

Syllabus Number: 3.B.31 / BOD no 181 (04-18-2013)
CMAS Self-Rescue Diver Training Programme
Minimum Course Content

1. Required theoretical knowledge

1.1 Subject Area 1: Introduction

1.1.1 Candidates shall be provided with:

- 1.1.1.1 All such knowledge to enable them to make a safe recover to the surface in the event that he becomes separated from his dive buddy.
- 1.1.1.2 Dive planning techniques to provide a suitable amount of breathing based on their actual "measured" surface air consumption rate (SAR) plus back-up gas.
- 1.1.1.3 Techniques for safe exit to the surface in the event of positive buoyancy event (eg a lost weight-belt), including making all necessary stops.
- 1.1.1.4 Practical techniques for cutting themselves free from an underwater entanglement involving line, rope and netting.
- 1.1.1.5 Practical deployment, from the dives MOD, of a red delayed surface marker buoy (DSMB) and a yellow DSMB from the final stop to the surface with instructions to the surface attendants to send down extra breathing gas.
- 1.1.1.6 Time limited (3-minutes max) search techniques to find a lost buddy using light and sound signals.

1.1.1.7 Specific Minimum Equipment

- 1.1.1.8 Each candidate will kit themselves with an appropriate dive suit for the planned conditions plus:
 - 1.1.1.8.1 Multi dive cylinders Scuba suitable at least for for the planned maximum operating depth (MOD) of this training programme, complete with two sets of demand regulators (DVs) and contents pressure gauges. One of the second-stage DCs will be fitted with 1.5 metre a second stage hose. This set will be mounted on a suitable Buoyancy Control Device (BCD), with at least two D-rings.
 - 1.1.1.8.2 At least one time/depth measuring device. And personal decompression computer.
 - 1.1.1.8.3 Mask and fins plus one back-up mask. Note the back-up mask will be stored in a suitable accessible pocket either on the BCD or dive suit.
 - 1.1.1.8.4 A lockable reel and line suitable for the planned MOD. Plus one Red DSMB and one yellow DSMB. Plus one back-up reel and line.
 - 1.1.1.8.5 One main torch and one back-up torch.

Note: Prior to the commencement of class, students should consult with a CMAS representative to verify that their equipment complies with the course requirements.

1.2 Subject Area 3: Physics and theory of Technical skills diving

- 1.2.1 These practical skills will be taught and practised during safe swimming pool sessions and three open water dive with a maximum operation depth (MOD) of 20metres. The skills will be assessed on a continuous basis throughout the course with constructive Instructor feed-back to the candidates. The theory sessions will classroom based supported with question and answer session at the end of each topic.
- 1.2.2 In addition their current knowledge candidates will determine their own surface air breathing rate (SAR). This will be done in a swimming pool, under the watchful eye of the Course Instructor, before the main course starts. The candidates will swim underwater circuits around a shallow swimming pool until they have consumed 10bar worth of pressure from a Scuba, with say Water Capacity (WC) of 12 litres). The starting cylinder pressure will be recorded at the start of the swim and the time taken to consume this gas will be noted and used to calculate their personal SAC.
Example: Using a twelve litre dive cylinder with a working pressure of 232bar to swim circuits around a swimming pool at a constant depth of 3-metres takes 10 minutes to consume 10bar.

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Initial gauge reading: 232.0bar

Reading after 10 mins: 209.9bar

22.1bar

Which gives an average of: $22.1 / 10 =$

2.21 bar per minute at 3 metres.

Now adjust back to the surface pressure of one bar, by dividing by the absolute pressure, which in this case is 1.3bar.

$2.21 / 1.3 = \text{bar/minute/metre (depth)}$

1.7 bar per minute

Or on litres per minute using a 12 litre WC dive cylinder =

$12 \times 1.7 =$

20.4 litres/minute

The Breathing Gas Estimating Table shown below is used to determine the required "Basic" gas requirement for any proposed dive. The diver must add emergency/back-up gas to the determined "basic" gas value.

**A Breathing Gas Estimating Table
with gas usable in bar/minute, not litres/minute**

Depth (m)	WC 12-litres				
	1	5	10	15	20
3	2.2	11	22	33	44
6	2.7	14	28	42	56
9	3.2	16	32	48	64
12	3.7	18	36	54	72
15	4.2	21	42	63	84
18	4.7	24	48	72	96
21	5.2	26	52	78	104
24	5.7	28	56	84	112
27	6.2	31	62	93	124
30	6.7	34	68	102	136
33	7.2	36	72	108	144
36	7.7	39	78	117	156
39	8.2	42	84	126	168
42	8.7	44	88	132	176
45	9.2	46	92	138	184
48	9.7	48	96	144	192
51	10.2	51	102	153	204

Breathing Gas Estimation Table
For dive cylinders with a water capacity (WC) of 12-litre

Assumed gas consumption rate: 20 litre/minute/bar

Note, these Tables are cylinder water capacity (WC) size specific. The enable the dive to determine their gas requirements directly in "bar per minute" for any tabulated depth with minimal calculation. Furthermore, the results plus any back-up gas (in bar) the dives wishes to include can be directly compared to the contents pressure gauge of the Scuba being used.

