BSAC
Safe Diving

Your guide to the safe practices of
sports diving as recommended

by

the British Sub-Aqua Club

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SAFE DIVING

This booklet is an alphabetical guide to the safe practices of sports diving as recommended by the British Sub-Aqua Club (BSAC) - the Governing Body of the sport of sub-aqua diving and snorkelling in the UK. The ideas expressed within reflect the current thinking of the National Diving Committee (NDC) and the advice on which it is acting. The recommendations cover both normal and 'technical' diving. However, not all items relate to both of these differing types of diving. So, where a recommendation is specific to a particular type of diving an appropriate annotation is shown in the subject heading or in the text. All technical divers should be aware that mixed gas diving increases the element of risk. To minimise this risk the mixed gas diver should adhere to BSAC safe diving practices as well as those of the training agency that they qualified under if this was not BSAC. Diving is an adventure sport and like all adventure sports its participants require differing levels of enjoyment and challenge. At one extreme we have the equivalent of the Himalayan mountaineer who, in peak condition, accepts the challenge of new routes and exploration. At the other extreme we have the equivalent of the weekend summer rambler who follows well marked trails through the countryside. What is safe diving practice for the former may well be very perilous for the latter and so the contents of this booklet are not a set of rigid rules but recommendations for safe diving practices. These recommendations can be amended depending upon the particular type of diving being planned and the experience and capabilities of the divers carrying out the dive. Where appropriate the advice in this document is also applicable to snorkel diving. The Diver's Code of Conduct is appended to the end of this booklet. It contains sensible advice on the conduct of all dives, and is seen as complementary to the guidance given here.

Safety and Incidents Advisor
BSAC National Diving Committee

Access / Egress

Ensure that your access to the water is safe and that you can successfully regain contact with and recover onto your boat / beach / shore. Always ensure, when diving from the land, that it is possible to climb out at the planned exit point at varying states of the tide and under prevailing weather conditions.

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Accidents / Incidents

Anyone involved in a diving accident or incident is encouraged to submit a report, in confidence, to BSAC for inclusion in the Annual Diving Incident Report. It is a requirement of BSAC membership that members involved in a diving accident or incident should notify BSAC HQ. An incident report (available from BSAC HQ or the BSAC website) should be completed and returned as soon as possible. Reports are treated as strictly confidential and are used to prepare an analysis of safety performance each year, from which any emerging issues and their training implications can be identified, whilst protecting individuals' anonymity. If there is any possibility of a third party insurance claim arising out of the circumstances it is particularly important that a form is completed without delay.

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Adverse diving conditions

Divers should always consider the weather and sea conditions and ensure that their experience is adequate for the conditions anticipated. Due to the extra discipline, extended dive times, decompression requirements and precision required when diving deeper or involved in wreck or cave penetration, adverse diving conditions should be avoided. Examples are heavy seas or strong tidal currents.

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Alternate gas sources (Air and nitrox diving)

BSAC strongly recommends that all divers carry an Alternate (gas) Source (AS) in the event that they may need to share gas

underwater. A suitable AS is a second 2nd stage fitted to the same 1st stage of the regulator. In this case divers should be aware that a first stage failure on their regulator will affect both second stages and may render them inoperative.

A more strongly recommended alternative, however, is a totally independent gas supply such as a 'Pony cylinder' (a small 2-7 litre auxiliary cylinder attached to the main cylinder with its own regulator assembly) or separate regulators attached to each cylinder of a matched pair. If a manifold is fitted to the pair of cylinders it should allow the diver the ability to isolate each cylinder / regulator assembly should a failure occur. Auxiliary cylinders having a capacity of less than 2 litres and BC mouthpieces (with/without an integrated 2nd stage regulator) are not considered adequate AS.

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Alternate gas sources/Bailout (Technical diving)

It is recommended that all technical divers should carry an alternative gas supply with its own regulator assembly, to provide the following:

- An adequate bailout breathing system in the event that the diver's primary supply suffers a catastrophic failure.
- A breathing system to support an assisted ascent to the surface in the event that their buddy's breathing system suffers a catastrophic failure.

Divers should satisfy themselves that:

- The system contains sufficient gas to provide for the above capabilities in addition to any planned gas consumption and any likely consumption due to changes in depth, mask clearing etc.
- The gas supply can be isolated in the event of a malfunction. The capacity of an independent bailout system and the gas mix it contains should be adequate to enable an ascent to be made to the surface from any point during the dive, including any decompression requirements. It is recommended that the capacity allows a significant margin to cater for the significantly increased breathing rate inherent in the stress of a bailout. Incidents have

indicated that a Respiratory Minute Volume (RMV) otherwise known as breathing rate (surface) of between 50 and 70 l/min is not unusual under the stress of a bailout situation. Ideally, the calculations should allow for one third of the bailout gas to be available on surfacing. It is the diver's obligation to ensure that bailout is calculated in the dive planning process and gas is safely managed throughout the dive.

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Altitude and reduced atmospheric pressure

Diving at altitude, or travelling to altitude (including flying), either before or after diving, involves the diver being exposed to a reduced atmospheric pressure. This can both affect the decompression procedures required and increase the diver's susceptibility to decompression illness. The BSAC 88 decompression tables, Levels 1-4, (Air and nitrox diving) have been specifically designed to allow the various factors involved to be taken into account in a simple manner. They can be used for dives at altitude and also for determining whether a particular dive / journey sequence involving an excursion to altitude is permissible. (See BSAC 88 decompression tables). Many dive computers / dive panning software applications also compensate for the effects of changing atmospheric pressure although it is important that the user understands the implications of this for their particular computer / software.

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Ascent rate

Maintaining a safe rate of ascent is vitally important in preventing possible decompression illness and the risk of gas embolism. The BSAC 88 decompression tables (Air and nitrox diving and Ox-Stops) have been calculated based on a maximum ascent rate of 15 metres per minute up to 6 metres depth and 6 metres per minute from 6 metres to the surface and this must be adhered to when using the tables. The majority of dive computers and decompression / dive planning software incorporate ascent rates of either 9 or 10 metres

per minute throughout the ascent with the ability to configure the final depth at either 6m, 4.5m or 3m. On completion of decompression / safety stops all divers are recommended to follow the practice of ascending at 6 metres per minute to the surface.

Repeated multiple ascents should be avoided as they may result in decompression illness. Particular care should be taken when carrying out the various ascent training drills, for which specific advice is available. 'Sawtooth' dive profiles which involve repeatedly ascending and redescending over an uneven bottom should be avoided, but the practice of returning to the surface from maximum depth in progressively shallower stages is encouraged.

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Assisted ascents

The National Diving Committee strongly recommends the use of an Alternate Source (AS) of breathing gas (See Alternative (gas) Source) as the prime method of assisted assent, and that all divers should carry such equipment.

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Authorised branch dives

An authorised dive by a BSAC Branch is one carried out with the approval of the Branch Diving Officer.

A properly qualified and appointed Dive Manager shall be present and shall be in charge of all diving activities for the duration of the dive / expedition. All Branch dives should be carried out in accordance with current BSAC recommendations for safe diving. See the BSAC website http://www.bsac.com/divedefinitions for a full definition of dive authorisation and the responsibilities of those involved.

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Boats

Ensure your boats operate at slow speed in any area where divers are below. Those in the boat should keep close watch for divers surfacing unexpectedly. When dropping divers into the water, or

retrieving them, ensure the engine is in neutral, and that they are well clear of the propeller before you engage gear. All boats should be marked for easy identification by the rescue agencies and should be properly equipped before taking them to sea, in accordance with BSAC guidelines. Boats used on BSAC events must have appropriate third party insurance cover. When using boats take note of the recommendations for boat users laid down in the Diver's Code of Conduct and the document "Guidelines for Safe Operation of Member Club Boats".

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BSAC 88 decompression tables (Air and nitrox diving)

The NDC considers the BSAC tables to be safe sports diving tables and recommends their use. The BSAC 88 (air) tables, Levels 1-4, and the BSAC Nitrox and BSAC Ox-stop (accelerated nitrox decompression) tables, Level 1, have been specifically designed for sports diving to help divers avoid decompression illness.

The tables promote safer diving practices, particularly by encouraging slow, controlled ascent procedures (15m/min) and allow divers to make allowance for atmospheric pressure changes due to weather or changes in altitude. Due to the wide variations in human physiology and the large number of factors that can affect your susceptibility to decompression illness, no table can guarantee to protect you against all risk. Whenever diving the following advice should be taken into account:

- The maximum recommended depth for recreational diving, when using air, is 50m. Specific depth restrictions, appropriate to skill level and experience, are applicable to some BSAC diving grades (see Depth). When carrying out two or more dives in one day, perform the deepest dive first.
- It is recommended that no more than 3 dives be performed in any 24 hours. Any dive series involving consecutive days diving to 30m+ should be limited to 4 days, after which a 24 hour break should be taken.

- Always be in control of your buoyancy, especially during the ascent, and observe the recommended ascent speeds.
- It is permissible to conduct slower descents and ascents, whilst remaining within the dive profile envelope, but multiple 'saw tooth' ascents and descents should be avoided.
- Be aware that smoking, alcohol consumption, tiredness, age, increased body fat and any medical condition affecting the respiratory or circulatory systems may increase your risk of decompression illness. Susceptibility can also be increased with excessive physical exertion during or immediately after a dive.
- When diving with nitrox use the BSAC nitrox table or an established air or nitrox computer or software to determine the safe limits for your planned dive. (See Depth and Nitrox).
- When diving with trimix, or other mixed gases, the dive should be planned using an established mixed gas decompression table, computer or software. (See Depth and Mixed gas).

