

## 27. Advanced Mixed Gas Closed Circuit Rebreather Instructor - Unit Specific

### 27.1 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 custom Trimix as a breathing gas.

Instructors can be qualified to teach on any units that TDI has diver standards for.

### 27.2 Qualifications of Graduates

Upon successful completion of this course, graduates may teach the TDI Advanced Mixed Gas Closed Circuit Rebreather course not to exceed the manufacturers designed depth maximum or 100 metres / 330 feet with custom mixed gas as a diluent. This course is unit specific.

### 27.3 Who May Teach

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

### 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'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's discretion to reduce this number as conditions dictate

## **27.5 Student Prerequisites**

1. Minimum age 21
2. TDI CCR Mixed Gas (unit specific) Instructor (or equivalent) with 10 mixed gas students taught and 1 year teaching experience on the unit specific CCR
3. Properly verified and logged proof of 30 mixed gas dives on the unit specific rebreather with 15 logged beyond 65 metres / 215 feet

## **27.6 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

## **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
2. *TDI Diving Rebreathers* Instructor Guide
3. *TDI Standards and Procedures* Manual

### Optional Material:

1. *TDI Diving Rebreathers* PowerPoint Presentation
2. TDI Rebreather Work Slate
3. TDI Scenario Slates (14)
4. Richard Pyle - *A Learners Guide to Closed Circuit Rebreather Operations*
5. Kenneth Donald - *Oxygen & The Diver*
6. John Lamb – *Oxygen Measurement for Divers*
7. Barsky, Thurlow & Ward - *The Simple Guide to Rebreather Diving*
8. Bob Cole – *Rebreather Diving*
9. Jeffrey Bozanic – *Mastering Rebreathers*

## 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
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. Two bailout cylinders with a minimum capacity of 11.1 liters / 80 cubic feet with mix appropriate for planned depth

## 27.10 Required Subject Areas

Instructor trainers must use the *TDI Diving Rebreathers Student Manual*, instructor guide, 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. Manufacturer supported additional fittings, automatic diluent valve (ADV)
4. Gas Physiology
  - a. Oxygen (O<sub>2</sub>) toxicity
  - b. Nitrogen absorption
  - c. Carbon monoxide (CO<sub>2</sub>) toxicity
  - d. Gas consumption
  - e. Equivalent air depth (EAD) theory revision narcotic depth related to helium
5. Electronic Systems Design and Maintenance
  - a. Oxygen (O<sub>2</sub>) 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 (PPO<sub>2</sub>) 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 (PO<sub>2</sub>)
  - c. Oxygen (O<sub>2</sub>) integrated

8. Dive Planning.
  - a. Operational planning
  - b. Gas requirements including bailout scenarios
  - c. Oxygen limitations
  - d. Nitrogen limitations
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

### **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 or 100 metres / 330 feet.**

1. Demonstrate proper analysis of all gas mixtures to be used
2. Demonstrate a complete systems 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 break down and maintenance of rebreather

**In order to complete this course, students must:**

1. Satisfactorily pass the TDI Closed Circuit Rebreather Course 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 graded presentation on an advance mixed gas closed circuit rebreather topic
6. Present and evaluate all subjects covered in the unit specific diver standards