



CMAS

CONFÉDÉRATION MONDIALE
DES ACTIVITÉS SUBAQUATIQUES

WORLD UNDERWATER FEDERATION

CMAS Dry Diving Suit

Standards and Requirements

Version 2009/00

(BoD 166)

CMAS Dry Diving Suit Course Standard

Introduction

The original dry diving suit was invented by Siebe Gorman in the 19th century for use with their diving helmet. Because the suit and helmet were connected together the air supplied to the diver also prevented the diver being squeezed by the flexible suit. Modern swimming divers (frogmen) used self-contained breathing apparatus in the form of the oxygen Rebreather. Under these circumstances the dry diving suit was not supplied with air and the suit was allowed to compress down onto the diver's body, this was not too much of a problem because depth was restricted, due to the oxygen being breathed, to about nine metres (30feet).

With the advent of the open circuit scuba the plain dry diving suit became a problem for Scuba divers. This is despite Cousteau, in the 1940s, inventing a constant volume dry diving suit with the divers expired air being diverted into the suit via a connect to the face mask. The late 1950s saw the invention of the wetsuit, which then confined the dry suit to the rubbish bin of time.

The late 1970 saw the revival of the dry suit with new materials and the pressure being overcome by injecting low pressure air from the Scuba into the dry suit. Improvements in inlet valve design and automatic dump valves a new standard in comfort and protection was born.

The incident statistics of recent years has shown an unwanted growth in the number of divers being treated for decompression illness (DCI) associated with fast ascents. A high proportion of these accidents involve dry suited divers. There seems to be a number of divers with an inherent lack of dry suit diving skills. Further, the degree of faulty inlet and dump valves associated with these incidents also gives cause for concern.

The Purposes of a Dry Suit

In general the dry suit is used by divers to provide thermal protection. The temperature of the water is not the only factor; the duration of the dive is also very important. Divers have suffered hypothermia, even in tropical waters, where the sea temperature can be in the thirties (+30oC or +86oF), this was due long exposure times.

It should not be ignored that these suit also provide protection from a number of environmental hazards.

The beauty of the dry suit is its flexible nature allowing a verity of types of underclothes to be worn to match the challenges of the dive.

1. Course Classification (Type and level)

1.1. Classification

This CMAS Dry Suit course is for any grade of CMAS Diver.

1.2. Qualification term

This CMAS qualification has no expiry date.

1.3. Qualification Limits

Graduates are qualified to dive using a dry suit to the depth and other limitations of their diving grade.

1.4. Course documentation

The Course Director will provide all necessary course documentation.

2. Aims & objectives

The training aims and objectives are to provide candidates with information on the following:

- 2.1. Clear understanding of what is involved in diving with a Dry suit if a person has not dived in one previously or is intending purchasing one.
- 2.2. Provide a clear understanding of the types of dry suit available, including their advantages and disadvantages.
- 2.3. Environmental parameters - water temperature range and other environmental protection offered by different dry suit types.
- 2.4. Dry Suit construction: body materials, types of neck and wrist seal, waterproof zips including the advantages/disadvantages of each.
- 2.5. The types of suit entry available including their advantages and disadvantages.
- 2.6. Correct sizing the dry suit to allow freedom of movement to reach all carried equipment without being too excessive.
- 2.7. Trimming and fitting neck and wrist seals to fit.
- 2.8. Control valves: Low pressure power-inflation valves and connectors, automatic exhaust valves, cuff exhaust valves including their advantages and disadvantages.
- 2.9. Types of underclothing, including layering and wicking.
- 2.10. Fins for use with dry suits.
- 2.11. Head, hands and feet protection for dry suit diving.
- 2.12. Donning and doffing the dry suit and underclothing.
- 2.13. Static weighting for dry suit diving.
- 2.14. Buoyancy control.
- 2.15. Emergency Procedure Skills
 - 2.15.1. Inverted Position (Air in Feet)
 - 2.15.2. Inflator Valve Stuck Open
 - 2.15.3. Inflator Valve Stuck Closed
 - 2.15.4. Leaking Exhaust Valve
 - 2.15.5. Exhaust Valve Stuck Closed
 - 2.15.6. Slow Air Leak in Inflator Valve
 - 2.15.7. Loss/Interruption of Air Supply
 - 2.15.8. Flooded Drysuit
 - 2.15.9. Dropped/Lost Weight Belt
- 2.16. Routine user dry suit maintenance, including zips, cuff and neck seals, inlet and exhaust valves. The importance of checking the function of both inlet and exhaust valve should be emphasized.
- 2.17. Dry suit stowage, short term and long term.

