Nitrox Workshop (Ocean Diver Level)

Instructor Manual

WORKSHOP

BSAC
Dive with us

British Sub-Aqua Club, Telford's Quay, South Pier Road, Ellesmere Port, Cheshire CH65 4FL
T: +44(0)151 350 6200 F: +44(0)151 350 6215 W: bsac.com

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Acknowledgement

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Andy Botten
Joint Service Sub Aqua Diving Centre
Ginge Crook
Fran Hockley
Dominic Robinson

Course details

Purpose

This workshop brings divers who do not have a Nitrox qualification to the same level as a BSAC Ocean Diver.

It is suitable for pre-2007 Ocean Divers or those from other agencies who have not been taught to use Nitrox.

Course authorisation

Instructors must record completion of this workshop using the Workshop Attendance Form.

The qualification will be added to a student's record once the Payment Required Qualification Card Form has been submitted.

Student Entry Level

Any diving grade recognised as equivalent to BSAC Ocean Diver but without a Nitrox qualification.

Qualification with this Workshop

On completion of this workshop, students will be qualified to use up to Nitrox 36 for no-stop diving on BSAC '88 tables or air computers.

Achievement targets

At the end of this module students should understand

- The basics of breathing gas mixtures
- The benefits that can be gained by breathing Nitrox
- The effect of oxygen on the body when diving and how to avoid oxygen toxicity
- How to analyse Nitrox

Practical

It is highly desirable for students to have practical experience of using a Nitrox analyser to determine a mixture in a cylinder. Students should also gain experience of marking cylinders once they have been analysed.

Theory assessment

The theory assessment can take place once the theory lesson has been delivered and a pass mark of 80 per cent must be achieved.

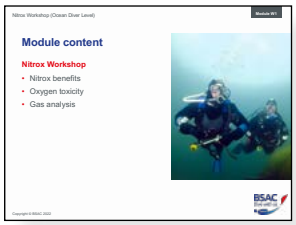
An oral assessment can be substituted if English is not a student's first language, or where a student has learning difficulties or difficulty with written English. This should be based on the theory paper provided and is be done one to one with a Nationally Qualified Instructor. A written record of the student's answers should always be made and treated as if written by the student.

The Nitrox Workshop (Ocean Diver Level)

This workshop provides divers who do not have a Nitrox qualification with the same level of knowledge as a BSAC Ocean Diver. On completion they will be qualified to use up to Nitrox 36 for no-stop diving on BSAC ‘88 tables or air computers.

The workshop is also designed to allow divers without a Nitrox qualification to progress onto Advanced Ocean Diver or Sports Diver training

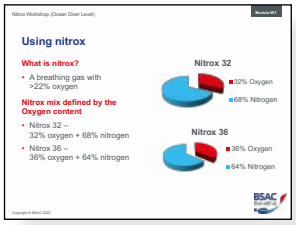
Module content



Nitrox Workshop

- **Nitrox benefits**
- **Oxygen toxicity**
- **Gas analysis**

Using nitrox



Nitrox is a breathing gas mixture made up of oxygen and nitrogen, where the percentage of oxygen is greater than 22 per cent.

Nitrox mixes, because they generally contain a greater percentage of oxygen, contain a correspondingly lower percentage of nitrogen. This helps to reduce nitrogen absorption.

What is nitrox?

- **A breathing gas with >22% oxygen**
  Ocean Divers may use nitrox mixes with up to 36 per cent oxygen in addition to air.

Nitrox mix defined by the oxygen content

- **Nitrox 32: 32% oxygen + 68% nitrogen Nitrox 32 contains 32% oxygen.**
- **Nitrox 36: 36% oxygen + 64% nitrogen Nitrox 36 contains 36% oxygen**

Nitrox benefits

There are a number of benefits associated with the use of Nitrox 32 or 36 as your diving gas in comparison with air (Nitrox 21).

Advantages of less nitrogen

- **Reduced risk of DCI when used with air table or computer**

  You can use nitrox to provide a greater safety factor against DCI: Air tables and computers (air) assume 79% N2, however, nitrox mixtures >21% oxygen have less nitrogen, therefore giving less exposure to nitrogen.

- **Some divers find it reduces fatigue**

  Divers often report that they feel less tired when diving on nitrox, but there is limited evidence to support this claim.

Disadvantages

On the flip side, there are some disadvantages of using nitrox

- **Nitrox divers can still suffer DCI**

  Divers are still exposed to nitrogen. Staying over time, rapid ascents, being unfit, drug/alcohol abuse, and all other usual causes of DCI cannot be ignored.

