

27. Helitrox Diluent CCR Decompression Procedures Instructor - Unit Specific

27.1 Introduction

This is the instructor level certification course for instructors wishing to teach the unit specific closed circuit rebreather helitrox diluent decompression procedures course. The objective of this course is to train instructors to teach recreational rebreather diving, and to develop basic rebreather diving skills appropriate to diving within the normal recreational depth limits for decompression diving to 45 metres / 150 feet using oxygen (O₂) and helitrox (minimum 20% oxygen, maximum 35% helium) as diluent.

27.2 Qualifications of Graduates

Upon successful completion of this course, graduates may teach the TDI Closed Circuit Rebreather Helitrox Diluent Decompression Procedures course not to exceed the manufacturers designed depth maximum of 45 metres / 150 feet with helitrox diluent. This course is manufacturer specific.

27.3 Who May Teach

Any active TDI Helitrox CCR Rebreather Instructor Trainer with a unit specific qualification may teach this course

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

27.5 Student Prerequisites

1. Minimum age 21
2. Certified TDI Unit Specific Rebreather Diver, or equivalent
3. Certified TDI Advanced Nitrox Instructor, or equivalent
4. Certified TDI Decompression Procedures Instructor or Helitrox Deco Procedures Instructor, or equivalent
5. Provide proof of 250 verified logged dives, 100 being on nitrox
6. Provide proof of a minimum of 100 logged dives and a minimum of 100 hours on the specific unit
7. Be a certified rebreather diver (not unit specific) for a minimum of 12 months
8. If the rebreather is a TDI approved sidemount rebreather, the student must hold the TDI Sidemount Instructor certification or equivalent.

OR

9. Be a current TDI Air Diluent CCR Instructor (unit specific) and TDI Open Circuit Helitrox Decompression Procedures Instructor (or equivalent)

27.6 Course Structure and Duration

Open Water Execution

1. Four dives

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

27.7 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 candidates:
 - 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

27.8 Training Material

Required material

1. *TDI Diving Rebreathers* Student Manual or eLearning
2. *TDI Diving Rebreathers* Instructor Guide
3. Manufacturer's manual and updates
4. Manufacturer's Build Checklist
5. *TDI CCR Preflight Checklist*
6. *TDI Decompression Procedures* Student Manual or eLearning
7. *TDI Extended Range and Trimix Diver* Student manual or eLearning
8. *TDI Extended Range and Trimix Diver* Instructor Guide
9. *Rebreather Course Evaluation* Form (see appendix)
10. Manufacturer's minimum training standards
11. *TDI Standards and Procedures* Manual

Optional Material

1. *TDI Diving Rebreathers* PowerPoint Presentation
2. *TDI Extended Range and Trimix* PowerPoint presentation
3. *TDI Rebreather* Cue Cards
4. *TDI Scenario* Slates (14)

27.9 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 unit specific. Any modifications must be approved by the manufacturer.
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. Bailout cylinder with appropriate capacity for planned dive
8. Ascent reel with lift bag / surface marker buoy with adequate lift and size for the dive environment and a backup.

27.10 Required Subject Areas

Instructor trainers must use the *TDI Diving Rebreathers* and *TDI Extended Range and Trimix Student Manual* or eLearning, instructor guides, manufacturer's manual and the current *TDI Standards and Procedures*, 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 the unit specific CCR
 - b. Layout and design of the unit
 - c. Absorbent canister design and maintenance
 - d. Breathing loop de-contamination procedures
 - e. Manufacturer supported additional fittings, automatic diluent valve or (ADV)
 - f. Keying valve to individual's metabolic rate (if unit is equipped with this valve)
 - g. Valve maintenance
 - h. DSV (mouthpiece) use, design and limitations
4. Gas Physiology
 - a. Oxygen (O₂) toxicity
 - b. Nitrogen absorption
 - c. Carbon dioxide (CO₂) toxicity
 - d. Gas consumption
5. Electronic Systems Design and Maintenance
 - a. Oxygen (O₂) metabolizing calculations
 - b. Equivalent air depth (EAD) theory revision
 - c. Fuel cells
 - d. System electronics functionality and calibration procedures
 - e. Battery condition / testing
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 (OTU)

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 open circuit bailout scenarios / limitations
 - c. Oxygen limitations
 - d. Nitrogen limitations
 - e. Off board open circuit bailout
9. Emergency Procedures
 - a. Use of B.A.D.D.A.S. - Bail out, Anxiety breaths, Decide – Diluent flush, Always know your PO₂, Skills to overcome problem
 - b. Three H's problems
 - c. Flooded loop
 - d. Cell warnings
 - e. Battery warnings / failure
10. Helium Considerations
 - a. Helium absorption and elimination
 - b. Advantages of hyperoxic mixes for decompression
 - c. Advantages of helium for bottom gas
 - d. Hypoxia
 - e. HPNS
 - f. Effects on respiration
 - g. Effects as an insulator
 - h. Helium limitations

27.11 Required Skill Performance and Graduation Requirements

The following skills must be completed by the instructor candidate. The maximum training depth shall not exceed the manufacturers design limit.

1. Demonstrate proper analysis of all gas mixtures to be used
2. Demonstrate a complete systems check and rebreather configuration
3. Demonstrate appropriate pre-dive planning limits based on:
 - a. Personal gas consumption
 - b. Oxygen consumption and exposures at planned depth
 - c. Nitrogen absorption at planned depth
 - d. Thermal constraints

4. Properly execute the planned dive within all pre-determined limits
5. Demonstrate the proper procedures for:
 - a. Mouthpiece familiarity drills
 - b. Bailout drills
 - c. Gas shutdowns and loss of gas
 - d. Broken hoses
 - e. Flooded absorbent canister
 - f. CO₂ breakthrough
 - g. Semi-closed mode
 - h. Low oxygen drills
 - i. High oxygen drills
 - j. Flooding Loop
 - k. Electronics and battery failure
 - l. Properly execute the ascent procedures for an incapacitated CCR diver and tow the diver a minimum of 50 metres at the surface with both rescuer and victim wearing complete CCR diving system and bailout system
6. Properly execute the break down and maintenance of rebreather
7. Demonstrate comfort swimming on surface and at depth carrying one bailout/decompression cylinder
8. Demonstrate ability to drop and retrieve one bailout/decompression cylinder while maintaining position in the water column
9. Demonstrate ability to deploy SMB / lift-bag solo and as a member of a team
10. Demonstrate appropriate reaction to simulated free-flowing deco regulator
11. Buddy breathing deco gas for at least 1 minute
12. Oxygen rebreather mode at less than 6 metre / 20 foot stops
13. Complete one bailout scenario at depth to include simulated or actual decompression obligation on open circuit

In order to complete this course, students must:

1. Satisfactorily complete the TDI Diving Rebreathers and TDI Extended Range and Trimix course written examinations with a minimum score of 80 percent on each, 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 the TDI Helitrox CCR Diver Program
5. Present a minimum of 1 graded presentation on a Helitrox CCR topic