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Buddy diving

All divers should train to be self-sufficient; however, it is important for safe diving that divers are formed into appropriate buddy pairs. Buddy diving means a pair of divers operating as a unit, each taking some responsibility for the safety of the other. On every dive one diver, usually the senior in grade or experience, should be elected as the dive leader. Divers with a minimum grade of Ocean Diver may dive together at the discretion of the Branch Diving Officer. Divers below the grade of Ocean Diver (i.e. divers under training) must be led by a qualified instructor or an Assistant Diving Instructor. (See Odd numbers and Trio diving). A full buddy check should be carried out prior to entering the water. When snorkelling, dive alternately so that the snorkeller underwater is covered by their buddy at the surface.

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Buddy lines

In conditions of poor visibility, you may wish to use a buddy line to retain contact with your buddy. A line two to three metres long is ideal, with a quick release shackle or small karabiner spliced to each end. This allows it to be looped over wrists, if so desired, or it can be clipped to a suitable piece of equipment e.g. BC, to leave both hands free. Ensure the line can be released quickly and safely in an emergency.

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Building experience

BSAC strongly recommends that newly qualified divers undertake a structured series of dives to progressively build their experience. Subsequently, when completing more advanced training, in particular a mixed gas-training course, BSAC recommends that dive experience in those aspects should again be built up progressively.

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Build-up dives

When a diver has had a lay-off from diving for a period of time, or is planning a dive to a depth significantly deeper than that to which they have recently dived, a planned program of dives progressively building up to the target depth is recommended. A diver must be physically and mentally dive fit for the depth he or she plans to dive. This is particularly true of self and buddy rescue skills, which by their nature, are the least regularly used.

They should also be revised whenever any change is made to the equipment configuration, such as when a new drysuit or BC is being used or when additional equipment is to be carried to cater for mixed gas diving.

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Buoyancy

Buoyancy is one of the key issues involved in decompression Illness incidents. All divers should ensure that they:

- Have sufficient buoyancy to be supported on the surface.
- Are practiced and confident at performing decompression stops within +/- 0.5m.
- Are able to maintain neutral buoyancy and maintain a depth level at all stages of the planned dive.
- Are able to control their ascent rates within recommendations.
- Are proficient in managing emergency buoyancy control scenarios, e.g., over inflation, loss of primary gas, faulty equipment, etc.

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Buoyancy compensators

Divers need to be able to adjust their buoyancy underwater to compensate for buoyancy losses due to pressure changes on descent, and then to reduce this buoyancy as they ascend. This may be provided by inflation of a drysuit or by means of some buoyancy compensating device. Total reliance on a drysuit is not sensible and a suitable buoyancy compensator (BC) should be worn on every open water dive. There are three main types of buoyancy compensator currently on the market, the Adjustable Diving Vest (ADV), the Stabiliser Jacket (STAB) and the 'wings' style of BC. Most are made in various sizes and care should be taken to choose the correct size and amount of buoyancy offered. All buoyancy compensators must have a direct feed mechanism for routine buoyancy adjustment. The diver's other requirements for a buoyancy system are to stay afloat at the surface or to give emergency buoyancy whilst rescuing or being rescued. An inflated drysuit is not a good solution in these surface situations and drysuited divers must wear a buoyancy compensator to maintain and control positive buoyancy safely. Divers should minimise the number of buoyancy systems in use at any given time during the underwater phase of the dive. When wearing a dry suit it is recommended to use the drysuit only to compensate for loss of buoyancy due to compression at depth and change over to the BC for positive buoyancy at the surface.

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Buoyancy compensator and DSMBs cylinders

Some buoyancy compensators can be fitted with a small gas cylinder for emergency inflation. Some DSMBs are also fitted with similar cylinders. These cylinders if they are less the 0.5 ltr, do not need to be tested/ inspected at the same interval as larger diving cylinders but you should follow the manufacturers' recommendations.

Never overcharge a cylinder and avoid storing one for any length of time fully charged. Ensure that the working pressure of the mini cylinder is compatible with the working pressure of the aqualung cylinder. Avoid completely emptying such cylinders since, if the valve is allowed to remain open, any water in the buoyancy jacket or DSMB or moisture from the atmosphere, may be drawn into the cylinder.

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Buoyant ascents

These fall into two categories, buoyant ascents in an emergency, and controlled buoyant ascents in a non-urgent situation. In the former it is vital to remember the risk of embolism and positive breathing out is absolutely essential. In the latter case, the training programme teaches the correct techniques to ensure a safe ascent rate in a controlled manner. It is most important that an ascent rate of 6 metres per minute is achieved from 6 metres to the surface and this requires that the diver is always capable of being neutrally buoyant at 6 metres with a near empty cylinder.

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Checklist

BSAC recommends that divers prepare their equipment by devising and using a checklist. This is especially important in preparing for a dive with a rebreather. (See Rebreather - Pre-dive checks).

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Compressors

For safety reasons only properly trained and competent people should operate compressors. If you use a portable petrol or diesel engine compressor take care not to have the air intake in a place where fumes may be ingested with the air, and never use the compressor in a site where it is an annoyance to other people. It is essential that air of a high standard of purity is delivered. The production of compressed air for use in oxygen enriched mixtures requires specialised oil-free equipment and training. Only properly trained operators using appropriate equipment should undertake this.

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Cylinders

The current test and inspection specifications (August 2002) approved by the Health and Safety Executive are BS EN 1968 (Steel) and BS EN 1802 (Aluminium). Diving cylinders must be tested according to the aforementioned standards. These standards call for diving cylinders to be visually inspected every TWO & a HALF years and subjected to a hydraulic test every FIVE years. Divers should ensure that test stations carry out their tests in accordance with BS EN 1968 and BS EN 1802 and should obtain a test certificate which states this. Test stations approved by the Inspectorate for Diving Equipment Servicing and Testing (IDEST) are recommended. (See the IDEST website: http://www.sita.org.uk/idestmembers.html). The cylinder should be stamped by the test station after every inspection / test and a label attached to indicate when the next inspection is due. Cylinders to the obsolete specifications HOS, HOT (steel) and HOAL 1, 2, 3, and 4 (aluminium) are still legal for use by divers, although no longer manufactured. Test standards BS 5430 Part 1 & 3 have been withdrawn.

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Cylinders (Nitrox and mixed gas)

Additional to the requirements set out above in the 'Cylinders' section, cylinders that are for use with nitrox and mixed gases should be dedicated to this use, marked with a suitable label that clearly identifies the gas mixture contained (oxygen and / or helium percentage) and the Maximum Operating Depth (MOD). This practice should ensure divers do not confuse cylinders and that they breathe the correct gas at the correct time and depth. Cylinder contents should always be analysed at the time of filling and again immediately prior to the dive. BSAC recommends the convention of configuring the richest oxygen mix gas to the right hand side to assist gas recognition. Cylinders should be regularly (maximum duration of 15 months) cleaned to oxygen service standard. Oxygen service standard is essential where the oxygen concentration is greater than 21% and the cylinder is likely to be filled using either an oxygen delivery system or pure oxygen by the partial pressure method.

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Cylinder pressures

The dive should commence with sufficient gas to conduct the planned dive in all cylinders including bailout gas. Cylinder pressures should be regularly monitored throughout the dive and it is recommended that:

- Open circuit divers return to the surface before pressures have fallen to one third of the cylinder's capacity.
- Rebreather divers should return to the surface before the pressure falls below 30 bar in any supply cylinder directly connected to the breathing loop. Rebreather bailout cylinders should be capable of allowing the diver to return to the surface with one third of gas remaining in the cylinders.

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Decompression

All dives involve some decompression, which normally takes place during the ascent and subsequent period on the surface. It

follows that it is as important to correctly perform these stages as it is to monitor the dive itself. Decompression computers can assist in this if they are correctly used and are programmed to an appropriate algorithm. This means that for a simple rectangular profile they should give dive times at least as conservative as the BSAC 88 decompression tables. All dives must be planned using a decompression tool the diver has been trained to use. These could include hard copy tables, computer generated tables or a dive computer. Whatever primary decompression plan is being used the diver must also have a back up plan. It is important to realise that both tables and computers are unable to make allowance for factors such as age, fitness, exertion, obesity and injuries, which may all significantly affect susceptibility to decompression illness. Divers should therefore be aware of these factors and avoid diving beyond their limits. Dive computers increasingly allow additional safety factors to be selected and some are available which monitor the diver's heart rate and such developments should help with the management of these issues. Take particular care when planning repeat dives. Where two or more dives are being made the same day it is good practice to carry out the deepest dive first. It is also good practice to achieve maximum depth as early in the dive as possible and to avoid redescending once any ascent has commenced.