- **Some methods of cylinder filling can expose cylinders to 100% oxygen In such cases, cylinders must be in oxygen service**

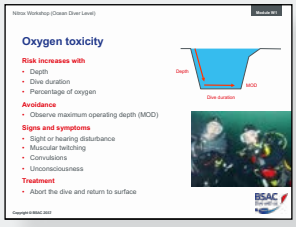
  - **Cylinders need periodic cleaning**

    Certain equipment may be dedicated for the use of Nitrox in excess of 40%. This may mean additional expense for annual cleaning and certification (oxygen service). Care needs to be exercised that the dedicated equipment is not accidentally contaminated.

- **Oxygen toxicity**

  Increased percentage of oxygen in the breathing gas, may lead to oxygen toxicity.

Oxygen toxicity



Although very unlikely to affect Ocean Divers, the following explains what oxygen toxicity is. While there are actually two types of oxygen toxicity, this section concerns only acute oxygen toxicity.

Acute oxygen toxicity can occur when oxygen is breathed in a combination of high percentage and high pressure. This risk increases with higher oxygen percentages, deeper depths and longer duration dives.

(Note: Advanced Ocean Diver and Sports Diver training covers the concept of partial pressures. This is an important concept but is too complex for at this level)

.Risk increases with

- **Depth**
  As the depth increases and the pressure increases, the body is subjected to higher levels of oxygen, which in turn raises the toxicity risk. Oxygen toxicity determines a maximum operating depth (MOD) for a particular mix, but staying within that MOD does not guarantee freedom from oxygen toxicity.
- **Dive duration**
  The length of time that oxygen is breathed at high pressures is also a major consideration.
- **Percentage of oxygen**
  Richer nitrox mixes also carry a higher risk of oxygen toxicity.

Avoidance

It is essential that oxygen percentages are checked by analysing the cylinder contents both at the filling station, and then again just before the nitrox mix is used. This ensures that divers know exactly what mixture they are breathing.

- **Observe maximum operating depth (MOD)**
  Knowing the percentage of oxygen in the mix allows the diver to accurately know the MOD of their mix. Do not exceed the MOD.

Signs and symptoms

The following signs and symptoms do not necessarily happen in any order and some may not happen at all.

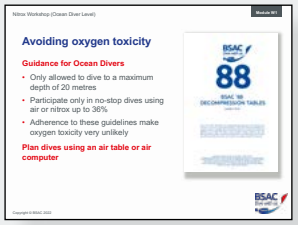
- **Sight or hearing disturbances**
  Visual or auditory disturbances, including dizziness or nausea, can occur.
- **Muscular twitching**
  Muscular twitching of the face, lips, or fingers may be seen.
- **Convulsions**
  In serious cases convulsions or fits may occur, which lead to a significant risk of drowning when underwater.
- **Unconsciousness**
  Unconsciousness may result with potentially serious consequences.

Treatment

Remind students that prevention is better than cure. Ocean Divers are restricted to 20m maximum depth and to nitrox mixes of up to 36 per cent, which should largely eliminate the risk of oxygen providing you follow the rules. In the event of an oxygen toxicity incident

- **Return to the surface, abort the dive**
  This may require the buddy to execute a rescue if convulsions or unconsciousness has occurred.

Avoiding oxygen toxicity



To ensure that Ocean Divers can safely use nitrox there are a number of controls have been put in place to minimise the risk posed by oxygen toxicity.

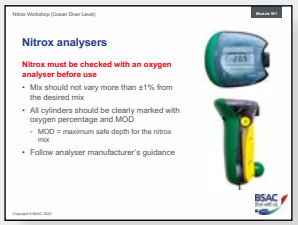
Guidance for Ocean Divers

The depth limit of 20m for Ocean Divers combined with the no-stop limit and choice of the standard gas mixes not exceeding 36 per cent virtually eliminate the risk of oxygen toxicity at this stage.

- **Only allowed to dive to a maximum depth of 20m**
- **Participate only in no-stop dives using air or nitrox up to 36%**
- **Adherence to these guidelines make Oxygen toxicity very unlikely**
  Plan dives using an air table or air computer.

In addition, Ocean Divers should treat nitrox as air when it comes to dive planning for increased safety over increased dive time. Advanced Ocean Diver and Sports Diver training covers the option of using nitrox to extend dive time.

