate. However, if you establish any of the following symptoms or signs following a dive, it may be necessary to highlight them to the diver and get them to understand that first aid oxygen is necessary.

- **Itches, rashes**
- **Numbness, tingling, joint pains**
- **Vision disturbances**
- **Dizziness, nausea, headaches, confusion**
- **Weakness, paralysis, loss of bladder control**
- **Shortness of breath, chest discomfort/pain**
- **Shock, memory loss, unconsciousness**

First aid

First aid action for the conscious, breathing casualty starts with lying them down and getting them to breathe 100% oxygen on demand. Sipping water, provided they are alert and not feeling sick, is also beneficial. Reassure the casualty while determining and recording their symptoms and signs. As soon as you have a suspicion of DCI, call the Diving Emergency Helpline (or local equivalent) and speak with a diving medical specialist doctor.

- **Lie casualty down flat**
- **Keep casualty calm**
- **Administer 100% oxygen**
  The increased nitrogen pressure gradient assists in nitrogen elimination from the bubbles in blood and tissue. Whenever possible, administer 100% oxygen as higher percentages will be more effective.

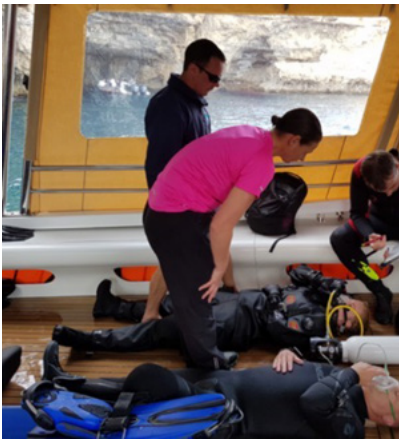
  This will also improve oxygen supply to tissues where blood flow is reduced due to bubble blockage.

- **Give fluids by mouth (sips) if fully conscious and not nauseous / vomiting**
  A sports water bottle, rather than an open-topped bottle, glass or cup, is the safest way to give fluids. With such a bottle, the casualty can remain lying down and minimise the time off oxygen to take sips. In the short term, plain or flavoured water is adequate. You should carry at least two litres (4 x 500ml ideally) with your oxygen first aid kit.

- **It is also very important to arrange evacuation to a recompression facility as soon as possible**
  Do not delay in contacting emergency services, even if you are uncertain. When operating at sea or on the coast, call the coastguard. If inland, then contact the ambulance service, or emergency diver helpline, to make them aware of the situation and the support required. If operating outside the UK, establish the local procedures well before diving commences.

Go back

Missed decompression



If a diver misses decompression stops for any reason or is subject to a rapid ascent, it is likely that they may suffer from DCI, so the following actions should be taken:

- **Do not wait for signs/ symptoms to appear**
- **Lay casualty down and keep them calm**
- **Administer oxygen and fluids**
- **Seek specialist medical advice on further action from diving medicine specialist doctor.**

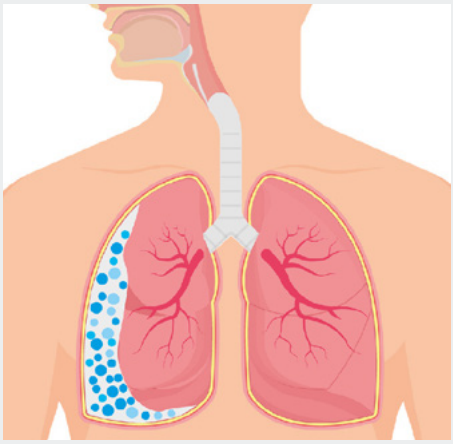
  The BHA Diver Helpline (England and Wales), Scottish Diver Helpline or whichever is appropriate for the country in which you are diving.

Burst lung

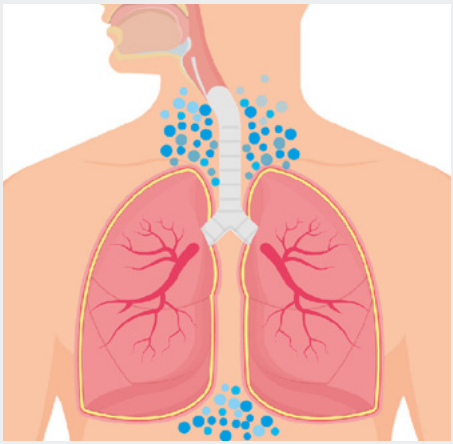
Burst lung is where expanding gas over-pressurises the fragile tiny air sacs in the lungs (alveolus)and results in them rupturing. Sometimes it arises from rapid ascents, particularly when a diver is panicking and may be holding their breath. Pulmonary pathology might also cause this, hence the interest in respiratory function in the diver medical declaration. Diving while suffering from a chest infection or its after effects might also result in gas becoming trapped, so is best avoided.

Burst lung presents in the two main forms explained below but may also result in DCI. This is normally caused by gas escaping from the alveolus, which is then introduced into the bloodstream and hence to the body's tissues.

There are two main types:



- **Collapsed lung (pneumothorax)**
  Pneumothorax describes the condition where escaping gas goes in between the lungs and the ribs and causes the lung to collapse. As the lung is now less efficient, the diver may experience breathing difficulties. As the diver ascends in the water column and the pressure reduces, this volume of gas will expand and cause a more severe problem (tension pneumothorax).



- **Bubbles between organs and tissues (emphysema)**
  The other possibility, emphysema, is where the gas escapes into the tissue of the lungs and either remains in the local area or migrates towards the neck and face. The casualty may feel discomfort in breathing. They, or an observer, may feel bubbles under the skin of the throat and lower face.

If either of these conditions is suspected, remain alert as both of the above can occur in isolation but are often accompanied by an arterial gas embolism (DCI).

Go back

Symptoms

The signs and symptoms for burst lung include;

- **Chest discomfort/pain, bloody froth**
- **Shortness of breath**
- **Changes to vocal tone, crepitation**
- **Shock**
- **Unconsciousness, death**

Signs and symptoms of burst lung are often accompanied by those for decompression illness.