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Decompression illness

Decompression illness (DCI) symptoms vary between those so sudden that immediate air evacuation to a chamber is vital, to those which may not become apparent for some hours. Some of these less dramatic symptoms, such as tingling and numbness, may well be delayed but can be more serious and produce greater disability than the pain often associated with DCI in a joint. Severe DCI symptoms, occurring at sea, require rapid transfer of the subject to a recompression chamber, laid flat on their back and if possible, the administration of 100% oxygen and fluids. Being bounced, repeatedly, in a small boat is almost certainly going to worsen the symptoms rather than help the situation. For assistance with

decompression illness, advice in the UK can be obtained from the National Decompression Illness Helpline. When at sea, contact should be made via the Coastguard on VHF Channel 16. When on shore, contact can be made via the following 24hour telephone numbers: If calling in England, Northern Ireland or Wales call 07831 151 523 to be connected to the BHA / National Diver Helpline. If calling in Scotland call 0845 408 6008 to be connected with the Aberdeen Royal Infirmary. For other emergency assistance, when ashore in the UK, use 999 or 112, as usual. When diving outside of the UK, ensure that you know the local emergency contact procedures. (See BSAC 88 decompression tables / Oxygen). Return to Top

Decompression stops

Dives requiring decompression stops should be well planned beforehand and executed according to recommended techniques. Avoid deciding upon decompression stops once in the water. An accurate means of measuring depth and time is essential and all decompression stops should be carried out using a suitable decompression system, static line, decompression trapeze or a minimum of a delayed SMB. For the longer decompression schedules the use of a decompression station is recommended as spare gas can be attached to the system and the entire dive team are together. It also assists the surface team, who only have to monitor one decompression station.

Any diver who has missed planned decompression stops could be suffering from decompression illness and should be returned to the shore as quickly as possible. No attempt should be made to carry out any form of re-entry decompression as this inevitably worsens the situation. The diver should be treated as a potential casualty, kept quiet and administered oxygen and oral fluids. Emergency advice should be sought and their recommended actions followed - see the section on Decompression for contact information. (See BSAC 88 decompression tables / Decompression / Oxygen). Return to Top

Delayed surface marker buoy

A delayed SMB (DSMB) is no substitute for a fixed shotline and, wherever practical, a shotline should be used for the ascent and descent phases of the dive. However there are situations where the use of a shotline or a conventional SMB may not be appropriate, and in these circumstances consider the use of a delayed SMB. Ensure that you practice deployment and usage of the delayed SMB in safe, simulated conditions before using one in earnest, and when deploying the delayed SMB do not attach the free end of the line or reel to yourself, or to other personal equipment. Ideally the reel should be attached to some feature on the bottom (such as a wreck) during deployment, to avoid the risk of being pulled towards the surface. Many divers now carry two DSMBs, often one yellow and one red. The purpose here is to have the red one for general use when making a normal ascent. When a problem arises and divers wish to notify the surface cover that they need assistance, the yellow and red ones will be sent up together and on the same line. For dives where a direct ascent to the surface is inadvisable (e.g. dives involving planned decompression stops) BSAC recommends this approach as good practice.

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Depth limits (Air diving)

A depth of 50 metres is recommended as the limit for normal recreational air diving. Within this limit BSAC divers have additional restrictions upon the maximum depth to which they should dive, dependent upon their diving grade. The specific depth limitations for each grade are contained within the current Diver Training Programme, Qualification Record Logbook and on the BSAC website (www.bsac.com/syllabus).

There is evidence that decompression illness is more likely to occur on dives deeper than 50 metres, even though decompression tables may be strictly adhered to, and such occurrences are usually serious, with central nervous system (CNS) involvement. When diving deeper than 30 metres, special care with planning is vital,

and recommended deep diving practices should be adhered to. The NDC strongly recommends that dives in excess of the recommended maximum depth limits should not be undertaken by recreational divers.

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Depth limits (Nitrox and Trimix Diving)

BSAC recommends:

- For oxygen / nitrogen gas mixes, a maximum depth the lesser of 50 metres or the depth at which the partial pressure of oxygen in the mix reaches 1.4 bar during the dive phase. In the decompression phase a maximum PO_2 of 1.6 bar is permitted. When diving with oxygen enriched mixtures it is essential that the maximum operating depth for the mixture is adhered to. Failure to do so may have fatal consequences due to the onset of oxygen toxicity.
- For oxygen / nitrogen / helium or oxygen / helium gas mixes a maximum of 100 metres. When diving below 30m the use of helium based mixtures can provide a safety benefit. It should be acknowledged that dives to greater depths and using helium will likely incur extended decompression requirements. When using helium based mixes BSAC recommends planning an equivalent narcotic depth of 30m. (See also Equivalent narcotic depth)

All divers using mixed gas should be suitably qualified in its use. Divers planning an expedition may conduct dives to depths beyond those currently recognised by BSAC provided that they have recognised qualifications gained outside BSAC. Dives in excess of 100 metres demand very serious dive planning and logistical requirements including support diver teams, etc.

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Distress at sea

Distress at sea can range from an extreme form of decompression illness, where life is threatened, to divers being lost on the surface having been swept away by the tide. Procedures to deal with such a range of emergencies are as follows:

Any dive boat at sea requiring Search or Rescue assistance for

a missing or overdue diver should use a 'MAYDAY' call if a vessel or person is in grave and imminent danger. Less serious, but nonetheless urgent requests (e.g. a boat drifting with no engine), may warrant a 'PAN PAN' (Urgency) call. For vessels with Digital Selective Calling (DSC), a DSC alert should be activated on Channel 70 followed by a voice call on Channel 16. For non-DSC equipped vessels the call should be made on Channel 16. If your boat does not carry VHF radio it is sometimes possible to attract the attention of passing vessels who may radio on your behalf. Flares can be used to attract attention, either from the shore or from other vessels in the area. It is important that flares are not wasted, so only fire them if there is someone likely to see your signal. Several Maritime and Coastguard Agency reports, each year, indicate that some divers leave it too long before raising the alarm. Do not delay too long if you are convinced problems are arising which you cannot control. For distress at sea, where decompression illness is involved, see Decompression.

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Dive computers

Dive computers offer accurate and automatic recording of depth and time and continuously calculate the diver's decompression requirements according to the depth and duration of the dive. Computers are also available with advanced features such as the ability to calculate decompression requirements for a variety of nitrox mixes and mixed gases, and also to monitor available gas and gas consumption rates. The use of a dive computer is no substitute for proper dive planning, including proper attention to gas requirements and dive time. Divers should learn how to use the planning function on their own dive computer and apply this practice prior to every dive. It is recommended that divers choose a computer which is at least as conservative as the BSAC 88 decompression tables on a rectangular dive profile. Individual susceptibility to decompression illness varies and can be affected by a number of factors, for which no computer or decompression table is able to allow. Divers should be aware of this and avoid pushing

computers beyond their limits. The advice on safer diving attached to the use of the BSAC 88 tables applies equally to computer users and should be followed. (See BSAC 88 decompression tables).
Note: See advice for military divers P.54

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Dive discipline

It is a rule of BSAC that the Dive Manager has the authority of the Branch Diving Officer to suspend a member from diving if instructions are not obeyed. (See Authorised branch dives).

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Dive leadership

See Authorised branch dives / Buddy diving / Dive planning and organisation.

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Dive management

The Dive Manager should be appropriately qualified or have an assistant who is qualified for the dive(s) to be undertaken. The Dive Manager should know and document:

- Divers' names and pairing
- Divers' cylinder size and contents
- Divers' planned decompression schedule
- Divers' planned decompression technique
- Divers' back up plan in case of an emergency
- Dive start and finish times

The Dive Manager should complete a full dive log. Additionally for mixed gas diving the Dive Manager should know and document:

- Divers' gas mixes for bottom, travel and decompression
- Divers' maximum operating depth (MOD)
- Divers' cylinder sizes and contents for all gases
- Rebreather divers' absorbent material life and primary set-points

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Dive planning and organisation

When planning any dive the following factors should be considered:

- The divers' experience and qualifications
- The divers' current fitness to dive
- The divers' depth limitations
- A suitable dive platform and experienced skipper (for boat diving)
- A safety backup plan for all aspects of the dive in case of an emergency. Additionally, technical diving involves planning for the various combinations of gas mixtures to be used at different depths and also accounting for loss of gas mix scenarios. This requires a very disciplined diver to both plan and then execute the dive as planned. The technical dive plan should consider:
- The 100 metre depth limit
- Manufacturers' equipment specific depth limit recommendations
- The MOD (maximum operating depth) of the gases being used
- END (Equivalent narcotic depth) When boat dives are taking place, divers should make sure that a responsible person on shore has details of the dive plan and estimated time of return. When diving in the UK the Maritime and Coastguard Agency (MCA) should be contacted by phone / radio call to brief them of your intentions and to confirm that you have returned to shore safely. Accurate records of diver training, dives and expeditions should be kept at all times.

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Diving flag

The international code flag 'A' should always be flown when divers are in the water. For small boats it should be at least 1/2 metre square and should have the means to fully extend it in calm conditions. It should not be flown when travelling to or from a dive site.

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Diver propulsion vehicles

A diver propulsion vehicle (DPV) is a very effective and effortless way for the diver to cover a large underwater area. By riding, or being dragged along by the DPV, the diver is provided with greater mobility and range for the dive, as well as breathing a reduced amount of the appropriate breathing mixture due to the reduced effort required for motion. Such a reduction in gas consumption may therefore also allow the diver to spend a longer period of time underwater, subject to the personal decompression requirements. The major risks related to DPVs are listed as follows:

- Difficulty looking at, and therefore properly monitoring, pressure, depth and other gauges whilst holding on to the DPV. However the diver can pause from time to time to review these instruments.
- Loss of equipment due to the speed of the DPV. The diver will need to ensure that all ancillary equipment such as torches etc. is securely strapped to the person, and, in addition, do not dangle from the body where they could fall into the propeller guard.
- Barotrauma and other pressure related injuries could occur as a consequence of a rapid descent, and particularly on the ascent. Due to the potential speed that the diver may travel using a DPV, these vehicles should be very carefully used for the descent and ascent phases of the dive.
- Diver separation from the buddy could occur, unless the buddy also has a DPV. It is important that both members of the buddy pair use DPVs of similar performance, since if only one member of the pair has such a vehicle then it is quite possible that the pair may become separated due to their obvious different speeds of movement through the water.
- Collision in poor visibility; always a potential risk, but unlikely.
- The DPV should be equipped with a cut out switch to prevent it moving off on it's own and the operation of the switch should be checked prior to each dive.

