

THE BRITISH SUB-AQUA CLUB

Skill Development Course

Syllabus and Instructor Notes: Drysuit Training

COURSE AIM	To teach members the correct and safe techniques for drysuit diving.	
DURATION	May be conducted over a series of Branch meetings or may be run as a specific one-day course.	
ENTRY LEVEL	Trainee Club Diver who has completed all Theory Sessions and Sheltered Water Lessons.	
INSTRUCTORS	Any BSAC NQI who is an experienced drysuit diver. Instructor / Student Ratio: No limit for theory training: one instructor for every two students for all practical training: one to one advised for Club Diver open water lessons.	
FACILITIES	Classroom for theory lessons. Sheltered open water training area for Section 3 practical instruction, with depth ranging from 1.5m to 4m maximum, with entry / exit by shelving beach, steps or ladder. For initial experience a swimming pool is ideal, so long as overheating is not a problem. Drysuit, basic equipment, aqualung and BC, weightbelt, for each trainee. For open water experience dives a site with progressively shelving depth to a maximum of 15m is required.	
APPROVAL	Skill Development Course Approval is not necessary. This training can be given within BSAC Branches and BSAC Schools without reference to BSAC HQ.	
CERTIFICATION	Drysuit Diving certificate for the member's Qualification Record Book – Note 1.	
PROGRAMME	Instructor briefing Assemble, introductions, administration <i>Note: All students must take part in Sections 1, 2 and 3. Activities undertaken in Section 4 will depend on their diving qualification at the start of the Course, as these notes indicate.</i>	
Theory Lesson 1:	SECTION 1 - DRYSUITS AND EQUIPMENT - Introduction and lesson objectives - Review of physics: effects on a drysuit diver - Type of drysuits - Undergarments - Suit controls - Use of Buoyancy Compensator with Drysuit, for: <ul style="list-style-type: none"> • Emergency Buoyancy • Escape from depth • Escape from inversion • Emergency breathing - Suit care and maintenance - Summary	(45 mins)
Theory Lesson 2:	SECTION 2 - DRYsuit DIVING TECHNIQUES - Introduction and lesson objectives - Drysuit preparation, dressing	(45 mins)

- Correct weighting, buoyancy checks
- Drysuit diving in safety
- Emergency actions – ‘blow-up’, inversion, flooding
- Drysuit diver rescue
- Summary

Sheltered Water **SECTION 3 - USING A DRYSUIT** (3 – 4m Maximum depth) (120 mins)

Lesson

- Briefing
- Prepare and dress in drysuit
- Don aqualung: familiarise with suit controls,
- Enter water, buoyancy adjustment and trim, get the feel of the suit while swimming, ‘comfort factor’, descent and ascent under control
- Coping with / recovering from inversion underwater (1 – 2m max.)
- Coping with / recovering from ‘blow-up’ and inversion at surface, both as subject and buddy / helper
- Drysuit diver rescue: controlled buoyant lift of ‘casualty’ *
- Exit, remove equipment, remove drysuit, debrief.
- Summary

** Sports Diver and above only. Club Divers will cover these skills during Sports Diver training.*

Regardless of their diving qualification, students should only be allowed to progress to Section 4 – Drysuit Dive Experience, if they have displayed competence at the above skills.

Open Water **SECTION 4 - DRYSUIT DIVE EXPERIENCE** (60 mins)

Lesson

This experience will depend on the diving qualification held by the student at the start of Drysuit Training:

Trainee Club Diver: If Section 3 was carried out in a swimming pool, it should be repeated in shallow open water, integrated with initial Club Diver Open Water Dives. The Drysuit Diving Certificate can be awarded concurrently with Club Diver qualification.

Club Diver and above: If Section 3 was carried out in a swimming pool, it should be repeated in shallow open water. Once competence is demonstrated the dive can then be continued to greater depth. It is recommended that this initial drysuit dive should be limited to 15m maximum. The Drysuit Diving Certificate can be awarded on completion of this dive.

NOTES

1. Drysuit Diving QRB certificates are available free of charge from the Technical Support Department at BSAC HQ.
2. There are no Drysuit Training Visual Aids: appropriate Club and Sports Diver visual aids should be used.
3. When the Drysuit Training Course is offered as a one day course, appropriate account should be taken of the decompression implications of the number of ascents involved in Sections 3 and 4.

