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## **17. TDI – Air Diluent Closed Circuit Rebreather Diver Course, Unit Specific- Ambient Pressure Inspiration / Evolution**

### **17.1 Introduction**

This is the entry level certification course for divers wishing to utilize the Inspiration / Evolution Closed Circuit Rebreather (CCR) for air diving. The objective of the course is to train divers in the benefits, hazards and proper procedures for diving a CCR and to develop basic CCR diving skills to a maximum of one hundred thirty (130) fsw / forty (40) msw using an air diluent for minimal decompression diving (no greater than 5 minutes required at 20fsw / 6 meters).

### **17.2 Qualifications of Graduates**

Upon successful completion of this course, graduates may engage in diving activities utilizing the Inspiration / Evolution CCR to a maximum of one hundred thirty (130) fsw / forty (40) msw, utilizing an air diluent with a decompression/safety stop at twenty (20) fsw / six (6) msw for a maximum of five 5 minutes duration.

### **17.3 Who May Teach**

Who may teach this course:

1. An active TDI Instructor with a TDI Air Diluent Inspiration / Evolution CCR Instructor rating.

### **17.4 Student – Instructor Ratio**

Academic:

1. Unlimited, so long as adequate facility, supplies and time are provided to insure comprehensive and complete training.

Confined Water (Swimming pool-like conditions):

1. A maximum of two (2) students per active TDI Instructor is allowed or four (4) with a certified assistant.

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

1. A maximum of two (2) students per active TDI Instructor is allowed or four (4) with a certified assistant.
2. The ratio should be reduced as required due to environmental or operational constraints.

**Special note;** A “certified assistant” is a SDI Divemaster or equivalent from agencies recognized by TDI, with an Air Diluent CCR user qualification and a minimum of 30 hours logged diving on the CCR being taught.



## **17.5 Student Pre-Requisites**

The student must:

1. Be a minimum age of eighteen (18).
2. Show proof of sixty (60) logged open water dives.
3. Minimum certification level of Advanced Nitrox Diver (Advanced Nitrox Diver may be combined with this course) or equivalent from agencies recognized by TDI.

## **17.6 Course Structure and Duration**

Confined Water Execution:

1. Minimum of one hundred twenty (120) minutes confined water training to a maximum of thirty (30) fsw / six (9) msw.

Open Water Execution:

1. Minimum of three hundred eighty (360) minutes open water training to be completed over a minimum of six (6) dives with a gradual increase in depth each day to a maximum of one hundred thirty (130) fsw / forty (40) msw.

Course Structure:

1. TDI allows instructors to structure courses according to the number of students participating and their skill level.
2. The exam may be given orally if not available in a language the student understands.

Duration:

1. Minimum of six (6) hours academic development and two (2) hours equipment maintenance workshop. To be completed before any open water sessions.
2. The duration of the entire course must be spread over a minimum of five (5) days.

Crossover:

1. If a student already qualified as TDI Air Diluent CCR Diver or equivalent from agencies recognized by TDI wishes to qualify on another CCR recognized by TDI, the student must follow all unit specific course standards with the exception of:
2. Minimum of sixty (60) minutes confined water training to a maximum of thirty (30) fsw / nine (9) msw.
3. Minimum of one hundred eighty (180) minutes open water training to be completed over a minimum of three (3) dives to a maximum of one hundred thirty (130) fsw / forty (40) msw.

## **17.7 Administrative Requirements**

The following is the administrative tasks:

1. Collect the course fees from all the students.
2. Ensure that the students have the required equipment.
3. Communicate the training schedule to the students.
4. Have the students complete the Liability Release and Medical history forms.
5. The Instructor must review the Liability Release and Medical Forms before starting on the course.

Upon successful completion of the course the Instructor must:

1. Complete the Student Registration Form and send the Registration Form to TDI.



2. Award card.

## **17.8 Required Equipment**

The following are required for this course:

1. TDI Inspiration / Evolution Rebreather Manual.
2. TDI Slide Set.
3. Manufactures' Manual & Updates.

The following equipment is required for each student:

1. A complete Inspiration / Evolution closed circuit rebreather.
2. Minimum of one (1) CCR dive computer and / or bottom timer and depth gauge.
3. Mask, fins and a suitable line-cutting device.
4. Slate & pencil.
5. Reel with a minimum of one hundred thirty (130) fsw / forty (40) msw of line.
6. Lift Bag / Delayed Surface Marker Buoy (DSMB) with a minimum of twenty five (25) lb / twelve (12) kg Lift.
7. Exposure suit appropriate for the open water environment where training will be conducted.
8. Access to an oxygen analyzer.
9. Appropriate weight.
10. Bailout gas supply (may be the on-board diluent supply or an externally carried redundant air source). In addition the Instructor and any certified "assistant" will also carry a bailout gas supply for the student/s during all open water sessions. This redundant gas source must be greater than the Instructor and any certified "assistants" rebreather requirement.