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Diver recall systems

When divers need to be recalled to the surface there are several means available. If they are using SMBs a pre-arranged signal on the line may be sufficient. This can be achieved either by pulling on the line (Four pulls is a widely recognised signal for the diver(s) to return to the surface) or by clipping a small karabiner to the line and allowing it to slide down the line to the diver; this karabiner could have a message or coloured tab attached. Thunderflashes can be purchased, but ensure they are of large enough size and that they are weighted, before you need them, so that they will sink before they explode. Endeavour to allow divers to safely experience a thunderflash going off as a training drill so that they will recognise the sound when they experience it in a real situation. Thuderflashes, like all pyrotechnic devices such as flares should be stored, transported and operated in accordance with the manufacturer's instructions and should not be used after their expiry date and should be disposed of properly. Divers are cautioned against taking explosive devices abroad, as they are certain to cause major concerns with travel security personnel.

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Drugs

If you are taking prescribed medication of any kind, do not dive unless clearance has been given by an approved UK Sports Diving Medical Committee referee.

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Drysuits

There are three main types of drysuit in common use, the membrane type (which requires adequate undersuit thermal protection), compressed or crushed neoprene (which requires some undersuit thermal protection and foam neoprene drysuits. Each type has different weighting requirements. The buoyancy a drysuit provides cannot be guaranteed to support a diver on the surface safely - the air in the suit is too easily vented when swimming or in rescue situations. For this reason, plus the common sense of

having a 'redundant' method of obtaining controlled buoyancy, a buoyancy compensator (BC) should be worn. Drysuit training can be undertaken by branches during initial training or at any time in later training. Sheltered water / pool training, is essential before progressing to open water. Do not wear excess weight when using a drysuit, wear just sufficient to be neutrally buoyant at 6 metres with a nearly empty cylinder. Divers have experienced problems on ascents because they have used both buoyancy compensator and drysuit to compensate for buoyancy loss, and have not had enough hands to operate all the controls plus coping with whatever else they might be carrying. Drysuited divers should include their method of achieving neutral buoyancy as part of the buddy check and dive brief. Drysuits are generally not capable of supporting a controlled buoyant lift (CBL) since gas can escape through the neck seal and render the diver negatively buoyant. The NDC recommends that drysuited divers adjust their buoyancy underwater by introducing air into their drysuits, rather than into their buoyancy compensators.

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Emergency bailout plans (Technical diving)

If a diver loses his travel or decompression gases due to any of a number of reasons (equipment failure, gas loss, etc), the decompression schedule may become very punitive. This is especially true of ineffective off gassing of helium. The decompression schedule would become very long and the diver may not have enough gas to finish the dive or, in Northern European waters, may not be able to cope with the cold conditions. It is vital that bailout gases are available to avoid this situation. All divers must plan decompression schedules to cover all potential gas failure possibilities and how they can set up spare cylinders in case they need them.
These include:

- Written or pre-programmed decompression schedules for longer bottom time than planned.
- Written or pre-programmed decompression schedules if the diver is unable to use travel or decompression gases in case of a gas loss or equipment failure.

- Spare decompression gas available to the diver in case of a gas loss or equipment failure.
- How the divers would access the spare gas in an emergency (spare cylinders on decompression line or cylinders lowered to divers from diving platform).
- Overall duration of emergency decompression considered relative to the expected water temperature.
- A diver to surface signalling protocol to facilitate requesting gas or assistance in an emergency.

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Engine Kill Cords

Engine controls in small open boats should be fitted with an engine isolation device that will stop the engine in the event the Coxswain falls overboard. The device is intended to stop the boat continuing under power and injuring the crew and passengers in the water. The Coxswain should fit the lanyard from the device in accordance with the manufacture's recommendations.

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Equivalent narcotic depth (Technical diving)

Equivalent narcotic depth (END) is the depth at which the partial pressure of nitrogen in the gas mixture would be the same if the diver were using air. BSAC recommend a suitable END with regard to the dive conditions and a personal narcotic tolerance. One of the major benefits of diving mixed gas is to have a clear head whilst at the maximum depth. 30 metres is generally accepted as a narcosis level a diver can cope with in an emergency situation. Some divers are happy to increase this depth if the diving conditions are better, such as warmer water, better visibility, etc.

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Explosives

It is extremely dangerous to attempt to recover or retain live explosive devices. Immersion in water could render them very unstable, especially if they are consequently dried out, so keep well

clear of any such devices you find. If you consider that they are in a dangerous location, inform the Maritime and Coastguard Agency (MCA). Never:

- Attempt to bring them to the surface and on no account abandon them in shallow water, or on the beach.
- Undertake the use of underwater explosives for carrying out underwater work without a recognised course of training.
- Dive near sites where underwater explosives are being used since the shock waves can be fatal.

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Fitness to dive

Diving uses as much energy as moderate to heavy work. Before resuming diving, after a lay off, you are advised to regain physical fitness, practice basic underwater skills in the pool or sheltered water training area and complete a series of 'work up' dives before diving to depth. Ensure all divers are both physically and psychologically fit for the dives they plan to undertake.

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Flares

Orange smoke and red handheld / parachute flares should be carried by all dive boats in order to attract attention when in difficulties at sea. Similar flares, in waterproof containers, are available for divers to carry in the event of them becoming lost at sea. Orange / red flares should not be used for signalling purposes in a non-emergency situation. Gun type flare launchers require a firearms certificate for use within the UK. Divers are cautioned against taking such devices abroad, as they are likely to cause concern to travel security personnel.

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Flying and diving

Flying or travelling to altitude after diving can give rise to decompression illness. Flying or travelling to altitude before diving, may increase the risk of decompression illness on a subsequent

dive. It is therefore recommended that divers use the BSAC 88 decompression tables (Levels 1-4) or other appropriate dive planning tool to determine whether the proposed dive / journey combination is acceptable. (See BSAC 88 decompression tables / Altitude).

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Gas analysing

When nitrox and / or mixed gases are being used, all gases must be analysed prior to the dive. All cylinders must be clearly marked with their oxygen and helium percentages and MOD (Maximum operating depth). The partial pressures of oxygen (PO_2) should not exceed 1.4 bar for the dive phase and primary gases. For suitably qualified divers, the partial pressure of oxygen must not exceed 1.6 bar for any chosen decompression gas mixture. For divers not holding appropriate qualifications, the PO_2 of 1.4 bar should not be exceeded for any gas mixes including decompression gases.

BSAC recommend a suitable equivalent narcotic depth (END) with regard to the dive conditions and a personal narcotic tolerance. When gas mixes involving helium are used in technical diving, wherever practicable, the helium content of the mix should also be analysed by an appropriate instrument (e.g. helium analyser) as a confirmation of the precise mix.

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Gas mixtures (Technical diving)

Technical divers should only use gas mixes for which they hold a recognised qualification. Appropriate safeguards should be put in place to avoid premature gas loss and to ensure that the respective maximum operating depths of all open circuit gases carried are observed. All divers are strongly advised not to use an hypoxic gas unless the depth requires it to reduce the PO_2 to a breathable value. When hypoxic mixes are being carried divers must carry and use a suitable travel gas mix.

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Gas requirements

All divers should carry the gas they need to complete the dive safely. They should also have a plan to access bailout cylinders in case of a gas failure. (See Gas reserve) For technical divers using open circuit equipment this includes bottom gas, travel gas and decompression gas. They should also have a plan to access bailout cylinders in case of a gas failure. Reserve requirements for travel (descent & ascent) and primary gas should be calculated on the rule of thirds. Reserve gas for decompression is normally calculated as double the amount of gas required for the planned decompression schedule.

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Gas reserve

Divers should calculate their gas requirements based on their cylinder configuration for the planned dive demonstrating that they have an adequate reserve of gas should an incident occur. The amount of gas deemed to be an adequate 'reserve' will obviously depend on a number of factors including the size and working pressure of your main cylinder(s) together with the depth and type of the dive – a standard figure is not appropriate. The recommended practice is to have a reserve of one third of the primary cylinder's or cylinders' capacity on surfacing. When a single or small capacity cylinder or a deeper dive is anticipated a greater pressure reserve than one third may be more appropriate. The reserve should be sufficient for an ascent, accounting for the increased breathing rate that is likely to occur during an incident (note: rates greater than 50 litres per minute have been observed) from the beginning of the incident to the first point of safety, plus any decompression stops, allowing adequate amounts for surface swimming and allowing for the potential need for the buddy to use the diver's alternate gas source throughout the ascent.

Remember that rates of gas consumption can vary enormously with the effects of exertion, anxiety, cold, fitness, experience and depth, and you should monitor your own and your buddy's gas supply

regularly and consider terminating the dive early if a diver's gas consumption rate is higher than predicted.

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Hyperventilation

Hyperventilation, before a snorkel dive, should be avoided at all costs, as it has the effect of flushing out carbon dioxide from the respiratory system. Build up of carbon dioxide, rather than lack of oxygen, creates the desire to breathe and, by getting rid of carbon dioxide in this way, snorkellers are more likely to suffer a 'blackout' through hypoxia (shortage of oxygen).