3. Theoretical Training to Provide an Understanding of:

- 3.1. The different types of dry suits, the materials they are manufactured from and the properties of these materials.
- 3.2. Dry suit components and their functioning.
- 3.3. Theory of buoyancy control including the effects of dry suits.
- 3.4. Protection against cold when using dry suits
- 3.5. Simple maintenance that is required with dry suits. Repairs that can avoid leaks.
- 3.6. Pre-dive examination of and testing of seals, inflator valve and dump valves.

4. Practical Diver Training:

It is essential that all candidates are trained in the following:

- 4.1. Correctly sizing a dry suit to allow freedom of movement to reach all carried equipment without the suit being too excessive in size.
- 4.2. Dressing and undressing; including using underclothing. Different types of suit design for ease of entry and exit.
- 4.3. Candidate must connect their power-inflator direct-feed to their demand valve and test the operation with their dry suit.
- 4.4. With their dry suit on and before entering the water, candidates must test the function of:
 - 4.4.1. Operation of the Power-inflator when connected to the dry suit and air supply. Use four short injections of air. Ensure the flow of air is smooth and stops promptly when released and that there is no leakage of air from the connected valve when in the static position.
 - 4.4.2. With the automatic shoulder exhaust valve set to its minimum, partially inflate the dry suit, confirm air is dumped by squatting down.
- 4.5. To obtain and control neutral buoyancy.
 - 4.5.1. In the water at the surface, add static weight to the diver's weight-belt to overcome the positive buoyancy of the fully kit diver: This is with full dive cylinders with both the dry suit and the BCD fully deflated. The diver must also account for the increase in positive buoyancy that will be caused by the consumption of the breathing gas during the dive. Note: Air weights approximately 1.23g/litre.
 - 4.5.2. During the descent and at the operating depth the diver must release suit squeeze. This should be done by injecting a small amount of breathing gas into the dry suit. The objective is to allow the suit to gently hug the diver's body. Gas injections must be short and slow.