## **17.9 Required Subject Areas**

The TDI Rebreather manual and the manufacturer's manual are mandatory for use during this course but instructors may use any additional text or materials that they feel help present these topics. The following topics must be covered during the 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 Inspiration.
  - B. Layout and design of the unit.
  - C. Absorbent canister design and maintenance.
  - D. Breathing loop de-contamination procedures.
  - E. Manufacturer supported additional items (Automatic Diluent Valve, etc.)
4. Gas Physiology.
  - A. Oxygen toxicity.
  - B. Nitrogen absorption.
  - C. CO<sub>2</sub> toxicity.
  - D. Gas consumption.
5. Electronic Systems Design and Maintenance.
  - A. O<sub>2</sub> metabolizing calculations.
  - B. Fuel Cells.
  - C. System electronics functionality and calibration procedures.



6. Dive Tables.
  - A. Constant PPO<sub>2</sub> theory.
  - B. CNS and awareness of OTU tracking.
7. Dive Computers.
  - A. Mix adjustable.
  - B. Constant PO<sub>2</sub>.
  - C. 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

## **17.10 Required Skill Performance and Graduation Requirements**

The following open water skills must be completed by the student during open-water dives with the following course limits:

1. All open water dives must be between thirty (30) fsw / nine (9) msw to one hundred thirty (130) fsw / forty (40) msw.
2. Two dives must be deeper than sixty (66) fsw / twenty (20) msw and one dive must be deeper than one hundred (100) fsw / thirty (30) msw.
3. PO<sub>2</sub> not to exceed manufacturer recommendation or a working limit of 1.3 bar.
4. All dives to be completed within CNS% limits with a recommend maximum of 80% of the total PO<sub>2</sub> CNS limit.
5. Safety stops to be conducted with a minimum three (3) minutes at twenty (20) fsw / six (6) msw.
6. Where the user opts for an Automatic Diluent Valve (ADV) fitted by the manufacturer additional skills such as regular diluent gauge monitoring and addition control must be emphasized.

Open Water Skills:

1. Pre dive checks.
2. Verify diluent and O<sub>2</sub> cylinder contents using O<sub>2</sub> analyzer where appropriate.
3. Demonstrate correct pre dive planning procedures including
  - A. Limits based on system performance.
  - B. Limits based on oxygen exposures at chosen PPO<sub>2</sub> levels.
  - C. Limits based on nitrogen absorption at planned depth and PO<sub>2</sub> setpoint.
  - D. Thermal Constraints
4. Emergency procedures.
  - A. Mouthpiece familiarity drills.
  - B. Gas shutdowns and loss of gas.
  - C. Broken hoses.
  - D. Flooded absorbent canister.
  - E. CO<sub>2</sub> breakthrough.



- F. Semi-closed mode.
- G. Low oxygen drills.
- H. High oxygen drills.
- I. Flooding Loop.
- J. Electronics and Battery Failure.
- K. Properly execute the ascent procedures for an incapacitated CCR diver
5. Use of BC/suit and effective management of loop breathing volume for buoyancy control.
6. Stop at ten to twenty (10 – 20) fsw / three to six (3-6) msw on descent for leak bubble check.
7. Electronics systems monitoring for PO<sub>2</sub> levels (SETPOINT) and switching setpoints.
8. Manual control of setpoint if electronically controlled CCR is not used.
9. Use of Lift Bag / Delayed Surface Marker Buoy and Reel.
10. Proper execution of the dive within all pre-determined dive limits.
  - A. Demonstration of safety stops at pre-determined depths.
  - B. Constant Loop Volume Management.
11. Post dive clean of unit to avoid contamination and spread of disease.

In order to complete the course and achieve the TDI Air Diluent CCR rating the student must:

1. Satisfactorily complete the written examination with a pass mark of greater than eighty (80) %.
2. Complete to the Instructors satisfaction all confined and open water skill development sessions.
3. Demonstrate mature, sound judgment concerning dive planning and execution.
4. Course must be completed within six (6) weeks from the starting date.
5. Complete a refresher course following a period of inactivity greater than six (6) months following the course.

## **17.11 Recommended Additional Reading and Support Material**

The following articles and books are recommended reading and allow wider understanding.

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