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Ice diving

See No Clear Surface.

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Incidents

See Accidents / Incidents.

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Insurance

Please see current information and guidance at www.bsac.com/insurance

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Legislation

With the exception of requirements relating to cylinders (see Cylinders), the law which protects historic wreck sites and more recently laws requiring a licence to recover objects, there are currently few laws or government regulations in the UK about the way in which the sport of diving must be conducted. However, if you dive for money or reward, even using recreational techniques and equipment, you are considered to be a professional diver and are subject to the requirements of the Diving at Work Regulations 1997. These regulations require a diving medical issued by a medical examiner approved by the Health and Safety Executive (HSE) and

impose detailed safety requirements on all diving operations. Amateur divers must be aware that any job of work carried out for anything other than essential expenses e.g. petrol or air costs, would be considered subject to the requirements of the regulations. It does not matter whether the money or gifts are presented to the divers or their branch, this would still be seen by the HSE as diving at work. Even jobs of work undertaken for true expenses are seen by professional divers as 'stealing their work' and will often be a source of aggravation. The regulations recognise that different techniques are used by the different sectors of the diving industry, and there are five separate Approved Codes of Practice (ACoP) covering Offshore diving, Inshore diving, Scientific and Archeological diving, Recreational diving and Media diving. Divers working professionally have to comply with the requirements of the relevant Code of Practice. Those teaching sport diving professionally must comply with the 'Recreational diving' ACoP. Appropriate BSAC qualifications have been approved by the HSE for activities covered by this Code.

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Manufacturers' recommendations

In addition to the guidance given in this document the manufacturers' recommendations should always be adhered to (eg frequency of servicing).

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Medical examination

Divers should ensure they are fit and healthy to dive and diver training or diving must not be undertaken until the diver has completed an annual medical self-declaration form on renewal of membership. If the diver has no underlying medical condition that would potentially prevent them from diving safely, they may sign the form and a copy should be retained in branch records. If a member has an underlying medical condition or query, telephone contact should be made with a medical referee for further advice. (Forms and medical referee list available from BSAC HQ or can be downloaded from the BSAC website). Branch Diving Officers should

ask for proof of current self-declaration status when members transfer to them from another branch. If any member has been the subject of a decompression accident they must not commence diving again until medical clearance has been obtained from a UK Sports Diving Medical Committee approved referee. Some countries have local regulations that may require a medical examination so it is worth checking before travelling and diving abroad. Potential new members who are undergoing the 'Try Dive' or other introductory course should be asked to sign a medical declaration, which states they have not suffered from diseases or conditions which would make aqualung diving hazardous. An example medical declaration can be obtained from the BSAC website www.bsac.com/trydive_poolsafety.

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Mixed gases (Technical diving)

The terminology 'mixed gases' can encompass many types of gases a diver could breathe during a dive. However, it is generally accepted that the main gas used is tri-mix. Tri-mix contains oxygen, helium and nitrogen in various percentages. The amount of oxygen in the mix is reduced the deeper the dive. This is to reduce the effects of high partial pressures of oxygen and to ensure the diver does not suffer from oxygen toxicity. The nitrogen percentage is also lowered to reduce the effect of nitrogen narcosis. Once the percentages of the oxygen and nitrogen have been calculated the balance gas added is helium. Tri-mix containing less the 17% oxygen, i.e. a hypoxic mix, should not be breathed on the surface or in shallow water. Divers using mixtures unable to support life at the surface are required to carry additional travel & decompression mixes and switch mixes at the appropriate depths. All divers should be aware that mixed gas diving, with its greater depths may also entail substantial amounts of decompression requirement and increases the element of risk. It is important that divers are not only suitably trained and qualified but gain depth experience and dive fitness in a progressive way.

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Multiple dives (Technical diving)

Technical divers should always track their oxygen uptake. When conducting multi-day diving, it is essential to ensure that the NOAA (National Oceanic and Atmospheric Administration) oxygen exposure limits for both the short term (central nervous system) and long term (pulmonary toxicity) implications are observed. BSAC recommendation is one deep dive in a 24-hour period.

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Neutral buoyancy

Neutral buoyancy is achieved when the diver is able to remain in either a static position in the water when using a rebreather or rises or falls about a static position as a result of breathing in and out when using open circuit equipment. Comfortable diving means the achievement of neutral buoyancy, if required, at any stage of the dive. Correct weighting is critical to gaining neutral buoyancy easily; the diver should carry just enough weight to hold a 6m decompression stop with a nearly empty cylinder. Where a drysuit is being worn the NDC strongly recommend that, as far as comfortably possible, the drysuit is used to maintain neutral buoyancy underwater.

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Night diving

Night diving, especially in tidal waters, requires very careful planning. Each diver should have a working torch otherwise the dive should be terminated. Each diver should carry a backup torch or some other means of identifying their position if their main torch fails. An efficient system of marking the point of exit must be employed. Care must be taken with diver to diver signals to ensure that the torch is not shone directly into the diver's eyes.

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Nitrogen narcosis

As the partial pressure of nitrogen in a diver's breathing gas increases with depth it begins to have a narcotic effect on the

diver. Nitrogen narcosis decreases a person's ability to cope with emergencies, slows down reaction and realisation time and increases the risk of an accident.

(See Equivalent narcotic depth).

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Nitrox

The use of nitrox (nitrogen / oxygen mixtures where the oxygen content is greater than that of air) as a breathing gas can provide a safety benefit in terms of a reduced risk of decompression illness, or enable longer dive times / shorter decompression stop requirements with no added risk. The use of nitrox has certain disadvantages which require training and suitable equipment to minimise the risk. Properly trained and qualified BSAC members are permitted to use nitrox on branch dives, with the approval of the Dive Manager. BSAC provides nitrox training within Ocean and Sports Diver qualifications and a range of further courses and qualifications in nitrox diving. BSAC recommends a maximum partial pressure for oxygen exposure when diving of 1.4 bar. For divers with additional appropriate qualifications a maximum partial pressure of oxygen for decompression of 1.6 bar is recommended. This figure will determine the maximum operating depth for any nitrox mixture. Failure to observe the maximum operating depth for any gas mixture may have fatal consequences due to the onset of oxygen toxicity. (See Cylinders (Nitrox and mixed gas) / Gas analysing (Technical diving)).

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No clear surface

(Cave diving, ice diving, diving inside wrecks). Members wishing to dive in caves should contact the appropriate cave diving organisations, as this is very specialised diving, in terms of technique and equipment, and is not covered in BSAC diver training. Diving under ice should only be undertaken with a surface party of at least two. This allows one to tender the divers, while the other is free, if required for any other reason, including an emergency. One of the divers must be securely roped to the surface, if diving

in pairs, and contact between them should be by means of a buddy line. Wrecks should not be penetrated without proper training and equipment. (See Wreck diving).

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Odd numbers

It is very strongly recommended that diving in 'odd numbers' be avoided, as the 'odd man out', to some extent, is without a buddy. Threesomes are not uncommon in incident reports.

(See Buddy diving and Trio diving).

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Oxygen

The administration of 100% pure oxygen following a decompression accident is recognised as an effective FIRST AID TREATMENT and may result in much less serious injuries. It SHOULD NEVER be regarded as a substitute for recompression, which is the only effective treatment in such cases. Members who have taken part in appropriate training courses and who have appropriate equipment, are recommended to use oxygen to treat any divers showing symptoms of decompression illness, while they are waiting for recompression treatment. Always consider the role of the rebreather in first aid following a DCI incident within the diving party. A rebreather allows prolonged oxygen enriched air to be made available to the conscious casualty. However, the use of the rebreather should be considered a back-up measure. The first preference would be dedicated oxygen administration equipment using an oronasal mask); then the rebreather (high oxygen content but via a mouthpiece) and finally using nitrox (lower oxygen content and via a mouthpiece). The only time oxygen should not be given is when the casualty is actually showing signs or symptoms of oxygen toxicity.

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Oxygen partial pressure

When mixed gases and nitrox are being used the partial pressure of oxygen (PO_2) should not exceed 1.4 bar for each mix used for

either travel (descent and ascent) or bottom phases. For divers holding an appropriate qualification a PO_2 of 1.6 bar may be used for decompression purposes down to a maximum depth of 10m. All divers who do not hold a suitable qualification should not exceed a PO_2 of 1.4 bar for any chosen gas mix.

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Pairing divers

The best option is to pair divers who are using the same type of dive equipment and who plan similar decompression schedules. If pairing together divers who are using different breathing gases or if pairing an open circuit diver with a rebreather diver, both divers must carry out the same decompression schedule to ensure they remain together at all times. This means that both divers should follow the most conservative schedule.

As with all diving, a thorough buddy check should take place prior to the dive.

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Patent foramen ovale

During pregnancy the right and left sides of the foetal heart are connected. The hole between the right and left sides is known as the foramen ovale. Normally this should heal over after birth, separating the venous and arterial blood supplies passing through the heart. However in a proportion of the population (perhaps 25%) this hole does not close up completely, resulting in a patent foramen ovale (PFO). The consequence for divers is that having a PFO can increase the risk of decompression illness. This occurs as a result of bubbles in the venous circulation (which would normally be filtered out in the lungs) shunting across to the arterial circulation, where they continue to expand in size.

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Pots and markers

Dive well away from fishermen's buoys, pots and pot markers, unless there are special circumstances.