First aid

First aid action is as for DCI;

- **Lie casualty down**
- **Keep casualty calm**
- **Administer 100% oxygen**
  This assists in re-absorption of the nitrogen content of air in pneumothorax or emphysema. It also offsets reduced effective lung surface area for gas transfer due to collapsed lung.
- **Treat for shock**
- **Seek advice from a diving medicine specialist doctor and arrange evacuation to a recompression facility as soon as possible.**

An untreated pneumothorax is one of the only occasions where a diver cannot be treated in a hyperbaric (recompression) chamber. This will often make it necessary for the diver to attend a hospital emergency department to have the pneumothorax resolved.

Immersion pulmonary oedema (IPO)

In recent years, there has been an increasing awareness of immersion pulmonary oedema (IPO), which has been identified as a factor in a number of diving incidents. It is not limited to divers and occurs in surface swimmers and particularly those who are exerting themselves, e.g. triathaletes.

Causes of IPO

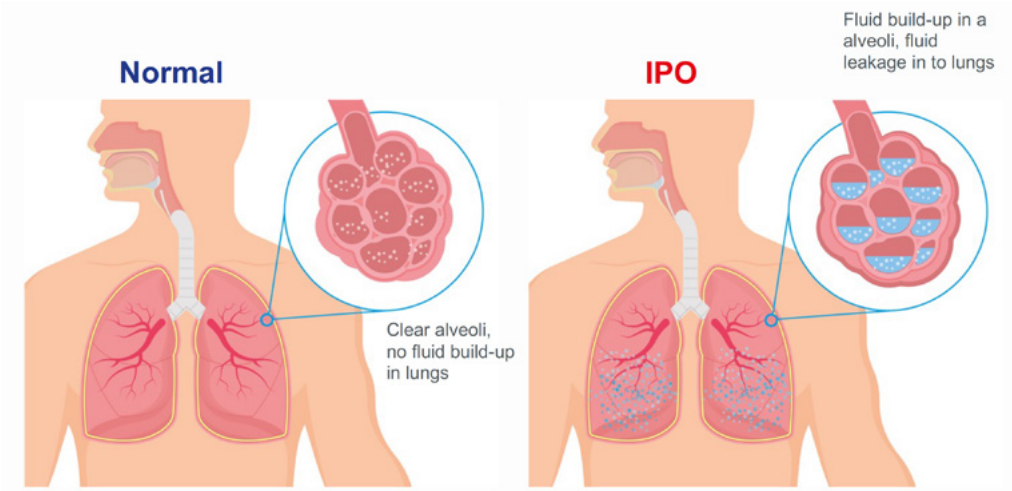
- **Being immersed in water**
- **Having untreated high blood pressure**
- **Strenuous exercise**
- **Overhydration**
- **Negative inhalation pressure**

IPO is often identified where a diver, while on the seabed and not on the ascent, feels that they are having difficulty breathing. They might suspect they are running low on gas, only to find that their cylinder gauge shows that there is plenty. When they change from the primary demand valve to their alternate source (AS), they get no improvement.

Go back

Similarly, after taking their buddy's AS there is still no improvement. This should immediately arouse suspicion as the likelihood of three This should immediately arouse suspicion as it is extremely unlikely that three different regulators will malfunction.

A similar course of events may be experienced by a rebreather diver who gets no improvement after coming off the loop and onto a bailout gas.



Normal lung function on the left and lungs suffering from IPO on the right

Signs and symptoms

- **Breathing**
  Someone with IPO may experience breathing difficulties that have no obvious cause. This may include abnormal breathing (rapid, uneven, heavy) and/or persistent coughing.

- **Thinking equipment faulty**
  The diver may believe that their breathing difficulties are due to an

equipment issue. Examples include believing that their regulator is not functioning correctly and/or signalling that they are out of gas even when their cylinder has plenty remaining.

Someone with IPO may also reject or refuse an alternate source (AS).

- **Panic**
  Not surprisingly, someone experiencing breathing difficulties and believing their equipment to be faulty may well end up panicking.

First aid

The first aid for IPO

- **Get casualty out of the water!**
  If you suspect IPO, it is vital to get this diver to the surface and out of the water safely and without delay. A significant part of the mechanism causing the symptoms they are experiencing is that they are immersed in the water. Even being partially immersed, such as swimming on the surface, can cause IPO and incidents of this have been reported by military rebreather users.

  The rescuer should accompany the casualty all the way to the surface if it is safe for them to do so. It could be that the increased PO_2 at depth is keeping the casualty conscious and that the reducing PO_2 on ascent will result in unconsciousness.

- **Sit the casualty upright (If conscious)**
  This position is more comfortable for the casualty and may allow them to breathe more easily than if they were lying down.

- **Give 100% oxygen**
  First aid action is 100% oxygen on demand or via a non-rebreathe mask (15 litres/minute constant flow) with the casualty sitting up. In

Go back

IPO, the alveoli are flooded with fluid, and a sitting up position will provide some relief to their breathing difficulty.

- **Keep the casualty warm**
  They will be in shock because of the reduced capacity of oxygen to move from alveolus to capillaries and blood.
- **Do NOT give fluids**
  Do not administer fluids as their system is already overhydrated.
- **Seek medical attention**
  Reassure the casualty and arrange transfer to emergency medical services as their condition may deteriorate very quickly.

Drowning

Drowning, even where the casualty has remained fully conscious and breathing normally, can lead to delayed respiratory and cardiac arrest. In the event of a diver inhaling even small quantities of water, they should be monitored closely for any deterioration for up to 72 hours. In some instances, this condition has arisen where a diver has experienced a 'wet breathe' from their demand valve over a period of time.

Cause

- **Respiratory impairment due to immersion in liquid (water)**
- **Loss of breathing gas supply underwater**

Signs and symptoms

- **Not responsive and not breathing normally (addressed separately BLS)**
- **Coughing, difficulty breathing**
- **'Shocky', pale, weak and rapid pulse**
- **BE CAUTIOUS where the casualty is apparently unaffected by the event**

Encourage them to remain in the company of others and not be left alone without responsible company for several hours. Remain alert to the potential for rapid deterioration and the need to contact emergency medical services without delay.