Example 15 minutes at 30 metre requires
101 bar + back-up gas

- 1.2.3 Instructors should show candidates how use this system. A batch of PowerPoint slides are shown in the appendix 1 attached to this syllabus, which can assist in this process. Furthermore, a copy of the illustrations is available in PowerPoint to assist Federation/Instructors prepare their course material.
- 1.2.4 Instructor may like to show candidates how to prepare their own Air Estimating Tables for other cylinder WCs and breathing rates.
- 1.2.5 Instructors will give advice and practical guidance on the determination of the quantity of back-up gas required for a range of dive types.
- 1.2.6 Increasing the quantity of carried breathing gas can cause buoyancy issues. For example increasing the carried gas from a single 12 litre cylinder increases the weight of the air from 3.4kg to 6.8kgm. Discuss management techniques so as to avoid positive buoyant ascent problems and negative buoyancy during the dive.
- 1.2.7 Instructor will set a dive planning problem for candidates to solve by preparing a dive gas plan including the provision of back-up gas. In appendix 1 of this syllabus, there is PowerPoint set of slides, which set out the extent of the level required with, worked a worked example plus a sample ascent gas plan for candidates to do in class. Instructors should also set homework for candidates prepare for the three 20metres to be completed during this course. Instructors will

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- set the parameters for the dive plan, which may have imaginary decompression stops and include the dive plan's mid-point turning time and pre-determined mid and end point pressure gauge readings. The candidates will be assessed not just on the plans they prepare, but also on the manner in which they enact each plan.
- 1.2.8 Equipment configurations, number of cylinder methods of mounting and management will be discussed for a range of dives. This should include the issues involved with single dives cylinders and loss of gas during a single-point of failure. Discuss the benefits/disadvantages of each system including avoiding the avoidance of back strain. PowerPoint slides are available and are included in appendix 1 of this syllabus.
 - 1.2.9 Discuss the benefits/disadvantages of using extra-long second stage DV hoses. Point out that the 2-m hoses may be an advantageous if tight squeeze situation and allow single file swimming, but they have been known to cause snagging problems.
 - 1.2.10 Equipment configurations should be arranged to allow free-hand access to all valves on all equipment and all other gear eg knives, torches, back-up mask etc. Furthermore, configurations must not inadvertently operate BCD and/or dry suit valves.
 - 1.2.11 Candidates will be taught to self-release themselves from underwater entanglements, using their **own** cutting tools, of line/rope/net cutting (to be taught and practised in a safe location with excellent visibility), with an Instructor close by for safety purposes: First with clear vision and then with a blacked-out mask. Instructors must underwater close at hand to the candidates to ensure they can assist in releasing individual in the event of problem.
 - 1.2.12 Emergency controlled ascent following an unintended positive buoyancy event (eg loss of weight-belt etc), e.g. using a hand-held reel fitted with a locking device and line.
 - 1.2.13 **Tethered-Ascent – Self-Rescue** - At MOD of the dive, enact a *simulated* positive buoyancy event self-recovery. Instructors will teach the candidates how to recover from a positive buoyant event when on a reef or wreck, with the aid of a locking divers reel and line. Pass the free-line-end of a locking-dive-reel through a D-ring on the BCD and tie to the reef or wreck, dump all stored gas from the BCD and/or dry suit. Now unwind the reel to control the ascent rate within the safe decompression limit. Once at the first stop lock the reel and make any necessary adjustments of buoyancy by dumping excess stored air from the BCD and or dry suit. On completion of the stop time release the reel lock and continue the controlled ascent to the next stop and repeat the buoyancy adjustments as required. At the final stop, repeat the procedure and send up a red DSMB and follow it with a yellow DSMB with a note asking for additional breathing gas. Note: During the candidates first Tethered Ascent a second line should be fixed to a D-ring on his BCD to allow the Instructor to maintain control and avoid any unwanted fast ascent. (There are PowerPoint slides in appendix 1 and real PowerPoint slides are also available. Candidate will repeat this Tethered-Ascent - Self-Rescue during each of the open water dives of this course. Assessment will be on a continuous basis with constructive feed-back.
 - 1.2.14 Candidates will be taught and practice light and audio signalling techniques to attract a lost buddy, alone with basic search techniques with a defined time constraint (3-minutes max) for re-buddying.
 - 1.2.15 Candidates will at the course MOD exchanging the primary DV for the alternative DV and shut-down the primary gas cylinder. Then remove their face-mask and hand it to the Instructor. Once this has been completed, he will remove his back-up face-mask from its storage pocket then fit and clear it of all water. Tis procedure will be completed, to the Instructor satisfaction, during each of the course dives.
 - 1.2.16 Instructor will teach how to set a red location DSMB from the maximum planned depth and then set an emergency yellow DSMB from the Safety-stop to the surface with a message outlining the diver's predicament. Each candidate will set both a red and yellow DSMB during each of the three course dives.
- 1.3 Instructors will provide the means of blacking out the back-up mask as required by 1.2.11 above.