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Pregnancy

Medical evidence as to the safety of diving whilst pregnant is not conclusive. However there is evidence that deep diving may cause harm to the foetus. Certainly decompression illness and its subsequent treatment could be harmful to the foetus. Consequently if a woman is pregnant, or is trying to become pregnant, she is strongly advised not to dive. Women who decide they wish to continue to dive whilst pregnant, or trying to become pregnant, should only undertake shallow dives, ideally less than 10m and no deeper than 20m, and remain well inside no-stop times. Even at shallow depths there remains a risk of pulmonary barotrauma which could require recompression treatment and cause harm to the foetus. If a woman discovers she is pregnant and has been diving during the pregnancy, she is advised to discuss her case with a BSAC medical referee. The scientific evidence is not clear cut and ultrasound studies, together with other indications, may be useful to allay fears and help in the decision as to how the pregnancy should be managed.

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Propeller guards

A propeller guard, fitted to an outboard motor, gives a degree of protection from injuries to divers. Before fitting a propeller guard, take note of the manufacturer's recommendations and instructions, as it is possible to cause stress to the gear box and low end of the engine. Some loss of power may result from fitting a propeller guard.

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Qualifying dives

Open water qualifying dives should be made under the guidance of a branch instructor or approved Dive Leader. Each dive should increase the diver's experience of differing underwater conditions and, where appropriate, follow the format laid out within the training scheme.

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Rebreathers

This section examines key areas specific to diving with rebreathers:-

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Rebreathers – Ascent

A rebreather diver should ascend slowly to allow proper venting of the breathing loop and to avoid becoming positively buoyant.

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Rebreathers – Boats

Increased care must be taken when manoeuvring a boat in the vicinity of rebreather divers as they may produce no, or very few, obvious bubbles. Boathandlers should be aware that a rebreather diver may surface unexpectedly, especially just after the initial descent. The boathandler should therefore patrol the dive site at a safe distance to enable an unplanned ascent by the rebreather diver. The rebreather diver should deploy a delayed SMB before surfacing unless they are returning up a fixed datum. The suitability of a boat as a diving platform and also the stowage possibilities for the rebreather to ensure adequate protection of rebreather units (e.g. hoses and cylinder valves) should be considered.

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Rebreathers – Breathing

It is recommended that rebreather divers make a conscious effort to breathe freely and normally. Many open circuit divers skip breathe, whether consciously or unconsciously. This practice will lead to carbon dioxide retention and is highly dangerous when applied to rebreathers. Pre-dive breathing checks should be conducted prior to entering the water.

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Rebreathers – Bubble check

As early in the descent as possible, but preferably no deeper than 6m, a bubble check should be performed to identify potential leakage.

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Rebreathers – Buddy diving

It is important to ensure the rebreather diver is partnered with a buddy who can assist them in the event of a problem. Therefore, BSAC recommends that, in order of preference, the buddy of a rebreather diver should be:

To 40m maximum:

- Another rebreather diver using the same type of rebreather (i.e. CCR with CCR or SCR with SCR)
- Another rebreather diver using a different type of rebreather (i.e. SCR / CCR mix)
- An open circuit diver.

From 40m to 100m:

Within this depth range rebreather dives will involve the use of gas mixes including helium and hence the above order of preference is modified to:

- Another rebreather diver with an appropriate mixed gas qualification using the same type of rebreather.
- Another rebreather diver with an appropriate mixed gas qualification using a different type of rebreather.
- An open circuit diver. Note: If diving below 50m the open circuit diver will also require an appropriate mixed gas qualification.

Where the buddy is not a rebreather qualified diver then the buddy of a rebreather diver (whether SCR or CCR) should be as a minimum:

- For dives to a maximum of 20m a BSAC Ocean Diver with basic nitrox training, the explicit approval of the Diving Officer and on a properly managed dive where surface rescue cover is immediately available. Both divers will be limited by the depth and no decompression limits of the Ocean Diver and no training should be allowed. The rebreather diver must be equipped with an alternate source (AS) accessible and usable by the Ocean Diver and consistent with their training.

- For dives to a maximum depth of 35m a qualified Sports Diver with nitrox training and with their DO's consent.
- For dives to greater than 35m, the buddy should be either a Dive Leader or a qualified Sport Diver holding an appropriate deep diving certification from a recognised training agency.
- For dives to greater than 50m should be as a minimum the holder of an appropriate mixed gas qualification from a recognised training agency.

The DO (or DM acting on behalf of DO) should ensure that the diver who will buddy a rebreather diver is:

- Experienced under the current diving conditions (i.e. depth, site and weather) .
- Capable of recognising the conditions of hyperoxia, hypoxia and hypercapnia.
- Capable of performing a rescue (CBL and surface support) on the rebreather diver in the case of an emergency.
- Is using a gas mix appropriate to the intended depth and be suitably equipped.
- carrying an independent bailout (i .e . redundant) breathing system . The capacity of this independent system (e .g . pony or twin set) should suit the dive profile of the dive being undertaken .
- carrying a DSMB (or SMB as appropriate) and at least one other surface detection aid.

The buddy check procedure should be modified to accommodate the rebreather layout and any controls the buddy may need to operate.

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Rebreathers - Checklists

Due to the more complex operation of rebreathers and the manufacturers' recommendations BSAC strongly advises the use of dedicated checklists to ensure that all pre-dive checks are fully and successfully completed before commencing a dive.

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Rebreathers – CO_2 absorbent material

It is imperative that for all rebreather diving the manufacturer's recommendations regarding both the type of absorbent material(s) and its effective duration are followed. Absorbent material should be stored and disposed of according to the manufacturer's instructions. It's important to note that long car journeys, bumpy boat trips, airplane flights and anywhere where there is vibration can have an effect on the packing of the absorbent material, possibly causing settling or 'channelling'. Both of these effects can adversely affect the performance of the absorbent material. This impact can be minimised by packing of the absorbent material as late as is practicable before the dive commences.

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Rebreathers – Decompression

The available entry-level training for rebreather diving incorporates limited decompression using nitrox as the breathing gas in rebreathers. Normoxic and full mixed gas rebreather training courses, available from recognized training agencies, provide qualifications involving more extended decompression diving. BSAC recommends that when using a rebreather for dives involving decompression, the maximum planned decompression requirement should not exceed that permitted by the unit manufacturer and / or the training agency certification held by the rebreather diver. For the decompression phase of the dive the actual PO_2 must not exceed 1.6 bar.

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Rebreathers – Equipment standard

Each model of rebreather is designed by its manufacturer to operate under a specific set of conditions and using specific gas mixes. These conditions may differ, not just from manufacturer to manufacturer, but also from model to model. Rebreather divers should ensure that they fully understand and observe the performance limits of their particular equipment. There is a growing range of independently produced modifications for rebreathers.

Before applying any such modifications to their rebreathers, divers should understand that any such modification extends the equipment beyond the design parameters envisioned by the manufacturer. Any such modification is therefore entirely at the risk of the user who needs to satisfy themself that the modification is not detrimental to the performance of the equipment. As part of the buddy check, the buddy of the rebreather diver should clearly understand the implications of the particular configuration of rebreather being used.

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Rebreathers – Hygiene

Rebreather divers should always disinfect the breathing loop in accordance with the manufacturer's recommendations.

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Rebreathers – Maintaining breathing loop volume

BSAC firmly believes that all rebreathers should be designed and manufactured as standard with an automatic means of maintaining an adequate breathing loop volume during the descent, to minimise the task loading to the rebreather diver. The manual addition of gas to maintain the breathing loop volume is required when an automatic diluent addition valve is not fitted, is isolated or fails. When an automatic diluent addition valve is not fitted a slow descent is recommended so that gas addition and buoyancy control can be managed without excessive task loading. The PO_2 in the breathing loop should be monitored to avoid excessive values during descent.

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Rebreathers – Oxygen monitoring

BSAC firmly believes that all rebreathers should be designed and manufactured with a facility for monitoring the oxygen within the breathing loop as standard. Furthermore, BSAC strongly recommends that rebreathers should not be used without an effective and efficient, real time PO2 and / or FO2 monitoring system that enables

the diver to know their precise content of oxygen in the loop at all times. Where such a system is fitted to a rebreather, the reading should be checked regularly and appropriate action taken if it is not at the expected value. Closed circuit rebreather divers should always use a diluent gas that has a PO2 equal to or lower than their maximum selected set-point to facilitate effective diluent flushes.

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Rebreathers - Oxygen cells

Oxygen cells fitted to rebreathers should be changed at the interval recommended by the manufacturer.

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Rebreathers - Pre-dive checks

Pre-dive checks should be conducted in accordance with unit specific training, including pre-breathing the unit prior to entering the water. The use of a pre-dive check list is very strongly recommended.

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Rebreathers - Rebreather diver rescue

Rebreather divers should ensure that their buddy understands the operation of their rebreather. The provision of adequate buoyancy to recover the casualty to / support the casualty at the surface, in the event of a rescue, should be emphasised. This may involve the need to close off the rebreather mouthpiece to counter the negative buoyancy incurred by loss of gas from the breathing loop.

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Rebreathers - Rebreather training

Divers wishing to use rebreathers should complete a training course provided by a recognised training agency. BSAC has introduced training courses for both SCR and CCR rebreathers. The training course should be specific to the particular rebreather that they wish to use and should be recognised by the manufacturer of that equipment. Divers wishing to extend their use of rebreathers to include gas mixes other than nitrox should complete a further unit

specific training course, provided by a recognised training agency, covering the use of such gas mixes. BSAC has introduced mixed gas rebreather courses. For diving within BSAC, qualified rebreather divers should register a copy of their highest rebreather qualification (entry level initially and, if subsequently upgraded, for mixed gas also) with BSAC headquarters. All such qualifications will be recorded on the member's individual membership record.