First aid

- **Remove from the water**
- **The unresponsive casualty who is not breathing normally will require CPR**
- **Difficulty breathing**
  If the casualty experiences difficulty breathing, then administer oxygen in the sitting position.
- **Recovery position if reduced level of consciousness (LOC).**
- **Evacuate to medical attention**
  This should take place even if they seem to be fully recovered. There is the potential for the casualty's condition to deteriorate rapidly.
- **Where the diver appears well and remains alert,**

Go back

monitor them closely and encourage them to seek medical advice

Because they appear unaffected after the incident, it might be thought safe to allow them to go off home or to accommodation (e.g. a cabin), unaccompanied. Arrangements should be made for them to be in the company of a briefed and responsible person for 72 hours. In the event of any deterioration, they should be given 100% oxygen on demand and EMS or diving medical specialist doctor contacted without delay.

Shock

Shock is a life-threatening condition resulting from many injuries and illnesses. For a variety of reasons, oxygen is not getting to all the living cells in the body. As you will appreciate, all of the conditions that have already been described may result in some level of shock.

Shock can also be caused by others, such as bleeding, burns and dehydration through heat exhaustion and vomiting. Although oxygen treatment helps with shock, the main problem must also be addressed, e.g. stop the bleeding or fluid loss.

Cause

- **Inadequate oxygenation of the living cells in our body, resulting in them ceasing to function**

- **Occurs to some extent in all significant injuries and illness**
- **Mechanism**
- **Reduced blood volume (bleeding, burns, vomiting)**
- **Massive dilation of blood vessels (fainting, spinal injury)**
- **Inadequate cardiac output (heart attack)**
- **Allergic (anaphylactic) reaction to drugs, food or stings**

The classic signs and symptoms of shock are pale and clammy skin (particularly obvious on the face), a weak and rapid pulse, dry mouth and feeling thirsty, feeling cold (see them shivering), nausea, dizziness, anxiety and reducing level of consciousness.

- **Weakness, dizziness, nausea**
- **Pale and clammy/sweaty**
- **Rapid weak pulse**
- **Rapid breathing, feeling breathless**
- **Reduced level of consciousness**

First aid

Lie the casualty down, deal with the cause, administer oxygen, elevate the legs (but not in the case of DCI or IPO) and no fluids by mouth. They will need medical attention as shock can have a significant impact on body systems.

- **Treat prime cause (e.g. stop bleeding)**

Go back

- **Reassure casualty (TLC)**
- **Keep casualty calm**
- **Lay casualty down with legs raised**
  This should not be done with cases of suspected DCI, IPO, burst lung or leg fractures.
- **Keep warm and comfortable**
- **Administer oxygen**
  The increased oxygen dissolved in the blood offsets effects of inadequate circulation.
- **Monitor casualty's condition**
- **Nothing by mouth (except DCI cases)**
- **Arrange evacuation to medical attention**

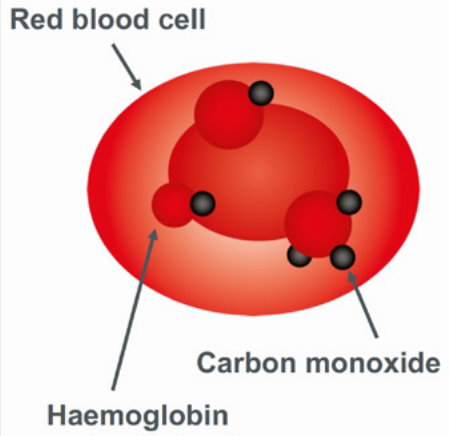
Immersion shock

A condition which is linked to extended periods of immersion, particularly in cold water and where the casualty's body core temperature falls. May be encountered following dives with extended decompression requirements or where a diver has been lost on the surface for an extended period of time.

Immersion shock occurs when the blood vessels dilate due to prolonged immersion. If a casualty is removed from the water upright, this can cause blood to pool in lower limbs which will worsen the condition and can be fatal.

To avoid this, keep the casualty horizontal at all times and discourage any movement or activity. They should be supplied with oxygen by a demand vale or non-rebreathe mask.

Carbon monoxide poisoning



Carbon monoxide (CO) poisoning is another mechanism by which the cells in the body are deprived of oxygen. CO is created by incomplete combustion and, through a variety of means, may end up in cylinders containing breathing gas. Whatever the cause of contamination, very small amounts can be overwhelming as it combines preferentially with the haemoglobin in blood. This prevents oxygen from being carried around the body in the blood. 100% oxygen will increase the amount of oxygen being carried in solution in the water of the plasma and red cells. It also helps to push CO off the haemoglobin.

When back on the surface, the casualty will continue to feel unwell, and their level of consciousness may fall. The administration of oxygen will help, but they will need urgent medical attention.

Go back

Mechanism

- **Carbon monoxide combines about 200 times more readily with haemoglobin than does oxygen**
- **Interferes with the blood's ability to transport oxygen**

Signs and symptoms

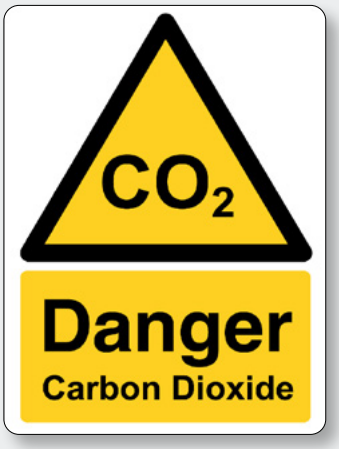
These will generally worsen with depth:

- **Headache**
- **Pale or greyish appearance**
- **Weakness, dizziness**
- **Tunnel vision**
- **Nausea, vomiting**
- **Rapid pulse**
- **Rapid breathing**
- **Convulsions**
- **Coma**

The first aid is:

- **Remove casualty from contaminated breathing supply**
- **Lie breathing casualty down with legs raised**
- **Administer 100% oxygen or oxygen-enriched rescue breathing**
  More oxygen is transported in solution in the plasma, which provides some assistance in breaking down carboxyhaemoglobin. It will also help restore normal cellular function.
- **Arrange evacuation to emergency care**

Carbon dioxide poisoning (hypercapnia)



Carbon dioxide (CO_2) is a gas that we produce and exhale, but it can cause poisoning (hypercapnia). In well-designed open circuit scuba equipment, hypercapnia is very uncommon, though skip breathing (not breathing in a normal rhythm) may cause it. It is more commonly encountered by divers using full-face masks and rebreathers. In both cases, it is often because of a failure to follow guidelines on the assembly and use of the system or poor maintenance.

