

## **38. Rebreather Cavern Diver**

### **38.1 Introduction**

This course is designed to develop the minimum skills and knowledge for diving a TDI approved rebreather in cavern and overhead environments within the limits of light penetration; in addition, outline specific hazards associated with rebreather cave diving. The Rebreather Cavern course is not intended to provide instruction for diving in cave environments. The objective of this course is to train divers in the proper planning, procedures, techniques and hazards of rebreather cavern diving.

### **38.2 Qualifications of Graduates**

Upon successful completion of this course, graduates may engage in rebreather cavern diving activities without direct supervision provided the graduates adhere to the following limits:

1. Daylight zone, i.e. within natural light of the cavern entrance
2. Diver carries adequate bailout to safely exit from the furthest point of penetration using a minimum SAC rate of 30 litres per minute/1 cubic foot per minute OR the student's calculated elevated SAC rate to account for a CO<sub>2</sub> event, whichever is greater
3. 60 linear metres / 200 linear feet from the surface
4. 30 metres / 100 feet maximum depth
5. No decompression diving
6. No restrictions; no areas too small for 2 divers to pass side-by-side
7. Safety stops as appropriate or necessary
8. Maintain a continuous guideline
9. Proper cavern diving equipment is used in conjunction with a TDI approved rebreather
10. No removal of life support equipment shall be permitted within the overhead environment
11. Visibility must be adequate to identify the exit from inside the cavern

Upon successful completion of this course, graduates are qualified to enroll in:

1. TDI Rebreather Introductory Cave Diver course

### **38.3 Who May Teach**

1. Any active TDI Rebreather Full Cave Diver Instructor qualified to teach on the TDI approved rebreather used may teach this course

### **38.4 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



### **Open Water**

1. A maximum of 4 students per active TDI instructor

### **Cavern**

1. A maximum of 3 students per active TDI Instructor are allowed; ratio should be reduced as required due to environmental or operational constraints

## **38.5 Student Prerequisites**

1. Minimum age 18
2. Provide proof of TDI Air Diluent CCR diver or equivalent
3. Provide proof of a minimum of 25 logged dives and 25 hours on the specific unit

## **38.6 Course Structure and Duration**

### **Water Execution**

1. Minimum of 5 dives must be conducted including
  - a. 1 open water session
  - b. Four cavern dives with a minimum total bottom time of 120 minutes conducted at 2 different sites
2. Visibility must be adequate to identify the exit from inside the cavern

### **Course Structure**

1. TDI allows instructors 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. Course must be conducted over a minimum of 2 days

## **38.7 Administrative Requirements**

### **The following are the administrative tasks:**

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment and certifications
3. Communicate the training 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* or registering the students online through member's area of the TDI website



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## **38.8 Required Equipment**

**The following are required for this course**

1. *TDI Diving in Overhead Environments* Manual
2. *TDI Diving in Overhead Environments* Instructor Guide
3. *TDI Diving in Overhead Environments* Instructor Resource CD (Optional)
4. *TDI Diving Rebreathers* Student Manual
5. *TDI Diving Rebreathers* PowerPoint Presentation (optional)
6. Rebreather Manufacturer's manual and updates
7. Manufacturer's Build Checklist
8. *TDI CCR Preflight Checklist*

### **Suggested reading materials**

1. *NACD Art of Safe Cave Diving*
2. *Basic Cave Diving – A Blueprint for Survival*
3. *CDAА - Cavern / Sinkhole* Manual
4. *NSS-CDS Cavern* Manual

**The following equipment is required for each student:**

1. A complete TDI approved rebreather
2. Minimum of 1 rebreather enabled computer or PO<sub>2</sub> monitoring device
3. Bailout cylinder(s) with volume appropriate for the dive
4. Bailout regulator(s) equipped with pressure gauge and low pressure off board (quick connect) gas supply hose.
5. Access to an oxygen analyzer (instructor may supply)
6. Buoyancy compensator device (BCD)
7. Exposure suit adequate for cavern environment
8. Mask and fins
9. Line cutting device
10. Safety reel with a minimum of 37 metres / 125 feet of guideline
11. One primary reel with length appropriate for intended dive
12. Three battery powered lights; 1 primary and 2 back-ups, each with a burn time suitable for the planned dive time
13. Slate or wet notes and pencil
14. Submersible dive tables or backup dive computer
15. Three directional line arrows
16. Weight system