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Semi-closed rebreathers (SCR)

SCR - Ascent

A slow controlled ascent is important to avoid a drop in the partial pressure of oxygen in the breathing loop to hypoxic levels. It is therefore recommended that, whenever possible, ascents are made via a shot line or some other fixed datum. An SCR diver should flush the breathing loop before commencing an ascent, to ensure that the FO_2 is at a maximum and try to maintain this FO_2 during the ascent profile.

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SCR - Flow rate

When using an SCR the flow rate and gas mix recommended by the manufacturer for the planned dive should always be used. The flow rate should be tested prior to every dive to ensure it is within the manufacturer's prescribed limits.

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SCR - Surface swims

If a semi-closed circuit rebreather diver has to make a surface swim, BSAC strongly recommends that, in order to avoid the potential of hypoxia, the swim is completed using an open circuit regulator. If the gas within the bailout cylinder is planned to be used for a surface swim, then the pre-dive gas planning should take this into account when selecting the bailout cylinder.

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Closed circuit rebreathers (CCR)
CCR - Batteries

Any batteries in a rebreather should be changed or charged at the recommended intervals. Where batteries are rotated the new or fully charged battery should be powering the slave monitor wherever there is redundancy of control systems incorporated in the rebreather. This means that if the master battery fails there will always be an effective battery to power the control system.

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CCR - Partial pressure of oxygen (PO_2) / Set-Point

BSAC recommends the following maximum partial pressures of oxygen / set-points for the breathing mix for CCR diving:

1.3/ 1.4 bar PO_2 set-point during the dive

1.5/ 1.6 bar PO_2 set-point during decompression. When diving using gas mixes other than nitrox, the depth exposure and decompression obligations can result in significant exposure to high partial pressures of oxygen and its attendant CNS toxicity. For such diving use of a partial pressure / set-point lower than 1.3/1.4 bar PO_2 should be considered.

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Rebreathers in BSAC training

A BSAC publication titled “Rebreathers in BSAC Training” outlines the recommendations for the use of rebreathers in branch diver training and for BSAC events such as Skill Development Courses and Instructor Training Events. This publication is available from BSAC HQ or can be downloaded from the BSAC web site (www.bsac.com/rebreathers).

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Re-entry decompression

If a diver misses planned decompression stops, no attempt should be made to enter the water again in order to complete them. In this situation the diver is increasing the risk of decompression illness and merely placing a possible casualty in a hostile environment.

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Repeat dives

An appropriate planning tool should be used whenever planning and performing repeat dives. Where two or more dives are being made the same day, it is good practice to carry out the deepest dive first. You should also take care if you are involved in several days of diving deeper than 30m. It is probable that excess nitrogen will be accumulated over this period, and apparently 'innocent' dives, carried out near the end of the period of diving, can cause decompression illness. It is therefore recommended that any dive series involving consecutive days diving to 30m+ is limited to four days, after which a 24 hour break should be taken. (See BSAC 88 decompression tables / Dive computers).

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Rescue breathing and cardiac compression

When rescue breathing on land, the rate of ventilations should be judged by monitoring the rise and fall of the casualty's chest and the sound of the casualty's exhalations. To give a rescue breath, take 1 second to inflate, and then watch for the chest to deflate. When in water, the rate should be a minimum of 2 breaths/15 sec. When demonstrating or practising rescue breathing in the water, a proper seal (usually nose), should be made. A simulated seal is not sufficient to give the sense of realism required, and does not guarantee a successful acquisition of technique. The use of a manikin is strongly recommended when practising rescue breathing on land. Cardiac compressions should never be practised on a conscious breathing subject; a manikin should always be used. Cardiac compressions should be at a rate of 100-120 compressions/ min. When both techniques are being used a sequence of 30 cardiac compressions followed by 2 rescue breaths should be used.

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Risk Assessment

Safe Diving is founded on the processes of Risk Assessment and

it is inherent throughout diver training, dive planning and dive management. More information on Risk Assessment can be found at www.bsac.com/riskassessment

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Ropes and lines

Divers should take great care with the use of ropes underwater, especially using reels as distance lines from shot lines. Reels for SMB use should have a quick release system such as a bayonet fitting snap lock and divers should be taught how to use them. When divers do get into difficulties on ascent it is often the best course of action to ditch the reel so that both hands are free to deal with the situation. When using a reel and line as a bottom distance line, BSAC recommends that a reel and line which sinks is used and that when deploying line, hold the reel and line away from the body and especially the legs. It should also be recovered from in front of you. Never let a bight of line develop in front of you; slow down and wind in. Divers should always carry an adequate knife, especially when dealing with ropes and lines.

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Separated divers

If divers become separated underwater, a brief attempt (approx. 30 seconds) to re-locate should be made, after which the divers should surface. If the dive is subsequently re-commenced appropriate decompression planning must first be carried out.

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Signals

Divers should be completely familiar with the standard code of visual signals and should give them accurately and clearly. All signals should be acknowledged. The 'Come and get me' signal by a diver at the surface is to be used only for distress, and not as a 'Pick me up' signal. If the dive involves using ropes to signal all divers should have a clear understanding of the signals used and be practiced in using them.

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Skills practice

The essence of safe diving lays in the skill and competence of the diver; the more complex a dive the more important this is. A good level of skills can only be maintained and improved with constant practice.

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Solo diving

There are occasions, e.g. in nil visibility or when working underwater, when the 'buddy' system is ineffective. On these occasions a solo dive may be required, with the diver being securely roped and in constant rope communication with a surface 'tender', who should be a diver themselves. The rope must be securely fastened to a suitable object on the surface. Communicating signals must be fully understood and a fully kitted, roped, 'stand-by' diver must be immediately available to dive in the event of an emergency.

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Stand-by divers

On the majority of dives your stand-by diver is your buddy. A stand-by diver is required when a solo dive, using a rope tender, is in operation or as part of a pre-planned technical diving support team ready to come to the aid of the deep dive team member(s) following a predetermined signal (see Delayed surface marker buoy).

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Surface detection aids

Surface marker buoys (SMBs) should be used in significantly moving water, when operating well off shore, in areas with heavy surface traffic and where local regulations require it. There may be times, other than these stated, when their use might be deemed prudent by the Dive Manager. It is essential that correct training is given to new members in their use, as for any unfamiliar equipment. In some situations e.g. wreck sites with slack water, they are unnecessary and can actually be a hazard to the diver. It is also recommended that divers carry at least one additional surface detection aid. This

could be a signalling flag, stainless steel signalling mirror, personal flares, surface dye, torch, strobe, emergency position indicating radio beacon (EPIRB), whistle or audible signalling device.

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Tangle nets / Gill nets

Indiscriminate fishing, particularly on wreck sites, with difficult-to-see monofilament netting, is a real hazard around the British coast. Experiments have shown that the average diver's knife is very ineffective should the diver become entangled. A line cutter or a curved blade 'dinghy' knife, with a blunt end, are probably the most effective for this purpose and need to be worn on the arm. A knife with a sharp point could lead to a diver stabbing himself when in difficulties. Small shears or scissors are recommended as an effective tool for cutting netting. Once caught in netting, it is advisable to partially inflate your BC, so you rise inside the net, putting it under tension and making it easier to cut. The positive buoyancy will also help to 'tear' you away. If your buddy is free of the netting it may be easier for him to cut you away from the bulk of the netting but still enmeshed, and complete the job at the surface.

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Technical diving

BSAC uses the term technical diving to encompass mixed gas diving involving the use of helium based gas mixes and the use of Rebreather systems.

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Tides

The success of any sea dive depends on accurate, local, tidal predictions for the dive site you wish to visit. Admiralty charts give accurate large scale predictions and should be used in conjunction with the relevant local tide tables. Tidal Stream Atlases are also useful and are available for the UK and many other sea areas throughout the world.

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Training and qualification (Technical diving)

All divers who wish to undertake technical diving activities must have completed a technical training course. BSAC offers a comprehensive suite of courses and recognises the training of other agencies. See the BSAC website for more details.

All divers wishing to participate in technical diving should hold a minimum qualification of Sport Diver and a relevant nitrox certification.

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Trimix

Trimix is a mixture of three gases, oxygen, helium and nitrogen in various percentages. (See Mixed gases)

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Trio Diving

A key issue with trio diving is the distraction factor, which can impact either the identification of a developing problem or its subsequent resolution.

The task loading when diving in threes is increased and requires that all three divers are capable of coping. The following recommendations are therefore made for non-training dives:

- Diving in buddy pairs is preferable to diving in threes.
- Trio diving is not for the inexperienced or those unfamiliar with each other.
- Trio diving requires serious consideration by the Dive Manager to ensure that divers with the appropriate level of skill and reliability are grouped together.
- A dive plan understood and agreed by all divers prior to entering the water is essential.
- It should also be understood and agreed beforehand that the Dive Leader's decisions and directions will be adhered to.
- All three divers should consciously and conscientiously monitor both of their buddies.

• It is recommended that all divers should be equipped to be as self-sufficient as possible – i.e. each should have an adequate, completely independent bail-out gas supply; each should carry, and be able to deploy unassisted, a DSMB.

Training dives can involve groups larger than buddy pairs and for teaching some skills, e.g. Controlled Buoyant Lift this may even be necessary and requires separate consideration.

Where appropriate it may be prudent for instructors to be assisted by an experienced diver whose role is to act as safety monitor to both students and instructor.

(see Odd numbers and Buddy diving)

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VHF radio

VHF radios are a valuable aid to safety at sea and, together with suitable waterproof housings, are frequently used in small boats.

Radio installations should be covered by a Ship's Radio Licence and, under normal circumstances, should only be used by, or under the supervision of, someone who holds an appropriate Certificate of Competence.

It is an offence to use Marine VHF radio from the land, (unless it is a registered land station) so your shore party is not allowed to use one.

Many marine VHF radios include a Digital Selective Calling facility (DSC) and this capability brings additional safety features.

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Weather

Acquiring an accurate weather forecast for your dive site can save a lot of unnecessary travelling expense and can mean the difference between a controlled successful dive and a risky experience. BBC TV news bulletins are always followed by a UK forecast with easy to understand symbols. Some daily newspapers carry a good forecast with weather map, and the Maritime and Coastguard Agency always has an up to date forecast. MCA stations transmit on VHF radio local inshore waters forecasts. These forecasts are updated regularly

and are broadcast at set times published in nautical almanacs. These forecasts are always announced on Channel 16 VHF. Jersey Radio has a similar service for the Channel Isles. RAF stations have a meteorological station and are usually very helpful. The Shipping Forecast on Radio 4 is another very useful source. The Meteorological Office (Met Office) provides a telephone message and fax back service: its helpline is 0845 300 0300. Shipping and inshore forecasts for the UK can also be accessed via the Meteorological Office web site (http://www.metoffice.gov.uk/weather/marine). Divers are increasingly making use of websites and phone Apps for dedicated weather information. You should practice comparing these forecasts with observed conditions in order to judge the level of reliability to be expected from such forecasts especially for local conditions.

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Weightbelts / Integrated weight systems

Weightbelts or integrated weight systems, when used, should always be fitted with a reliable quick release and fitted so that they will always fall clear of other equipment when released. You should be practised in releasing your weights and should also make sure that your buddy is well briefed and fully familiar with your release mechanism. If the buckle is of the same type as on the cylinder harness, it is wise to wear it so that it operates in the opposite direction, to avoid confusion.

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Wreck diving

Wreck diving is one of the most popular forms of diving and requires extra safety precautions if divers venture inside the wreck. Many steel wrecks are in a dangerous state of decay, and loose overhead objects or steel plates are a real hazard. Never venture deep inside a wreck without ensuring your route to clear water is certain, and use a reel and line secured to the outside of the wreck to mark your return route. Avoid excessive finning inside a wreck as sediment stirred up is very slow to settle, due to lack of tidal flow.

Additional care should be taken if considering the penetration of a wreck to ensure that the hoses are not snagged in confined spaces or damaged by sharp edges. Always allow an adequate reserve of air at the end of your dive and never run down your air supply by attempting to remove an artefact. Never try to lift heavy objects from wrecks using your BC and / or drysuit. Underwater ordnance can be very unstable and should not be recovered. It is a criminal offence to be in possession of explosives without the relevant licenses. (See Diver's Code of Conduct).

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End

Military Diving

Recreational diving within the UK military is subject to the regulations in BRD 2806 (5), which references BSAC Safe Diving but may include additional requirements and so both documents should be referred to.

Additional information on dive planning when using computers.

Dive computers

When planning dives using a dive computer to monitor and manage a dive, no more than 3 dives should be carried out in a calendar day. Before commencing a further sequence of dives a minimum surface interval of 10 hours should be observed.

When multiple dives are being planned, the divers and SADS must ensure there is an appropriate surface interval between them commensurate with the depth and duration of each dive.

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THE DIVER'S CODE OF CONDUCT

More and more people are taking to the water; some for recreation; some to earn their living. This code is designed to ensure that divers do not come into conflict with other water users and sets out some guidelines which should be observed alongside the regulations relating to Marine Nature Reserves.

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Before leaving home

Contact the nearest BSAC Branch or the dive operator local to the dive site for their advice. Seek advice from them about the local conditions and regulations. If appropriate, have the correct chart and tide tables for the area to be dived.

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On the beach, river bank or lakeside

1. Obtain permission before diving in a harbour or estuary or in private water. Thank those responsible before you leave. Pay harbour dues.
2. Try to avoid overcrowding one site, consider other people on the beach.
3. Park sensibly. Avoid obstructing narrow approach roads. Keep off verges. Pay parking fees and use proper car parks.
4. Don't spread yourselves and your equipment since you may upset other people. Keep launching ramps and slipways clear.
5. Please keep the peace. Don't operate a compressor within earshot of other people - or late at night.
6. Pick up litter. Close gates. Be careful about fires. Avoid any damage to land or crops.
7. Obey special instructions such as National Trust rules, local bye-laws and regulations about camping and caravanning.
8. Remember divers in wet or drysuits are conspicuous and bad behaviour could ban us from beaches.

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In and on the water

1. Mark your dive boats so that your Club can be identified easily.
2. Ask the harbour-master or local officials where to launch your boat and do as they say. Tell the Coastguard, or a responsible person, where you are going and tell them when you are back.
3. Stay away from buoys, pots, and pot markers and don't interfere with them. Ask local fishermen where not to dive. Avoid driving through rafts of seabirds or seal colonies etc.
4. Remember ships have not got brakes, so avoid diving in fairways or areas of heavy surface traffic and observe the 'International Regulations for the Prevention of Collisions at Sea'.
5. Always fly the diving flag when diving, but not when on the way to, or from, the dive site. Never leave a boat unattended.
6. Do not come in to bathing beaches under power. Use any special approach lanes. Do not disturb any seal or bird colonies with your boats. Watch your boat's wash in crowded anchorages.
7. Whenever possible, divers should use a surface marker buoy.

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On conservation

1. Never use a speargun.
2. Shellfish, such as crabs and lobsters, take several years to grow to maturity; over-collecting in an area soon depletes stocks. Observe local Byelaws and restrictions on the collection of animal and plant specimens. However BSAC recommends that you do not collect shellfish, but if you must collect, only take mature fish or shellfish and then only what you need for yourself. Never take a berried female (a female with eggs), this is stock for future years. Never sell your catch or clean it in public or on the beach and do not display your trophies.
3. Ascertain and comply with seasonal access restrictions established to protect seabirds and seals from disturbance. During the seabird breeding season (1st March-1st August) reduce noise

and speed near seabird breeding sites. Do not approach seal breeding or haul-out sites. Do not approach dolphins or porpoises in the water.

4. Be conservation conscious. Avoid damage to weeds and the sea bed. Do not bring up sea-fans, corals, starfish or sea urchins - in one moment you can destroy years of growth.
5. Take photographs and notes - not specimens.

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On wrecks

1. Do not dive on a designated wreck site without a licence. Protected wrecks are indicated on Admiralty charts and marked by buoys, or warning notices on the shore nearby.
2. Military wrecks should not be disturbed or items removed from them. This includes the debris field. The debris field is the trail of wreckage that comes away from the main body of the wreck during the sinking process. This trail can consist of parts of the ship, the cargo and the personal possessions of the crew.
3. Do not lift anything that may be of Archeological importance.
4. If you do discover what might be an historic wreck do not talk about it, but contact the Receiver of Wreck (row@mcga.gov.uk), who will advise you about your next steps. If your find is important you may apply for it to be designated a protected wreck site. You can then build up a well-qualified team with the right qualifications to investigate your site with the assistance of a qualified archaeologist.
5. If you do lift any material from the sea-bed, it is a legal requirement to report it to the Receiver of Wreck as soon as reasonably possible; even if you own the wreck that the material has come from. Lifting material from the seabed is likely to require a licence from the Marine Management Organisation (MMO). For further information contact marine.consents@marinemanagement.org.uk

6. Avoid the temptation to take souvenirs. Go wreck diving to enjoy the scenery and life, or get involved in projects. If you must take something, try photographs or measurements, and records of marine life.
7. Know and understand wreck law. If you remove material from wreck, which you then sell for profit, you are diving for reward, which is outside the scope of sport diving and you must conduct your dives in strict accordance with HSE regulations. A sound knowledge of wreck law will prevent you breaking the law, perhaps even ending up with a criminal record where no crime was intended.

Members are reminded that in the light of this policy following any conviction of any BSAC member for an offence in relation to wreck the member will be liable to have his or her membership withdrawn for bringing BSAC into disrepute.

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Don't let divers down - keep to the diver's code

The Divers Code of Conduct that is set out immediately above was developed by BSAC many years ago, and is still relevant to all divers today. However environmental issues are of greater concern to all water users today than ever before, particularly when this Code was developed, and so BSAC will be actively developing its environmental presence by the development of the following policies:

- To provide education in environmental awareness, understanding and enjoyment.
- To promote Branch participation in environmental schemes and events.
- Highlight current environmental issues, and work with other environmentalists in order to provide a united approach to deal with these issues.
- To further develop and update the Divers Code of Conduct

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POLICIES OF BSAC

Environmental

To make a sustained and positive impact to the freshwater and marine environment.

Respect our wrecks

Do not dive on a designated protected site, and do not lift anything that appears to be of historical interest.

Safeguarding

Guidance to protect juvenile and vulnerable members of BSAC.

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Copies of all of these policies are available from BSAC Headquarters or you can download them at www.bsac.com/policies

For further details and information
please contact

**Diving Resources Department at
BSAC Headquarters:**

Tel: 44 (0)151 350 6200

Fax: 44 (0)151 350 6215

www.bsac.com

Email contacts:

**drt@bsac.com
membership@bsac.com**

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