Instructor Notes

Section 1 - Theory Lesson: DRYSUITS AND EQUIPMENT

1.1 INTRODUCTION, LESSON OBJECTIVES (1 min)

- This lesson will tell you about the two different types of drysuit, the features they embody and why a BC should be used with a drysuit.
- Unlike a wetsuit, a drysuit is an 'active' piece of equipment that can cause problems if not used correctly.
- Drysuit diving involves new equipment and new skills: this course will introduce them, first in the classroom and then in the water.

1.2 REVIEW OF PHYSICS: EFFECTS ON A DRYSUIT DIVER (9 min)

- Review pressure / volume changes and behaviour of air spaces under pressure / underwater.
- Drysuits surround the diver's body with air, providing insulation – and buoyancy.
- On descent, increasing water pressure will squeeze the suit against the diver's body and this can be painful. Buoyancy will also be lost.
- Squeeze can be avoided by admitting air into the suit on descent. This also helps to regain lost buoyancy.
- On ascent expanding air must be released from the suit to maintain the same degree of buoyancy.
- Any excess air in the suit will always be at the highest point.
- Air migration is a term used to describe the movement of the 'air bubble' within the drysuit.
- Consequences of a change in position should be considered before it is made.

1.3 TYPE OF DRYSUITS (5 min)

- Types: Foamed / Crushed neoprene drysuits; Membrane drysuits. Characteristics of each material.
- Degree of insulation of each material and hence undergarment requirement.
- Natural buoyancy of materials affects weight requirement for neutral buoyancy.
- Style and characteristics of drysuits:
 - Entry zip: position, lubrication
 - Neck and wrist seals: neoprene / latex
 - Too tight a neck seal is dangerous
 - Tapered seals, to trim to size.
 - Leakage of seals due to tendons
 - Hoods, separate or integrated
 - Dry Gloves
 - Availability, price ranges

1.4 UNDERGARMENTS (5 min)

- Types, styles and characteristics
- Availability and price range

1.5 SUIT CONTROLS (5 min)

- Inflation systems: types and positioning
- Vent systems: types and positioning
- Interference of BC and other kit with suit valves

1.6 USE OF BUOYANCY COMPENSATOR WITH DRYSUITS

(10 min)

- A drysuit may contain air but it is not a lifejacket
- BC should be worn with a drysuit to provide:
 - Emergency buoyancy at surface to leave diver face up

Independent source of emergency buoyancy

Assists in escaping from inversion

Emergency Buoyancy

- Passive, fully kited diver with an inflated drysuit is likely to float on the surface face up but face submerged or awash. Air in drysuit moves about much more than air constrained in BC.
- Casualty requires buoyancy around shoulders: this can only be provided by a BC
- Direct feed inflation can be slow, especially late in a dive when cylinder pressure is low.

Independent source of emergency buoyancy

- Neoprene drysuits loose buoyancy at depth
- Membrane drysuits have no natural buoyancy
- If drysuit is holed and air is lost from within, buoyancy can be gained by dumping weight belt – or by inflating BC.

Escape from inversion (at the surface)

- If air has migrated to feet, inflation of BC usually 'levels things up' from which position diver can get vertical again – with buddy assistance if necessary. Inversion is not a serious problem if drysuit is correct size for the wearer.
- If inversion does occur, it suggests either
 - **too much air in the suit** to compensate for **too much weight on weight belt**
 - heavy equipment (cylinders etc.) being worn too high on the body
- Correct buoyancy adjustment is important if the drysuit diver is to be stable and comfortable.

1.7 SELECTION CARE AND MAINTENANCE

(5 min)

- Which suit is for you? Personal insulation factors – big bodies need less insulation than small ones
- Neoprene drysuits require thinner / fewer undergarments
- Membrane suits require thicker undergarments
- Total cost similar for either type.
- Care and Maintenance
 - Rinse drysuit in fresh water and allow to dry naturally, avoiding direct sunlight / excessive heat.
 - Check and clean the zip, lubricate with beeswax, strip and clean inlet and vent valves periodically.
 - Talc all seals before storing the suit.
 - Store by:
 - hanging suit from neck on a suitably padded hangar which does not place any strain on the neck seal
 - hanging by the boots on a purpose designed hangar
 - loosely roll.