- **Open circuit - build up of CO_2 in gas space of a full-face mask**
- **Rebreather – failure of CO_2 loop and scrubber integrity, scrubber exhausted or compromised**
- **Gas density**

Mechanism

- **We all produce carbon dioxide as a product of metabolism**
- **If it is allowed to build up in a mask or loop, it will rapidly build up in the body and have undesirable effects**

Go back

Signs and symptoms

The classic initial signs and symptoms of CO_2 toxicity are an increased breathing rate and headache. These will generally worsen with depth:

- **Increased breathing rate**
  Despite attempts, the casualty will be unable to control their breathing rate.
- **Headache**
  Can be intense and does not always respond to medication.
- **Confusion and anxiety**
  The casualty will often be unable to make rational decisions.
- **Automaton behaviour**
  The casualty will continue to follow established procedures rather than responding to the changing situation around them.
- **Weakness**
- **Severe mental impairment**
- **Loss of consciousness**

First aid

Having the casualty breathe oxygen may be beneficial. The diver should receive medical attention, even when they appear to improve, as the condition is slow to resolve.

- **Lie down a breathing casualty**
- **Administer 100% oxygen**
- **Reassure the casualty**

- **The effects of hypercapnia take time to resolve and will have upset the blood balance**
- **Seek medical advice even where the symptoms are not overwhelming**

It will be necessary for the casualty to be assessed to determine what medical treatment will be required.

Evacuation

First aid has been given so, in all cases, the casualty must be referred to the medical services.

The level of attention the casualty will require depends on their condition and the potential for rapid deterioration. If in doubt, always refer to emergency medical services.

If appropriate, call emergency services without delay.

- **At sea: Coastguard, VHF channel 16**
- **On land (DCI): BHA Diver Helplines**
  - » England & Wales – 07831 151523
  - » Scotland – 0345 408 6008
- **On land (other): Ambulance/Police/Coastguard 999/112**

All relevant information must accompany the casualty, which should include their dive computer for suspected DCI cases. The gathering

Go back

and recording of information is covered in the next module OAT4, where the BSAC incident procedures and casualty assessment form and slate will be used.

Oxygen supply exhausted?

If the medical oxygen is exhausted before the casualty reaches the emergency medical services, then there are alternatives which can be used. These include the use of oxygen-rich mixtures, nitrox, which divers may be carrying with them or have on boat/shore. Also, the use of a diving rebreather, many of which will be able to provide 100% oxygen. The limitation with both these options is that they are normally fitted with a mouthpiece, which may not be tolerated by the casualty as readily as an oronasal mask. It's important to consider what backup options are available within your group in advance of the dive, rather than just developing a response when the problem arises.

Closed circuit rebreather

Most CCRs can be set to deliver (near) 100% oxygen.

Nitrox

- **(SCUBA) Open circuit or semi closed circuit rebreather**

- **Reduces the amount of inspired nitrogen**
- **Not as effective as 100% oxygen but better than breathing air**

Common considerations

- **Mouthpiece may not be tolerated**
- **Oxygen % reduced by air inspired via nose (do you have a nose clip in the kit?)**

What not to give divers

There are also some medications that should not be given to divers who are ill or injured.

Do not administer anything other than oxygen

- **Do not administer aspirin to divers with DCI**
  Aspirin is often suggested as being good for DCI. It is very important not to give a diver any medication, other than oxygen, unless directed by a diving medical specialist doctor.
- **Do not administer Entonox (nitrous oxide)**
  Entonox is a gas carried by emergency services because it rapidly reduces pain.

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Entonox

Ensure emergency personnel are aware that your casualty is a diver or has been diving in the last 48 hours. Please do this tactfully!

The UK Ambulance Service guidelines (JRCALC) quite clearly advise that Entonox should not be administered to divers. However, if you are diving outside the UK, there may be a different level of awareness among emergency services staff.

The problem with Entonox (50:50 nitrous oxide N_2O_2 and oxygen):

- **Entonox includes a mixture of oxygen and nitrous oxide**
- **Nitrous oxide is very soluble in blood**
  Nitrous oxide (N_2O_2) is very soluble, which is why it so effective at rapidly reducing pain. It will rapidly diffuse into any gas spaces in the body.
- **Nitrous oxide passes into nitrogen bubbles and causes the size of bubbles to increase**
  Nitrous oxide will diffuse into inert gas bubbles throughout the body and increase their size. This increases the risk of DCI, and may exacerbate a pneumothorax. It can precipitate DCI by making gas bubbles grow in size and may exacerbate a pneumothorax.
- **Never administer Entonox to a casualty suffering from a diving accident**
- **Do not administer Entonox to a person who has been diving within the last 48 hours**

Quiz 1

Can you name the two types of burst lung?

If a diver surfaces and says they have missed their decompression stop, what must you do?

Answers on page 107

Summary

Administration of oxygen is beneficial to the major diving disorders

100% oxygen will provide the maximum benefit

Administer oxygen as early as possible

Oxygen is a supplement to other first aid procedures to increase their effectiveness

Casualty must always be evacuated to appropriate medical aid:

- ✔ **As soon as possible**
- ✔ **Irrespective of any apparent resolution of their condition**

Go back

End of module quiz

1. What is the mnemonic that can be used to remember the priorities of BLS?
2. What are the causes of an IPO?
3. What is hypercapnia?
4. When would you raise a casualty's legs?
5. Can you name the two types of burst lung?
6. What is the correct depth for Chest Compressions (CC) administered to an adult?
7. How many times does carbon monoxide readly combine with haemoglobin?
8. Should you administer Entonox to a diver suffering from DCI?

Answers on page 108

Casualty assessment

Go back

OAT4 - Casualty assessment

The last module considered the diving illnesses and injuries that benefit from the use of oxygen. In each case, the mechanism, signs and symptoms were explained, which would help us identify the problem and allow us to decide on the most appropriate first aid action.

Module content

This module explains the BSAC incident procedures and casualty assessment slate which provides a prompt on what information is useful and a format in which to record it. Familiarity with the form in advance of having to use it will make the experience a little less stressful.

Casualty assessment

- **The benefit of using a checklist**
  The benefit of using the checklist when assessing the casualty is that it takes you through a logical sequence, reminding you of significant information that might help a medically trained person make an initial diagnosis. It also provides a tool for recording what you find. This information can then be read back or passed to third parties such as emergency medical services (EMS) and diving medical specialists.