**Instructor must use full cave diving equipment during all water exercises**

## **38.9 Required Subject Areas**

**The following topics must be covered during this course:**



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1. Policy for Cavern Diving
  2. Psychological Considerations
  3. Equipment Considerations
    - a. Bailout cylinder options
      - i. Single bailout cylinder vs redundant
      - ii. Long hose vs short hose on bailout
    - b. Rebreather configuration options
    - c. Buoyancy compensator device (BCD)/ harness options
    - d. Scrubber options
    - e. Reel options
    - f. Proper weighting
    - g. Equipment configurations
  4. Communication
    - a. Hand signals
    - b. Light signals
    - c. Touch contact signals
  5. Swimming Techniques
    - a. Body posture/ trim
    - b. Buoyancy control
    - c. Line following
    - d. Propulsion techniques
  6. Physiology
    - a. Breathing techniques
    - b. Stress management
  7. Cavern Environment
    - a. Geology
      - i. Bottom
      - ii. Ceiling
    - b. Local access requirements
    - c. Land owner relations
  8. Cavern Conservation
  9. Problem Solving
    - a. Emergency procedures
    - b. Equipment failure
    - c. Silting conditions
  10. Bailout Gas Volume Requirements
  11. Accident Analysis
  12. Review of Dive Tables and Decompression Theory
  13. Cavern Diving with Open Circuit Divers
    - a. Bailout configuration requirements



- b. Out of air emergencies
14. Cavern Diving Etiquette

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

**At NO point is the student to be unable to monitor their PO<sub>2</sub> while on the loop. Zero visibility drills must be performed in a way that the student may monitor the status of the breathing loop, i.e. no mask but able to monitor HUD, lights out but able to use display lighting to view PO<sub>2</sub>, etc. Or, the drill must be done on bailout.**

**The following land drills must be covered during this course:**

1. How to properly:
  - a. Deploy a guideline
  - b. Follow a guideline
  - c. Conduct bail out exit including bottle swapping while following a guideline
  - d. Conduct bail out exit including bottle swapping simulating zero visibility and using touch contact while following a guideline
2. Touch contact communicate
3. Correctly deploy directional markers

**The student must perform the following S-drill and skills during all dives:**

1. Demonstrate:
  - a. Adequate pre-dive planning
  - b. Equipment check and equipment matching
  - c. Bubble check
  - d. Specialized propulsion techniques
  - e. Proper buoyancy control
  - f. Proper body posture
  - g. Proper PO<sub>2</sub> management
  - h. Overall rebreather instruments analysis
  - i. Proper stress analysis (detection and management)

**The student must complete the following skills in a non-overhead environment prior to entering the cavern:**

1. Properly:
  - a. Deploy a guideline
  - b. Follow a guideline
  - c. Conduct bail out exit including bottle swapping while following a guideline
  - d. Conduct bail out exit including bottle swapping simulating zero visibility and using touch contact while following a guideline
2. Touch contact communicate
3. Correctly deploy directional markers



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**The student must perform the following in-water skills during cavern dives:**

1. Properly:
  - a. Deploy a guideline
  - b. Use directional line markers
  - c. Follow a guideline
  - d. Follow a guideline simulating loss of visibility
2. Perform bailout exit practicing bottle swapping with teammates:
  - a. Following the guideline
  - b. Simulating zero visibility and using touch contact, following the guideline
3. Remove and replace mask while in contact with guideline
4. Demonstrate light / hand signals and touch contact
5. Explore cavern
6. Execute proper conservation and awareness techniques
7. Use referencing as back-up navigation
8. Demonstrate adequate anti-silting techniques
9. Simulate a primary light failure, and deploy back up light and follow guideline to exit cavern
10. Demonstrate rebreather unit specific skills in compliance with current level of rebreather certification as outlined in the TDI course curriculum

**Note: No removal of life support equipment shall be permitted within the overhead Environment**

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

1. Perform all land drills and rebreather cavern dive requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Maintain an appropriate level of awareness and respect for the cavern environment
4. Log all dives