1.8 SUMMARY

(5 mins)

- Review topics covered
- Invite and answer questions
- End of lesson test

Section 2 - Theory Lesson: DRYSUIT DIVING TECHNIQUES

2.1 INTRODUCTION, LESSON OBJECTIVES

(1 min)

- This lesson will look at the practical aspects of drysuit diving, in preparation for Practical training, and deals with:
 - Preparation and dressing
 - Drysuit Diving in Safety
 - Emergency Actions
 - Drysuit Diver rescue

2.2 PREPARATION AND DRESSING

(8 min)

- Check suit as it is unpacked, talc seal, lubricate zip
- Dress in drysuit undergarments
- Put suit on: feet in first, arms in, head through neck seal.
- Make neck and wrist seals, close zip.
- Squat to squeeze air out

2.3 CORRECT WEIGHTING

(7 min)

- Initially guess the weight and set up a belt accordingly
- Kit up in full diving equipment
- Enter the water with spare weights within reach, submerge vertically.
- Attempt buoyancy check – breathe out, sink, breathe in, float up.
- Adjust weight on the belt to achieve neutral buoyancy within the span of breathing, with no air in the suit.
- Now 1 – 2 kg to the weight belt to allow for the buoyancy change due to air consumption during the dive.
- Inflate suit to regain neutral buoyancy within the span of breathing.
- **The air within the suit will add a 'comfort factor' – the minimum amount of air to relieve squeeze, to give adequate insulation and minimum air migration.**
- On descent add small amount of air to restore comfort.
- On ascent vent air to maintain comfort factor / neutral buoyancy.
- Ankle weights may be used if feet tend to float.
- With an adjustable valve, achieve neutral buoyancy as above and set the valve so that it starts to vent air it is raised above shoulder level.
- There should be no need to continually adjust the valve on the dive, vent by raising the relative height of the auto valve or press the centre of the valve.
- During ascent be ready to manually vent air by pressing the centre of the valve body if necessary.

2.4 DRYSUIT DIVING IN SAFETY

(6 min)

- Keep the suit zipped up whenever in a boat
- Make sure controls are not obstructed by other kit.
- Do not dive with excess weights on the weight belt.
- Use BC for surface inflation and emergency buoyancy
- Ensure a thorough buddy check for ALL equipment.
- Avoid overheating if zipped into a drysuit
- Use the drysuit for routine buoyancy.
- Descend feet first and add air regularly to maintain buoyancy
- Ascend under control make sure vent air from arms
- **If ascent accelerates and vent valve can not cope, pull open neck seal or wrist seal.**

2.5 EMERGENCY ACTIONS

(8 min)

Blow up / Inversion

- Blow up or inversion usually caused by inflator valves sticking open, or too much air in the suit, or failure to vent the suit on ascent.
- Try to disconnect flowing direct feed.
- If too blown up and unable to regain control, flare arms and fins to create drag - **exhale**.
- If head is down at any point, air will migrate to the feet: beware of feet first ascent
- Divers should be able to restore head up position by **forward** roll

Inversion at the Surface

- Try a forward roll into a head up position
- Inflate the BC to regain horizontal attitude, roll face up by holding one arm out to side while pushing down hard with the other outstretched arm.
- Buddy can assist with these actions.

Flooded Suit

- Rare but possible, if zip or seals fail or suit is torn.
- Abort the dive, use BC for buoyancy
- Weight of water in suit may make exit difficult.

After Effects

- Loss of control following blow-up / inversion / flooding could lead to various injuries: striking surface obstructions, lung damage, DCI, drowning, shock, hypothermia etc.
- Treat accordingly.

Tight Neck Seals

- Sudden unconsciousness: tight neck seal / compression of air against neck seal on ascent can exert pressure on 'carotid sinus' in the neck, causing sudden unconsciousness.
- If a neck seal **feels** too tight, it **is** too tight: trim it to a more comfortable fit.

2.6 DRY SUIT DIVER RESCUE

(10 min)

- Bringing the casualty to the surface: as dry suit will contain air it is better to lift the casualty using the buoyancy of the suit rather than try to control air expanding in both the suit and the BC at the same time
- Technique will vary depending upon configuration of suit controls, importance of buddy check before the dive
- At the surface inflate the casualty's BC:
 - to help maintain a suitable posture
 - if AV is needed achieving adequate neck extension may cause air to leak from the suit around the neck seal
- Review underwater rescue procedures

2.7 SUMMARY

(5 min)

- Review and emphasise important points
- Invite questions and answers
- End of lesson test

Section 3 - Sheltered Water Session: USING A DRY SUIT

Prerequisites

- As a minimum, have completed all Club Diver theory and sheltered water practical lessons
- Have completed Sections 1 and 2 of this Course.