Nitrox analysers



There are a wide variety of oxygen analysers available on the market, and the methods of operation of each are likely to differ, however, there is a generic principle of operation. We will go through an example (by kind permission of Analox.com) of such a generic principle of operation. It is important therefore, to follow the manufacturer's instructions for the proper use of the instrument in each case.

Nitrox must be checked with an oxygen analyser before use

Remind students that oxygen percentages should always be checked before use.

- **Follow manufacturer's guidance**
  Always read the manufacturer's instructions for the analyser and follow these carefully.
- **Mix allowed to vary ±1% from the stated mix**
  In September 2006, British Standard BS 8478:2006 was introduced defining what diver grade oxygen and nitrox is and what the measurement tolerances should be for a particular range of nitrox breathing mixes. This defines the standard for commercially supplied nitrox. For general measurements on site, if analysis shows that the mix is more than 1 per cent different from the mix desired, then the mix must not be used and the filling station requested to adjust the mix or refill the cylinder

Example: The desired mix is nitrox 32

Acceptable readings are between 31 and 33 per cent. Outside this is unacceptable.

- **All cylinders should be clearly marked with oxygen percentage and MOD**

  When using nitrox, all cylinders must be labelled with the percentage of oxygen contained and its MOD.

  » **MOD = maximum safe depth for the nitrox mix**

- **Follow analyser manufacturer's guidance**

  Always read the manufacturer's instructions for the analyser and follow these carefully.

Analysing a nitrox mix

Remind students to follow the guidance provided in the manufacturer's instructions. Wherever possible check the mix immediately before diving.

Ideally check the mix yourself

- **Calibrate the analyser**

  Start by calibrating the analyser to ensure it provides an accurate result. Switch on the gas analyser and do an air calibration. This is essential before use.

- **Keep flow rate even and low**

  Very slowly open the cylinder valve until the gas is heard gently hissing out. Present the analyser to the cylinder valve outlet and hold firmly to prevent gas escaping. Close the pillar valve after a short period (this will depend upon the analyser type). Take a reading. Care must be taken here to ensure that the cylinder gas reading is taken and not the surrounding, ambient air. Record the analysis: non-stable or erratic readings points towards analyser failure. Your analysis must be within plus or minus one per cent of your target mix.

- **Avoid windy conditions**

  Try to avoid taking measurements in windy conditions. The high airflow could result in inaccuracy.

- **Avoid moisture**

  Water vapour will reduce the life of your oxygen sensors and could result in imprecise results.

- **Store analyser away from elevated oxygen levels**

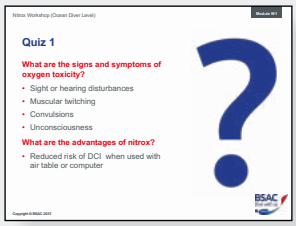
  Again, this would reduce the life of the oxygen sensor.

If using a filling station

Although the best advice is to check the fill yourself, many divers will not have access to their own analyser and will rely on the analysis of their gas provider.

- **Ask the technician to analyse the gas in your presence**
  Although breathing gas suppliers are rigorous in controlling breathing gas mixtures, experience shows that it is possible for a mixture to be supplied which does not correspond to the cylinder markings or desired mix. All breathing gas mixtures should be checked on receipt and re-checked immediately before assembling the scuba unit.
- **Filling stations may require a signature to confirm the percentage supplied**
  Many filling stations will show you the analyser and the percentage. Typically, they will then request a signature to confirm that you have accepted the mix provided. Note that you will normally be required to present your nitrox qualification when requesting and signing for a fill.

Quiz 1



Instructors should routinely check for transfer of knowledge to the students. This can be done by asking an open question such as:

What are the signs and symptoms of oxygen toxicity?

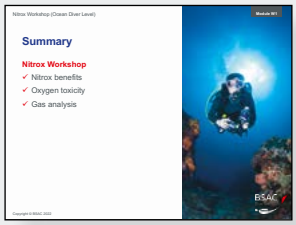
- **Sight or hearing disturbances**
- **Muscular twitching**
- **Convulsions**
- **Unconsciousness**

What the advantages of nitrox?

- **Reduced risk of DCI when used with air table or computer**

Correct any incorrect answers and reteach the relevant areas if necessary.

Summary



Recap the module objectives and provide students with opportunity to ask questions.

