

20. Semi-Closed Circuit Rebreather Instructor, Unit Specific- DOLPHIN, RAY, Atlantis, SUBMATIX ST100 & AZIMUTH

20.1 Introduction

This is the entry-level certification course for instructors wishing to teach one of the following semi-closed circuit rebreathers; Dolphin, Ray, Submatix ST100 or Azimuth. The objective of this course is to train instructors in the benefits, hazards and proper procedures while teaching SCR rebreather courses.

20.2 Qualifications of Graduates

Upon successful completion of this course, graduates may teach no decompression diving activities utilizing the Dolphin, Ray, Submatix ST100 or Azimuth to a maximum depth of 40 metres / 130 feet, to divers; utilizing nitrox mixes not exceeding their level of certification.

20.3 Who May Teach

Any active TDI Rebreather Instructor Trainer may teach this course. Specific TDI Instructor Trainer certification required for each specific rebreather.

20.4 Student to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and time are provided to ensure comprehensive and complete training of subject matter

Confined Water (swimming pool-like conditions)

1. N/A

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 6 students per instructor trainer for the Draeger units, for the Azimuth and Submatix units a maximum of 4 students per instructor trainer; it is the instructor trainer's discretion to reduce this number as conditions dictate

20.5 Student Prerequisites

1. Minimum age 18
2. Certified as a TDI Rebreather diver; specific certification required for each specific rebreather
3. Certified as a TDI Nitrox Instructor, or equivalent
4. Provide proof of 10 semi-closed rebreather logged dives, dives conducted during this course cannot be included

20.6 Course Structure and Duration

Open Water Execution

1. A minimum of 6 dives with a minimum of 150 accumulated minutes for the Azimuth
2. A minimum of 4 dives with a minimum of 100 accumulated minutes for the Drager units
3. A minimum of 5 dives with a minimum of 125 accumulated minutes for the Submatix ST100

Course Structure

1. TDI allows instructor trainers to structure courses according to the number of students participating and their skill level

Duration

1. The minimum number of classroom and briefing hours is 6

20.7 Administrative Requirements

The following are the administrative tasks:

1. Collect the course fees from all the instructor candidates
2. Ensure that the instructor candidates have the required equipment
3. Communicate the training schedule to the instructor candidates
4. Have the instructor candidate:
 - a. Complete the *TDI Liability Release and Express Assumption of Risk form*
 - b. Submit the *TDI Medical Statement* form signed by a licensed physician

Upon successful completion of the course the instructor trainer must:

1. Issue the appropriate TDI certification by submitting the appropriate TDI Dive Leader Registration form to TDI Headquarters

20.8 Training Material

Required material

1. *TDI Diving Rebreathers Diver Manual*
2. Specific manufacturer manual for the rebreather being dived
3. *TDI Standards and Procedures Manual*
4. *TDI Diving Rebreathers Instructor Guide*
5. *TDI Diving Rebreathers PowerPoint (optional)*
6. *TDI Diving Rebreathers Instructor Resource CD*

Optional Material

1. TDI plastic EAD and PO₂ tables
2. Nitrox and rebreather equations software

20.9 Required Equipment

The following equipment is required for each student:

1. Rebreather specific to the training being conducted
2. Integrated PO₂ monitoring device for inhaled PO₂ for each rebreather
3. Mask and fins
4. Exposure suit appropriate for the open water environment
5. Access to oxygen analyzer, instructor may supply
6. Appropriate weight
7. Bailout cylinder, minimum size 1.9 litres / 13 cubic feet
8. Flow meter, instructor may supply

20.10 Required Subject Areas

The *TDI Diving Rebreathers Manual* and the manufacturer's manual are mandatory for use during this course; instructor trainers may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit, and Semi-closed Circuit
3. Practical Mechanics of the System
 - a. Assembly and disassembly of the rebreather
 - b. Layout and design
 - c. Scrubber recharge
 - d. System maintenance
 - e. Breathing loop decontamination procedures

4. Review of Nitrox
 - a. Dalton's Law (triangle)
 - b. Optimum nitrox mix
 - c. Oxygen (O₂) tracking
 - d. Gas preparation
 - e. Dive planning examples
5. Gas Physiology
 - a. Oxygen (O₂) toxicity
 - b. Hyperoxia
 - c. Hypoxia
 - d. Asphyxia
 - e. Hypercapnia
 - f. Nitrogen absorption
 - g. Carbon dioxide (CO₂) toxicity
 - h. Gas consumption
 - i. Cylinder sizes
 - ii. Depth and workload
6. Formula Work / Metabolic Consumption
 - a. Oxygen (O₂) metabolizing calculations
 - b. Inspired (O₂) calculations, rebreather equation
 - c. Equivalent air depth (EAD)
7. Dive Tables
 - a. Inspired oxygen (O₂) table
 - b. Equivalent air depth
8. Dive Computers
 - a. Mix adjustable
 - b. Oxygen (O₂) integrated
 - c. Percentage oxygen (PO₂) monitoring devices
9. Problem Solving
 - a. Canister flooding
 - b. Mouthpiece loss
 - c. Scrubber exhaustion
 - d. Battery or sensor loss
 - e. Breathing Bag rupture
 - f. Open circuit bailout system
 - i. On board gas
 - ii. Off board gas
 - g. Hyperoxia scenario
 - h. Hypoxia scenario
 - i. Hypercapnia scenario
 - j. Post problem maintenance of equipment

10. Dive Planning
 - a. Operational planning
 - i. Gas requirements
 - ii. Oxygen limitations
 - iii. Nitrogen limitations

20.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed 1.6 ATM PO₂. The following skills must be completed by the student during open water dives:

1. Properly analyze gas mixture
2. Perform all pre dive checks, positive, negative, flow rate, by-pass regulator operation, relief valve pressure, a minimum of 6 times
3. Demonstrate a leak check and repair scenario
4. Demonstration of integrity of exhale counterlung for Submatix ST100
5. Properly packing a scrubber canister a minimum of 2 times; if using the ExtendAir cartridge one packing must be with granular material
6. Properly execute set-up and breakdown a minimum of 6 times for Azimuth or 4 times for Draeger and Submatix ST100 rebreathers
7. Demonstrate adequate pre-dive planning limits based on:
 - a. System performance
 - b. Oxygen exposures at planned depth with mix
 - c. Nitrogen absorption at planned depth with mix
8. Properly execute the planned dives within all pre-determined limits
9. Properly execute a recovery from a system failure and switch to bail-out stationary a minimum of 2 times
10. Properly execute a recovery from a system failure and switch to bail-out hovering a minimum of 2 times, one of the bail-out scenarios the diver must switch to open circuit and complete dive and safety stop on open circuit; direct ascent must begin when diver switches to open circuit, this scenario should be conducted no deeper than 20 metres / 60 feet
11. Properly demonstrate hose clearing technique after each bail-out scenario
12. Perform block switch a minimum of 2 times, Azimuth only
13. Proper PO₂ monitoring on all dives, if unit is equipped with PO₂ monitoring device
14. Properly execute a mask clearing exercise with emphasis on minimal gas loss

15. Safely and properly execute a buddy out of air scenario, it is preferable the buddy is on a SCR unit also
16. Diver will demonstrate actual safety stops at predetermined depths
17. Properly execute cleaning and maintenance of the rebreather, including breathing loop decontamination

In order to complete this course, students must:

1. Satisfactorily complete the TDI Diving Rebreathers course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution