

29. Advanced Mixed Gas CCR Instructor - Unit Specific

29.1 Introduction

This is the instructor level certification course for instructors wishing to teach the mixed gas closed circuit rebreather course. The objective of this course is to train instructors to teach mixed gas rebreather diving, and to develop technical rebreather diving skills appropriate to diving to a maximum depth 100 Metres/330 Feet or the maximum depth set by the manufacturer of the specific unit, using mixed gas with minimum 5% oxygen as a diluent.

29.2 Qualifications of Graduates

Upon successful completion of this course, graduates may teach the TDI Advanced Mixed Gas Closed Circuit Rebreather unit-specific course not to exceed the manufacturers designed depth maximum or 100 Metres/330 Feet using mixed gas with minimum 5% oxygen as a diluent.

29.3 Who May Teach

An active TDI Instructor Trainer with a unit specific advanced mixed gas instructor trainer rating.

29.4 Student to Instructor Ratio

Academic:

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

Confined Water (swimming pool-like conditions):

1. A maximum of 2 students per instructor trainer; it is the instructor's discretion to reduce this number as conditions dictate.

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

1. A maximum of 2 students per instructor trainer.
2. It is the instructor's discretion to reduce this number as conditions dictate.

29.5 *Student Prerequisites*

1. Minimum age 21.
2. TDI CCR Mixed Gas (unit specific) Instructor (or equivalent) with 15 mixed gas students taught and 1 year teaching experience on the unit specific CCR.
3. Provide proof of 25 logged mixed gas dives deeper than 60 Metres/200 Feet on the unit specific rebreather .

29.6 *Course Structure and Duration*

Open Water Execution:

1. Four dives.

Course Structure:

1. TDI allows instructors 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.
2. A maximum of 3 in-water sessions per day and a maximum of 2 decompression dives per day.

29.7 *Administrative Requirements*

Administrative Tasks:

1. Collect the course fees from all the students.
2. Ensure that the students have the required equipment.
3. Communicate the schedule to the students.
4. Have the students complete the:
 - a. *TDI Liability Release and Express Assumption of Risk* Form
 - b. *TDI Medical Statement* Form

Upon successful completion of the course the instructor must:

1. Issue the appropriate TDI certification by submitting the *TDI Diver Registration* Form to TDI Headquarters or registering the students online through member's area of the TDI website.

29.8 *Training Material*

Required Material:

1. *TDI Diving Rebreathers* Student Manual and Knowledge Quest or eLearning.
2. *TDI Diving Rebreathers* PowerPoint presentation.
3. *TDI Advanced Trimix* Student Manual and Knowledge Quest
4. *TDI Standards and Procedures* Manual.

Optional Material:

1. TDI Rebreather Cue Cards.
2. TDI CCR Instructor Evaluation Slate.
3. Richard Pyle - A Learners Guide to Closed Circuit Rebreather Operations.
4. Kenneth Donald - Oxygen & The Diver.
5. John Lamb – Oxygen Measurement for Divers.
6. Barsky, Thurlow & Ward - The Simple Guide to Rebreather Diving.
7. Bob Cole – Rebreather Diving.
8. Jeffrey Bozanic – Mastering Rebreathers.

29.9 *Required Equipment*

The following equipment is required for each student:

1. Closed-Circuit rebreather, the student must own or have access to their own CCR.
2. Depth gauge and automatic bottom timer and/or dive computer.
3. Mask, fins.
4. Exposure suit suitable for the diving environment.
5. Knife.
6. Slate and pencil.
7. Three bailout cylinders with appropriate capacity for the planned dive and with mix appropriate for the planned depth.

29.10 Required Subject Areas

Instructor trainers must use the TDI Diving Rebreathers Student Manual, PowerPoint presentation, TDI Advanced Trimix Student Manual, manufacturer's manual and the current TDI Standards and Procedures Manual but may also 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 Rebreather Systems and the Benefits/Problems with Each.
3. Practical Mechanics of the System:
 - a. Assembly and disassembly of unit specific CCR.
 - b. Layout and design of the unit.
 - c. Absorbent canister design and maintenance.
 - d. Breathing loop de-contamination procedures.
 - e. The Manufacturer supported additional fittings, automatic diluent valve (ADV).
4. Gas Physiology:
 - a. Oxygen (O₂) toxicity.
 - b. Nitrogen absorption.
 - c. Carbon monoxide (CO₂) toxicity.
 - d. Gas consumption.
 - e. Equivalent narcotic depth.
 - f. Gas density.
5. Electronic Systems Design and Maintenance:
 - a. Oxygen (O₂) metabolizing calculations.
 - b. Fuel cells.
 - c. System electronics functionality and calibration procedures.
6. Dive Tables:
 - a. Equivalent air depth (EAD) operation.
 - b. Constant partial pressure of oxygen (PPO₂) theory.

- c. Central nervous system (CNS) and awareness of oxygen tracking units (OTU).
 - d. Software generated dive profiles.
- 7. Dive Computers:
 - a. Mix adjustable.
 - b. Constant percentage of oxygen (PO₂).
 - c. Oxygen (O₂) integrated.
- 8. Dive Planning:
 - a. Operational planning.
 - b. Gas requirements including bailout scenarios.
 - c. Oxygen limitations.
 - d. Nitrogen limitations.
 - e. Diving in mixed teams.
- 9. Emergency Procedures:
 - a. Use of B.A.D.D.A.S.S.
 - b. Three H's problems.
 - c. Flooded loop.
 - d. Cell warnings.
 - e. Battery warnings.
- 10. Team Diving Considerations:
 - a. Purpose of dive
 - b. Use of pre-dive checklists
 - c. Buddy checks
 - d. Dive planning and setpoints
 - e. Bailout scenarios

29.11 Required Skill Performance and Graduation Requirements

The following skills must be completed by the instructor candidate. The maximum training depth shall not exceed the manufacturer's design limit or 100 Metres/330 Feet.

The following skills must be completed by the instructor candidate.

1. Demonstrate proper analysis of all gas mixtures to be used.
2. Demonstrate a complete unit buildup using manufacturer's unit build checklist, system check and rebreather configuration.
3. Demonstrate adequate pre-dive planning limits based on:
 - a. Personal gas consumption.
 - b. Oxygen consumption and exposures at planned depth.
 - c. Nitrogen absorption at planned depth.
4. Properly execute the planned dive within all pre-determined limits.
5. Demonstrate the proper procedures for:
 - a. Buoyancy control.
 - b. ADV use.
 - c. Bail-out.
 - d. Mouthpiece removal.
 - e. Ascent techniques.
 - f. Safety stops.
 - g. Buddy checks.
 - h. Simulated emergency.
6. Properly execute the breakdown and maintenance of rebreather.
7. Candidate must log dives at the end of each diving day.

In order to complete this course, students must:

1. Satisfactorily pass the TDI Advanced Trimix written examination with a minimum score of 80 percent without reference and be able to adequately explain each answer to a prospective student.
2. Demonstrate mature, sound judgment concerning training, dive planning and execution.
3. Complete all open water requirements safely and efficiently.
4. Demonstrate proficiency in teaching all skills in the unit specific advanced mixed gas diver standards.
5. Present a minimum of 1 passing graded presentation on an advanced mixed gas closed circuit rebreather topic.

6. Present and evaluate all subjects covered in the unit specific diver standards.