Nitrox Workshop

- **Nitrox benefits**
- **Oxygen toxicity**
- **Gas analysis**

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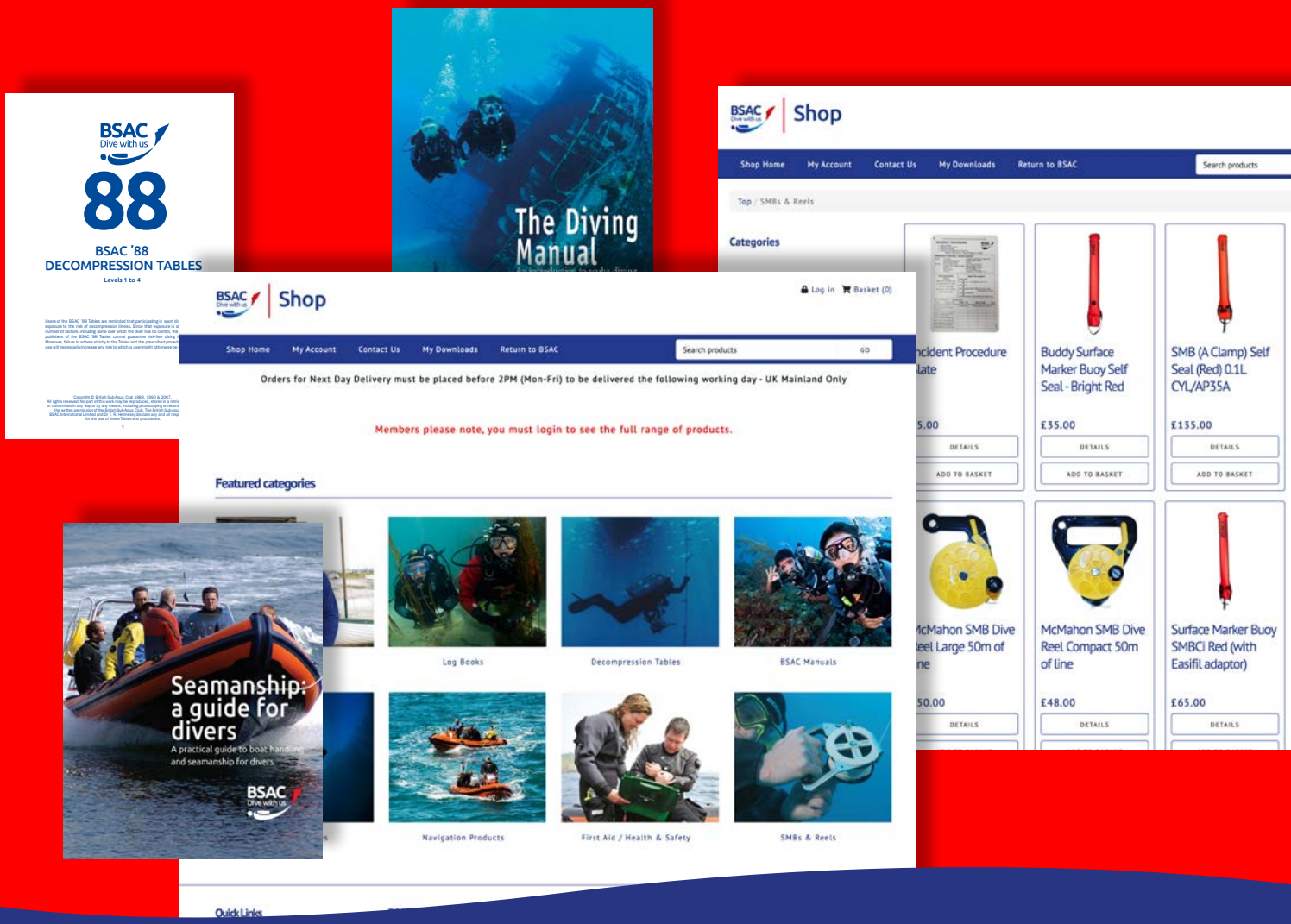

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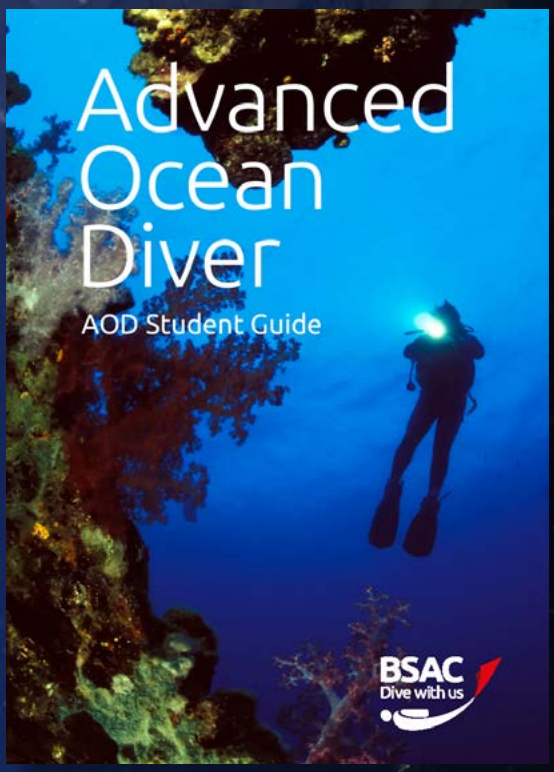
We highly recommend for your next skill development the Advanced Ocean Diver

AIM

This course has been designed to allow Ocean Divers to learn the theory and practical to support diving to 30 m. It encompasses both theory and practical diving and introduces equipment to aid navigation and the deployment of surface marker buoys.



COURSE OUTLINE

As an Advanced Ocean Diver trainee, they will then be expected to complete the following to obtain their AOD qualification:
Theory:

- Four theory modules to cover the equipment and techniques used to support deeper diving (these lessons can be classroom-based or delivered via eLearning)

Practical:

- An optional skill refresher session
- Two open water lessons
- Two depth progression dives (25/30m)
- A compass lesson which can be integrated into any of the other dives

ENTRY REQUIREMENTS

In order to attend this course, students must comply with the following:

- Qualified as a BSAC Ocean Diver

To enrol on the Advanced Ocean Diver, a trainee will need to have successfully completed the BSAC Ocean Diver course (or have an equivalent other agency qualification with Nitrox training). They must also be aged 14 or over to be able to progress to depths up to 30m.

If your club doesn't offer the course you want to do, you could attend a course run by a BSAC region **bsac.com/events** or at a BSAC centre **bsac.com/centres**

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Dive Planning and Management	SD
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Buoyancy and Trim	OD
Drysuit Training	OD
Equipment Care	OD
Compressor Operation	M
Nitrox Gas Blender / Mixed Gas Blender	SD

Technical

Open Circuit

Sport Mixed Gas Diver	SD
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Advanced Mixed Gas Diver	SD

CCR

MOD 1 AP Vision CCR Diver	SD
MOD 1 AP mixed gas top up	SD
MOD 2 CCR Diver	SD
CCR Inspiration Evolution/Vision Diver	SD
CCR Poseidon Se7en	SD
CCR Divesoft Liberty	SD
Advanced Mixed Gas CCR Diver	SD

Key:

M Any BSAC member can do this course.

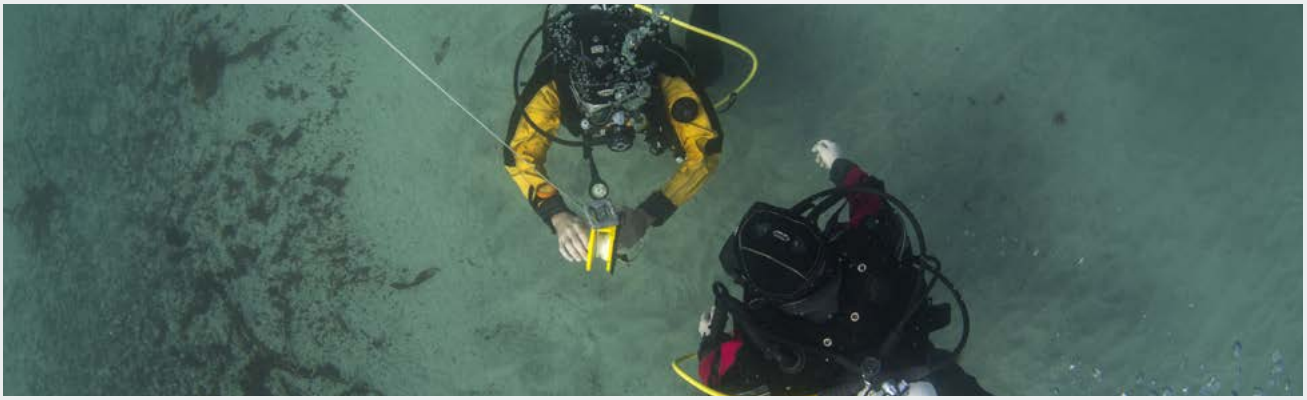
OD BSAC Ocean Divers (or acceptable alternative) and above can do this course.

SD BSAC Sports Divers (or acceptable alternative) and above can do this course.

Further prerequisites may apply such as minimum ages or buoyancy standards.

Book now

bsac.com/events



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