- **What to look for**
  As you work through the casualty assessment form, we are going to explore what it is we are looking for, how best to measure what you find, and how to record it accurately. The first consideration with any casualty is the DR ABC of basic life support (BLS).

- **Teamworking and recording**
  Although the form can be used by a single rescuer, the process is made more comfortable by working as a team. One person should examine the casualty while the other records what is found and prompts the next action. You will have the opportunity to try both methods during the practical lessons which follow on from these theory modules.

- **Passing information**
  You will also need to think about the best way to pass on the information you collect to EMS or the medical specialist who is advising on, or going to receive, your casualty. You need to keep it brief, while containing all the essential information. Having a written record will help you to keep on track. You may also send it with the casualty.

Top tip; take a photograph of the completed form first.

Go back

Casualty assessment and incident procedure form

This form (& dive computer & buddy if appropriate) should accompany the casualty to medical facilities

CASUALTY ASSESSMENT

Date:

Casualty name: **Age:** **yrs Male/Female**

Onset of symptoms: Time:
Description:

Time	Record observations every 15 mins and when casualty's condition changes							
Highest level of response			**A**lert, **V**oice, **P**ain, **U**nresponsive					
BLS	Note times started and stopped							
AED	Note times applied shocks given	Note if						
Orientation	**Day**	✓ normal	× abnormal					
	Place	✓ normal	× abnormal					
	Person	✓ normal	× abnormal					
Personality change		✓ absent	× present					
Chest pains		✓ absent	× present					
Respiratory rate			(breaths/minute)					
Pulse rate			(beats/minute)					
Vision			**N**ormal, **T**unnel, **B**lurred, **D**ouble					
Head & neck	**Tingling/numbness**		**L**eft/**R**ight/**B**oth					
✓ normal	**Facial weakness**		**L**eft/**R**ight/**B**oth					
Upper limb	**Tingling/numbness**		**L**eft/**R**ight/**B**oth					
✓ normal	**Weakness**		**L**eft/**R**ight/**B**oth					
Trunk	**Tingling/numbness**		**L**eft/**R**ight/**B**oth					
✓ normal								
Lower limb	**Tingling/numbness**		**L**eft/**R**ight/**B**oth					
✓ normal	**Weakness**		**L**eft/**R**ight/**B**oth					
Eye/hand coordination		✓ normal	× abnormal					
Oxygen therapy	Note time started &		stopped. Note O_2 %					
Fluid administered			Note time and amount (mls)					

Assessor name: **Contact name:**

Tel: **Vessel call sign:**

This form (& dive computer & buddy if appropriate) should accompany the casualty to medical facilities

INCIDENT PROCEDURE

- TAKE CONTROL
- ASSESS THE SITUATION
- DELEGATE ACTION
- CONTACT THE EMERGENCY SERVICES

Tell them: Who you are - Type of emergency - Location

EMERGENCY SERVICES - UNITED KINGDOM

At sea	All incidents: Coastguard	**VHF DSC** (or Channel 16)
	Lives in immediate danger:	Mayday (distress button)
	Decompression illness:	Pan Pan
On land	Decompression illness:	BHA Emergency Diver Advice Line
	England, Wales Northern Ireland:	**07831 151523**
	Scotland:	**0345 408 6008**
	Near drowning:	Ambulance **999** or 112
	Lost diver:	Coastguard / Police **999** or 112

Decompression Illness

Keep the casualty quiet

Lie casualty flat on back

Do NOT raise legs

Administer 100% oxygen

Administer fluids

Basic life support

Check safety
↓
Unresponsive → **Shout for help**
↓
Open airway
↓
Not breathing normally? → **Send for / go for AED**
↓ **Call emergency services**
30 chest compressions
↓
CC+RB 30:2 (follow voice prompts when AED in use)

DIVE DETAILS

Casualty name:

Ascent	**Normal Y/N**	**Rapid Y/N**	**Missed Stops**	**mins**

Use separate sheet for buddy	**Incident dive**	**Previous dives** (most recent first)			
GAS MIX (if rebreather write **RB** and diluent mix)					
Surface interval (since previous dive)					
Depth m & Dive time (surface to surface, or 1st stop if taken)					
Stop 1 (mins @ m) & deco mix					
Stop 2 (mins @ m) & deco mix					
Stop 3 (mins @ m) & deco mix					
Surfacing time (and date if needed)					

Available as a slate from the BSAC shop or a download PDF

Go back

Incident procedure

The incident procedure (IP) side of the form contains alot of useful information; how to contact emergency services, flow charts and prompts. Knowing what's there and where you can find it is very useful in an emergency. There are many tasks that need to be considered and acted upon. The form reminds us of these and allows us to check them off.

- **Prompts**
- **Useful information**

Learning objectives

On completion of this module, you will be able to:

- **List some of the information that can be found on the BSAC incident procedures and casualty assessment form**
- **Use the BSAC incident procedures and casualty assessment form to collect information about the casualty**
- **Use the form as a prompt to carry out some simple tests which might help a medical professional to diagnose the casualty's illness or injury**
- **Brief a medical professional on who your casualty is, when you identified they had a problem, what is their main complaint, what you have done as a first aid action and what impact that has had on the casualty.**

Casualty assessment and incident procedure form

Incident procedure

The form provides the following guidance, which is valid for any incident:

- **Take Control**
- **Assess the Situation**
- **Delegate Action**
- **Contact the Emergency Services**

When examining the casualty, it is important not to focus entirely on the form. Reassuring and engaging with the casualty will increase the chance of all symptoms being reported.

Casualty assessment

The casualty assessment side of the form has five 'time columns' in which to record the observations you make (listed in rows). It is suggested that an assessment (column of entries) is made every 15 minutes and when you notice any changes in their condition. Being familiar with this part of the form will make it easier to work with when you are dealing with a casualty.

With every casualty, start with DR ABC, noting the time initial contact was made with them. Ask yourself: Is it safe for me to continue? How responsive is the casualty? Is their airway clear and open? When we have ensured it is, are they breathing normally?