Targets

- On completion of this lesson, students should have demonstrated that they can:
- Put on and remove a drysuit with appropriate assistance

- Adjust and control buoyancy while using a drysuit
- Successfully manage air migration / inversion problems
- Perform CBL on a dry-suited diver (*Sports Diver and above only*)

Lesson Contents

3.1 ON SHORE

(15 min)

- Lesson briefing, objectives
- Dress in drysuit: sequence, making seals
- Kit up, buddy checks, including drysuit controls and how to do a CBL

3.2 STANDING DEPTH

(15 min)

- Enter water of standing depth. Notice squeeze on the lower limbs
- Submerge body to shoulder level, vent all air from the drysuit and BC
- Perform buoyancy check, achieve neutral buoyancy, then add 1- 2kg weight to belt.
- Regain neutral buoyancy with suit inflation, notice 'comfort factor'.
- Surface swims in full kit, with different degrees of inflation

3.3 UNDERWATER

(30 min)

- Familiarise students with suit and controls, progressively to a depth of 4m maximum
- Experience effect of air migration with different body attitudes / positions
- Note rates of inflation and venting, best body position when venting.
- **Warn students to exhale whenever ascending**

Buoyancy and trim

- Hover: neutral buoyancy
- Maintaining the 'comfort factor' throughout dive
- Best position of weights

Descent and ascent

- Head first and feet first descents
- Maintain neutral buoyancy / 'comfort factor' during descent and ascent

Inversion / Blow up drills

- Start each exercise at about 2m, head down to encourage air to migrate to legs.
- Swim down hard – can you overcome buoyancy?
- Forward roll into head up position
- Quick disconnect of suit inflator hose
- **Warn students to exhale whenever ascending**

3.4 ON SURFACE

(15 min)

Recovery from blow up and inversion

- Deliberately inflate suit fully at the surface until valve or seal blows – how does it feel? What is body attitude in water – head up or feet up? Face clear or submerged?
- With suit blown up, lay face down, one arm held close to body. Push down hard with other arm outstretched, to roll face up.
- Recover from position where face is up but submerged by inflating BC

3.5 DRYSUIT DIVER RESCUE (*Sports Diver and above only*)

(30 min)

- From 4m, student uses drysuit buoyancy to ascend to surface under control, venting drysuit as necessary. Repeat.
- From 4m, students use CBL to lift buddy to surface under control. Repeat.
- Buddy pairs reverse role

3.6 EXIT, REMOVE EQUIPMENT AND DEBRIEF.

(15 min)

- Teach an appropriate exit
- Remove diving equipment

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- Undress from drysuit, unzip, head out, arms out, remove suit.
 - Lesson debrief.

If this lesson is to be followed on the same day by an open water dive in drysuits, an appropriate surface interval of at least one hour should now be arranged.

Section 4 - Open Water Dive: DRYsuit DIVE EXPERIENCE

Prerequisites

- As a minimum, have completed all Club Diver theory and sheltered water practical lessons
- Have completed Sections 1, 2 and 3 of this Course.

Objectives

- On completion of this Drysuit Dive Experience, students should have demonstrated that they can dive safely in a drysuit, subject to the limitations of their diving qualification.

DIVE PLANS

Trainee Club Divers

- These trainees may not yet have started open water diving, or at best will have limited open water diving experience. Most will want to learn to use a drysuit in order to take their Club Diver Open Water Dives.
- The elements of Section Three should be integrated into initial Club Diver Open Water Dives building up drysuit skills as part of their development of buoyancy control. The Drysuit Diving Certificate can be awarded concurrently with Club Diver qualification.
- Maximum depth and leadership - as required for the Club Diver Open Water Lessons.

Club Divers

- Those who have gained their Club Diver qualification may now gain open water drysuit diving experience concurrently with Sports Diver open water lessons. They should repeat the Sports Diver Open Water Lesson, Rescue Dive 3 using a drysuit, even if they have already completed the exercise. The Drysuit Diving Certificate can be awarded concurrently with Sports Diver qualification.

Sports Diver and above

- Although experienced divers, it should be remembered that where drysuits are concerned, such divers are still learning. While the purpose of their initial open water drysuit dive is 'fun', rather than a strict training exercise, the student will be expected to demonstrate full control of the drysuit throughout the dive.
- A Controlled Buoyant Lift should be carried out from a depth not exceeding 6m. It should be performed before exceeding a depth of 6m and may either be incorporated into the initial or a subsequent dive.
- It is recommended that even for the experienced diver this first dry suit dive is restricted to 15m and that the Dive Leader is an experienced drysuit diver.
- The Drysuit Diving Certificate can be awarded on satisfactory completion of these exercises.