- 4.5.3. At the operating depth the volume of free-air in the suit must be closely controlled to a minimum. This is achieved by the diver adopting an upright position with the right arm raised above their head. The bubble of free-air should fill no more than a half the forearm of the suit. When swimming normally this will be sufficient to relieve suit squeeze and allow the underclothing to work correctly. For a new diver under these conditions the BCD should be used for buoyancy control.
- 4.5.4. Swimming attitude (trim):
The swimming attitude should be almost horizontal, slightly head-up. Trim can be adjusted by the position of the dive cylinder(s) and or weight-belt. Some use ankle-weights, which are often used to overcome the fear of inversion and/or poor diving technique and poor trim control. They lead to a feet-down attitude, damaging the environment and the fins alike. Rarely are they used for weight distribution. Proper static-weighting, cylinder and weight-belt positioning do a far better job.
- 4.5.5. Ascending from a dive wearing a dry suit:
- 4.5.5.1. After agreement with your buddy to end the dive, prepare for the ascent: At least on your first few dry suit dives ascend via the shot/anchor line. This will provide you with an anchor point if your buoyancy is slightly out on these occasions. Use the Federation's standard ascent procedure the with following additions as necessary:
- 4.5.5.2. Set the shoulder valve to fully open. This will allow the suit to vent-off properly during the ascent; without assistance from the diver.
- 4.5.5.3. If necessary dump extra air from the suit by lifting the shoulder valve above the height of the shoulder and the valve will vent-off.
- 4.5.5.4. Use the normal procedure to vent-off the BCD.
- 4.5.5.5. Commence the ascent at the Federation's standard ascent rate.
- 4.5.5.6. On the surface fill the BCD with air to maintain surface buoyancy and comfort.
- 4.5.6. Lifting heavy objects by using a lifting bag, not by the inflation of the dry suit or BCD.
Note: If the dry suit/BCD is used and the heavy object is dropped the increase in positive buoyancy can put the diver's life in danger. Whereas, releasing a lifting bag it will head for the surface without affecting the diver.
- 4.5.7. Dry Suit flooding: divers need to know that a dry suit flood is not a catastrophic disaster. It may be wet and cold, but it's not the end of the world:
- 4.5.7.1. Use the BCD to regain neutral buoyancy.
- 4.5.7.2. Position the dry suit leak as low as possible to minimise air loss.
- 4.5.7.3. Terminate the dive as soon as possible after informing your buddy.
- 4.5.7.4. Ascend in a controlled manner and complete all necessary stops along the way.
- 4.5.8. Dealing with an inversion: **IMPORTANT** - If the diver gets the static weight right, uses the BCD for buoyancy control, does not over-inflate the dry suit, an inversion is very unlikely. However, in the event of an inversion:
- 4.5.8.1. Swim hard for the bottom, hold on to the wreck or reef. Hold on and roll into a feet down position. Air will then rise to the shoulders where the diver should vent it off. If need be via the neck or a wrist seal.
- 4.5.8.2. In a mid-water inversion: kick hard toward the bottom, bend forward at the waist, and roll to an upright position. Immediately vent the dry suit through the exhaust valve or via the neck or a wrist seal. If unable to recover to an upright position and are experiencing an uncontrolled ascent, flare the body to reduce the speed of your ascent. Spread the arms and legs away from your body, with the fins parallel **to the surface. Continue exhaling all the way to the surface.**
- 4.5.9. Lost weight-belt:
- 4.5.9.1. If the weight-belt or one section of a built-in weight system is lost; dump air from the dry suit/BCD and swim hard for the bottom, hold on to the wreck or reef. If the diver or buddy can retrieve the weight-belt do so and re-fit it.
- 4.5.9.2. If weight-belt recovery is not practical, ascend, if possible, by using the anchor-line to control the positive buoyancy. Otherwise, run the line end from the diving-reel through a D-ring on the BCD and tie it to the wreck or reef. Now use the reel to control the ascent to the surface, make all necessary stops along the way.
- 4.5.9.3. If the weight-belt is lost mid-water use 4hb above.
- 4.5.10. User and dealer Maintenance.
Proper equipment maintenance save both lives and money. It falls into two categories: 1. Owner post dive maintenance and owner routine Pre-dive testing. 2. Annual dealer maintenance.
- Owner Post Dive Maintenance:**
- a. **After use:**
- Wash and dry naturally; not in direct sunlight.
 - Depress the inflation valve button when washing it with warm fresh water, to remove grit/sand.
 - Automatic shoulder valves should be washed in a similar manner.
 - The outer body of the shoulder valve should be rotated during washing. Finally, warm water (30°C max) should be run through the shoulder valve from the inside to the outside.
 - Check the valve for correct function, replace faulty or damaged parts.
 - Check the suit for any damage and repair as necessary.
 - Dust cuffs and neck seal with pure talc (non-perfumed).
 - Lubricate the zip on the outside only with Bee's wax or Paraffin wax (remove any granules) leave unzipped.
 - Flooded suits need washing inside and outside. Wash the inside first and allowed to dry, then deal with the outside.
 - For hygienic reasons suits need to be washed on inside at least once a year.

b. Post Dive checks:

- Check all valves for function, replace faulty or damaged parts.
IMPORTANT: Valves may seize up during storage.
- Check the suit for any damage repair as necessary.