The unresponsive casualty who is breathing normally should be placed in a recovery position to protect their airway. You should talk to them

Go back

reassuringly, even though they may not be responding, and monitor their condition closely. Observations such as their level of response, facial appearance, breathing and pulse rates (and quality) are fundamental.

If they are responsive and breathing normally, they should be made comfortable in an appropriate position and reassured. Asking them questions to establish what they can recall about the event and also to gauge their mental status. Pulse, breathing rate, and other indicators such as quality of breathing, capillary refill etc, should be measured and recorded. As appropriate, other first aid actions should be taken which may include positioning the casualty, delivery of emergency oxygen and/or administration of fluids orally.

When they are not responsive and not breathing normally, the focus must be on cardiopulmonary resuscitation (CPR) and getting an AED to them, while arranging evacuation to advanced care.

With a responsive breathing casualty, a simple neurological assessment and secondary survey should be completed whilst waiting for evacuation. A list of suggested, simple ‘tests’ forms the main body of the casualty assessment form.

None of these observations/tests should be allowed to delay transport to appropriate medical care, whether advanced life support (EMS) or a diving medicine specialist doctor. A detailed examination of the casualty is a good use of time while awaiting a helicopter or ambulance, or making passage to a handover RV point. Record unusual or out of the ordinary.

There will be opportunities to practice using these forms during the practical lessons which follow.

Quiz 1

What is very important that we continue to do while we are examining a casualty?

On the casualty assessment form, how often should we check for change of casualty's condition?

Answers on page 108

Summary

Casualty assessment

- ✔ The benefit of using a checklist
- ✔ What are we looking for?
- ✔ Teamworking and recording
- ✔ Passing information

Incident procedure

- ✔ Prompts
- ✔ Useful information

Go back

End of module quiz

1. What are the benefits of using a checklist?
2. What is a good idea to do before handing over a casualty assessment slate to the emergency services?
3. Where can the BSAC casualty assessment and incident procedure slate be obtained?
4. What is very important that we continue to do while we are examining a casualty?
5. Should transporting a casualty to medical care be delayed whilst completing the casualty assessment form?
6. What should be recorded on the casualty assessment form?
7. On the casualty assessment form, how often should we check for change of casualty's condition?

Answers on page 109

Course review

Go back

OAT5 - Course review

Module objectives

In this final module of the course your instructor will use the REAP formula, which you may be familiar with from other training, to debrief what you have achieved during the course. This is an important part of the process because it reminds you of what you have covered, encourages you to value what you have done well (so that you will repeat it in the future), reviews those areas in which you could improve (providing you with a plan) and looks ahead at future opportunities and how you will maintain these skills.

Achievement targets

At the end of this module you will be able to:

- **Recall the knowledge, and skills you have developed during the course**
- **Identify and record those skills that you did well during the course, so that you will put them into practice in the future**

- **Select two areas (knowledge or skills) that you think you could improve upon in the future and make a note of how you might make that progress**
- **Explain the need for continued practice and refreshing your skills**
- **Describe the opportunities for maintaining, refreshing and developing your skills**

Remember

The following are the key points to remember that we emphasised during the course:

- **Do not delay between RB and CC when administering CPR**
- **AED preparation must not disrupt CC and RB**
- **Everyone must be clear of the casualty before analysing and shocking**
- **Do not stop CPR until the casualty is breathing normally**
- **Ensure the oxygen is 1m clear of the casualty and AED before shocking**
- **The exhaled/exhausted gas from delivering 100% oxygen to a casualty is still 95% oxygen so poses a risk if there are sources of ignition nearby**

Go back

- **Having delivered first aid oxygen to the casualty, the next step is for them to receive appropriate medical attention.**

Progress - what's next?

- **Continue to practice your BLS skills**
- **Check oxygen unit and masks before every dive**

Not only does this ensure that the system is ready for use but it is also an opportunity to maintain your familiarity with the equipment.

End of module quiz

1. Should Chest Compressions and Rescue Breaths stop while preparing an AED for use on a casualty?
2. How far should oxygen be away from a casualty before administering a shock with an AED?
3. What must always happen if first aid oxygen has been administered?

Answers on page 109

End of module quiz answers

BSAC
Dive with us

Go back

OAT0

Quiz 1 answers

1. The person is unresponsive and not breathing normally
2. Head tilt and chin lift

End of module quiz answers

1. The key point of IMIST are:
   - Identification
   - Mechanism of injury/illness
   - Injuries or complaint
   - Signs and symptoms
   - Treatment given
2. 17%
3. Automated External Defibrillator
4. Breathing
5. Casualty responds to voice
6. Not more than 10 seconds
7. 30 Chest Compressions: 2 Rescue Breaths
8. Every 2 minutes
9. 5-6 cms
10. The 'how position'

OAT1

End of module quiz answers

1. Most casualties will need the use of a demand valve or a non-rebreathe (Hudson) mask
2. People holding the BSAC Oxygen Administration qualification should ONLY administer oxygen to other divers

OAT2

Quiz 1 answers

1. ‘D’ size
2. 100 to 160 litres/min

End of module quiz answers

3. 10 litres
4. Full 2-3 litre capacity cylinders will last around 20-30 minutes for a single casualty
5. In the UK and Europe, medical oxygen cylinders should have a white shoulder and body, although a black body is still common
6. A CD size cylinder has a volume of 2 litres and they are normally pressurised to 230 bar

7. To put 100% oxygen through a regulator it needs to have oxygen compatible components, be in 'oxygen service and be very clean
8. The simplest method for supplying oxygen to a non-breathing casualty is through an oronasal resuscitation (pocket) mask while delivering Rescue Breaths (RBs)
9. A demand valve is similar in operation to that used for diving. It provides oxygen when the casualty breathes and the flow ceases when they stop inhaling
10. Non-rebreathing, also known as Hudson, masks provide high concentrations of oxygen (80%)
11. Turning on the constant flow (normally set to 15 l/min) and placing a thumb over the one way valve on the top of the reservoir bag will cause it to inflate
12. Oxygen will make things burn faster so ensure that there are no naked flames or ignition sources. Spaces where oxygen is being used should also be well ventilated to allow it to be dispersed

OAT3

Quiz 1 answers

1. Emphysema, Pneumothorax
2. 100 to 160 litres/min

End of module quiz answers

1. DR ABC
2. The causes of an IPO are:
   - Being immersed in water
   - Having untreated high blood pressure
   - Strenuous exercise
   - Overhydration
   - Negative inhalation pressure
3. Hypercapnia is too much carbon dioxide
4. Raising the legs is particularly relevant in cases of shock. MUST NOT be used in cases of DCI or lung injury
5. Collapsed lung (pneumothorax) and bubbles between organs and tissues (emphysema)
6. 6. 5 - 6cm
7. Carbon monoxide combines about 200 times more readily with haemoglobin than does oxygen
8. Entonox should never be given for any injury following diving

OAT4

Quiz 1 answers

1. Reassure the casualty and engage with them
2. Every 15 minutes

Go back

End of module quiz answers

1. A checklist reminds you of significant pieces of information, takes you through a logical sequence and provides a tool for recording information that can be passed to third parties
2. Take a photo of the completed form (both sides)
3. The BSAC casualty assessment and incident procedure form is available as a slate from the BSAC shop or a downloadable PDF
4. While examining a casualty it is important to reassure and engage with them, even if they are unresponsive
5. Transporting a casualty to medical care should not be delayed while completing the casualty assessment form
6. As many of the fields as possible should be completed on the casualty assessment form. This includes details of the casualty, results of periodic assessments and anything that appears to be unusual and/or out of the ordinary

OAT5

End of module quiz answers

1. AED application must not disrupt CC and RB
2. Oxygen should be at least 1m away from a casualty before administering a shock with an AED
3. Having delivered first aid oxygen to a casualty, they must receive appropriate medical attention

Basic Life Support review

Go back

OAP1 - Basic Life Support review

Module objectives

This module reviews BLS and AED skills that you will have gained either through previous diver training or the optional BLS foundation module (OAT0 and SP1).

As you already have BLS and AED skills, your instructor will be working with you to refresh and enhance them. The interval of time since you and others on the course last practised BLS and the use of an AED will vary. It might all be fresh in your mind and you feel confident, or it may be some time since you last practised the skills. Don't worry if you are a little rusty, the whole point of this session is to get everyone up to speed and giving good quality BLS confidently.

Achievement targets

At the end of this module, you will be able to:

- **List, in order, the priorities of Basic Life Support (BLS)**
- **Assess an unresponsive casualty**
- **Recognise cardiac arrest**
- **Clear and open the airway**
- **Administer effective rescue breaths (RB)**
- **Administer effective chest compressions (CC)**

- **Combine CC and RB to provide effective CPR**
- **Competently operate an AED**
- **Place an unconscious breathing casualty into the recovery position**

Go back

Unresponsive non-breathing casualty

Go back

OAP2 - Unresponsive non-breathing casualty

Module objectives

In this module you will receive practical instruction so that by the end of the session, you should be able to assemble a first aid oxygen unit, select an appropriate delivery system and competently, confidently and safely deliver oxygen to a casualty in conjunction with Basic Life Support (BLS) and AED. You will then respond to at least one scenario (provided by the instructor) in which you will have to assess the situation and the needs of the casualty and respond accordingly. The scenarios are a team effort, just like they would be in a real-life situation, with everyone contributing to achieving the best outcome for the casualty.

Achievement targets

At the end of this module, you should be sufficiently competent and confident to:

- **Check the components of a first aid oxygen system while unpacking them from their container**
- **Assemble a first aid oxygen unit safely and test its function**

Go back

- **Select an appropriate method of delivering the oxygen to a casualty who is unresponsive and not breathing normally**
- **Deliver oxygen to a casualty who is unresponsive and not breathing normally via a pocket mask or bag valve mask (BVM)**

Note: The bag valve mask will only be included in the course if the instructor has appropriate training and experience.

- **Record the time of initial contact with the casualty and deployment of AED and oxygen**
- **Record relevant information on the BSAC casualty assessment form/slate**
- **Provide a brief to a third party, either over a communications system or on handover, outlining your observations, actions taken and any change in the casualty's condition**
- **Clean and dissemble the first aid oxygen unit before preparing it for next use by packing the components into its protective container**

All of the above must be done safely and with minimum supervision.

Breathing casualty

Go back

OAP3 - Breathing casualty

Module objectives

As in the previous module, you will start with the opportunity to practice assembly and testing a first aid oxygen unit. Your instructor will then demonstrate selection of an appropriate delivery system and delivering oxygen to a breathing casualty. You will then respond to at least one scenario (provided by your instructor) where a diver who is responsive and breathing is suffering from an illness or injury.

Achievement targets

At the end of this module, you should be competent and confident to:

- **Recognise when a diver has a condition which will benefit from them breathing oxygen**
- **Check the components of a first aid oxygen system while unpacking them from their container**
- **Assemble a first aid oxygen unit safely and test its function**
- **Select an appropriate method of delivering the oxygen to the breathing casualty**
- **Seek the casualty's consent and brief them on the use of the oxygen delivery system**

- **Deliver oxygen to the breathing casualty via non-rebreathe mask and demand valve and mask**
- **Monitor and record the casualty's signs and symptoms and the use of the oxygen**
- **Hand over the casualty to a third party, providing a briefing on your action and observations**
- **Clean and dissemble the first aid oxygen unit before preparing it for next use by packing the components into its protective container**

All of the above must be done safely and with minimum supervision.

Go back

Oxygen Administration SDC qualification record book

These pages can be printed off and used to record completion of theory and practical lessons.

Practical lessons do not have to be completed in a single session.

Once each individual skill has been achieved, the lesson can be recorded as completed.

Unique Reference Number

Course Pack URN	

Foundation module (optional)

Code	Description of Training	Date	Instructor's signature and number
OAT0	Theory Lesson **Basic Life Support**		 No:
OATE0	Module Theory Assessment **Dive leading**		 No:
SP1	Practical Lesson **Basic Life Support**		 No:

Theory module

Code	Description of Training	Date	Instructor's signature and number
OAT1	Theory Lesson **Oxygen administration in first aid**		No:
OATE1	Module Theory Assessment **Oxygen administration in first aid**		No:
OAT2	Theory Lesson **Equipment and its use**		No:
OATE2	Module Theory Assessment **Equipment and its use**		No:
OAT3	Theory Lesson **Diving illness and injury**		No:
OATE3	Module Theory Assessment **Diving illness and injury**		No:
OAT4	Theory Lesson **Casualty assessment**		No:
OATE4	Module Theory Assessment **Casualty assessment**		No:
OAT5	Theory Lesson **Course review**		No:
OATE5	Module Theory Assessment **Course review**		No:

Go back

Theory assessment

Where possible, theory knowledge should be assessed by the individual module theory assessments (OATE1, OATE1, etc). Once all of these have been completed, OATE can be recorded as complete without further assessment.