Annual dealer maintenance

- a. Dry suit should be checked annually by the manufacturer or an appointed agent.
- b. **Important Note:** An increasing number of dry suit divers are being treated for DCI as a result of fast ascents caused by poor dry suit maintenance. For this and other obvious reasons the Owner routine maintenance of dry suits is extremely important. Furthermore, dry suits cause divers to perspire, even in temperate conditions; this can lead to dehydration and DCI. Drink around two litres of water per day and remove the dry suit between dives.

5. Practical work:

Instructors will demonstrate the following and then candidates must practise, under supervision, until the required competence is achieved. Candidates must be able to demonstrate:

- 5.1. **The ability to select the correct size of dry suit for their needs and correctly don the suit showing all on-shore checks.**
- 5.2. The correct basic buoyancy static weight set-up and correct buoyancy control during sheltered shallow-water training dive, taking account of the increase in buoyancy that will occur due to the consumption of breathing gas.
- 5.3. A final ascent incorporating the appropriate signals to and from the buddy to terminate the dive and start the ascent. The ascent must be via a heavily weighted or fixed ascent-line to provide insurance against a buoyant ascent. The diver must set the dry suit up for the ascent by setting the shoulder dump valve to its minimum setting, preparing the BCD for the ascent and then make a controlled ascent to the surface. On the surface the diver will inflate the BCD to ensure surface buoyancy, check the buddy and then signal the shore OK.
- 5.4. The inversion control procedure. **IMPORTANT:** For this exercise candidates should be tethered, by a line, to the pool floor to prevent an uncontrolled ascent to the surface (rather like stabilizer wheels on a child's bicycle).
- 5.5. The reel and line technique (see item 4ia above) for controlling a buoyant ascent caused by a lost weight-belt.
- 5.6. The correct procedures for owner routine dry suit maintenance and pre-dive functional testing.

Federations should set a short examination paper to check the divers understanding of physics and practical use of dry suit diving. The pass mark should not less than 80%. The above skills demonstrations by the diver must be to the complete satisfaction of the course Director or Club Diving Officer.

6. Practical Exercises:

These exercises must be practised once the student has completed the basic training:

- 6.1. Efficient donning and doffing the dry suit with varying amounts of underclothing, the purpose is to ensure:
 - 6.1.1. All equipment works well without let or hindrance from each other.
 - 6.1.2. That all control can be reached by the diver in all conditions and positions, and
 - 6.1.3. The correct static weighting is used with the various undergarment arrangements, with account being taken, in each case, for air consumption.
- 6.2. Suit control procedures:
 - 6.2.1. Valve control both gas in and gas out, including:
 - 6.2.1.1. Lifting the left arm to raise the shoulder valve to assist gas dumping.
 - 6.2.1.2. Using a cuff dump valve where fitted.
 - 6.2.1.3. Using the centre push valve on the shoulder valve to speed dumping.
- 6.3. Emergency procedures:
 - 6.3.1. Cuff and neck dumping of gas to arrest a fast ascent.
 - 6.3.2. Controlling a lost weight-belt event.
 - 6.3.3. Controlling a buoyant ascent.
 - 6.3.4. Assisting another dry suit diver having difficulty with buoyancy control – this may mean using their dump valves or dumping from their neck/cuff seals.
- 6.4. Proving all suit valves work effectively in the water.
- 6.5. Adjusting buoyancy underwater at differing depths – using lungs, BCD/ dry suit inflation.
- 6.6. Perform stops at different depths to demonstrate appropriate buoyancy control.

7. Instructor Qualification

An instructor of any grade can give and qualify divers on this course so long as they have attended a Dry Suit course or are Instructors who are experienced Dry Suit divers.

8. Certification:

On satisfactory completion of the course graduates will be award an appropriate C-card or certificate by the adjudicating Federation.

This course is not a pre-requisite for any other qualification.