Students completing theory by eLearning will have completion of their individual module theory assessments displayed in the MyBSAC App and on their MyBSAC record.

Code	Description of Training	Date	Instructor's signature and number
OATE	**Oxygen Administration theory exam pass**		No:

Practical modules

Code	Description of Training	Date	Instructor's signature and number
OAP1	Practical Lesson **Basic Life Support review**		No:
OAP2	Practical Lesson **Unresponsive non-breathing casualty**		No:
OAP3	Practical Lesson **Breathing casualty**		No:

Record of qualification

Completion date	

Qualification card

BSAC photo-ID qualification cards are a universally accepted and convenient proof of qualification.

Obtaining your QCard (qualification card)

Once you have successfully completed all the training, your instructor will be able to apply for your QCard online.

Please be aware that you must supply the following information to them:

- **Your full name**
- **Your BSAC membership number**
- **A digital passport-style image (from your phone)**
- **The Unique Reference Number (URN) which came with your course pack**

Not received a qcard?

It can take time to produce QCards but if you haven't received yours within 3 weeks then please email qcards@bsac.com with the following information;

- **Your full name**
- **Your BSAC membership number**
- **The QCard you are expecting, i.e. Oxygen Administration SDC**
- **The name of the instructor who submitted the application**
- **The completion date of the training**

Go back

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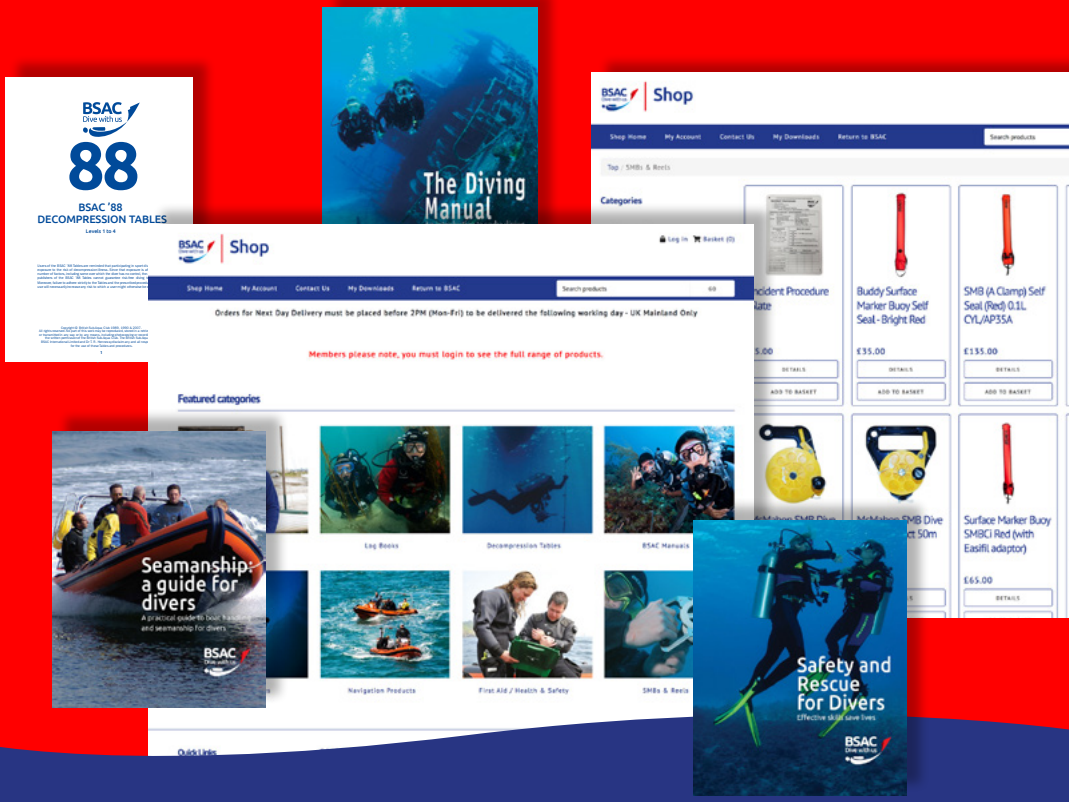

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- Secure online ordering
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- Buying online from the BSAC shop supports our work in underwater heritage, marine conservation and protecting our seas

Let's grow the love of British diving together

BSAC
Dive with us

After your course…

Go and use your newly acquired skills

Go diving… with the support of your club, you will be able to encounter a fascinating variety of wildlife and shipwrecks in seas, rivers, quarries, lochs and lakes. Plus, you will be able to dive anywhere in the world with your internationally-recognised qualification.

Progress your diver training…you can quickly move onto your next grade in BSAC's Diver Training Programme.

We recommend for your next course

Dive Leader

To start the course, discuss your options with your Training Officer/ Diving Officer of your branch, your Regional Coach or local BSAC Partnership Centre.

Learn new specific skills…you could also develop specific skills such as safety and rescue, wreck diving or driving a dive boat.

Other courses you may like

Practical Rescue Management
First Aid for Divers
Lifesaver
Advanced Lifesaver

To book and pay for your SDC course simply click on the link to get going...

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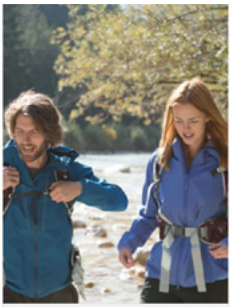

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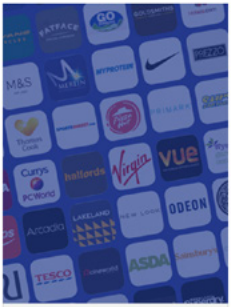

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Notes

Document change record

Date published	Document Version Number	Page(s) affected	Description of changes	Author
5/6/2023	v1.0	All	New course	Jon Parlour


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Keep in touch

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