

37. Rebreather Full Cave Diver

37.1 Introduction

This course is the third stage of training in the series of TDI's Rebreather Cave Diver development program. Advanced rebreather cave dive planning, the practical execution of different types of cave systems and scenarios divers encounter are presented. This rebreather cave diving course is not intended to prepare divers for evaluating all facets of cave diving. The objective of this course is to expand and critique previous skills accomplished in the TDI Rebreather Cavern Diver and Rebreather Intro to Cave programs. Emphasis is placed upon dive planning and skill perfection through actual cave penetration.

37.2 Qualifications of Graduates

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

1. Diver carries adequate bailout to safely exit from the furthest point of penetration and complete any decompression stops 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 CO₂ event, whichever is greater
2. 45 metres / 150 feet maximum depth
3. No equipment removal in cave
4. Complete safety and decompression stops as appropriate or necessary
5. Maintain a continuous guideline
6. Proper cave diving equipment is used in conjunction with a TDI approved rebreather

37.3 Who May Teach

Any active TDI Rebreather Full Cave Diver Instructor. The instructor must be qualified as an instructor on the TDI approved rebreather they are diving, and as an Air Diluent Decompression Diver (or equivalent) on the TDI approved rebreather the student is diving.

37.4 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 3 students per active TDI Instructor are allowed
2. The ratio should be reduced as required due to environmental or operational constraints

Cave Dives

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

37.5 Student Prerequisites

1. Minimum age 18
2. Certified TDI CCR Air Diluent Decompression Procedures Diver certification or equivalent
3. Provide proof of certification as a:
 - a. TDI Rebreather Intro to Cave or equivalent

OR

 - b. TDI Full Cave Diver or equivalent
4. Provide proof of a minimum of 50 logged dives and 50 hours on the rebreather unit used

37.6 Course Structure and Duration

Water Execution

1. Six cave dives are required with a minimum accumulated bottom time of 420 minutes at 3 different sites
2. At least 1 of these sites should be a location not utilized in training during the cavern or introductory cave courses
3. At least 2 dives must be at least 75 minutes long

Course Structure

1. TDI allows instructors to structure courses according to the number of students participating and their skill Level

Duration

1. The suggested number of classroom and briefing hours is 6
2. Course must be taught in no less than 4 days
3. The combined Rebreather Cavern, Intro and Full Cave course must be taught in no less than 7 days

Upgrade

1. Divers who are certified both as TDI Full Cave Diver or equivalent AND TDI Air Diluent CCR Decompression Procedures Diver or equivalent may be upgraded to TDI Rebreather Full Cave Diver by completion of all course requirements except:
 - a. Four cave dives are required with a minimum accumulated bottom time of 240 minutes at two different sites. At least two of the dives must be at least 75 minutes long.
 - b. All other course requirements must be met
2. Required in-water skills to focus on integrating the CCR into full cave diving including
 - a. Bailout planning
 - b. Complex dive planning (hub and spoke diving)
 - c. Complex navigation
 - d. Exiting the cave in SCR mode
 - e. Exiting the cave with simulated solenoid failure (if applicable)
 - f. Exiting the cave on open circuit bailout
 - g. Demonstrate rebreather unit specific skills in compliance with current level of rebreather certification as outlined in the TDI course curriculum

37.7 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

37.8 Required Equipment

The following are required for this course:

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

Other suggested reading materials:

1. *CCR Cave Almost Simplified*- Mel Clark
2. *NACD Art of Safe Cave Diving*
3. *Basic Cave Diving – A Blueprint for Survival*
4. *CDAA - Cavern / Sinkhole* Manual
5. *NSS – CDS Cave Diving* Manual
6. *Cavern Measureless to Man*
7. *The Darkness Beckons* – Martyn Farr

The following equipment is required for each student:

1. A complete TDI approved rebreather
2. At least one rebreather enabled computer capable of monitoring PO₂, and a redundant means of monitoring PO₂. Redundant devices may either be an enabled computer or HUD. Any modifications to the unit must be approved by the manufacturer
3. Off board bailout cylinder(s) – volume appropriate for planned dive
4. Bailout regulator(s) equipped with pressure gauge and low pressure off board (quick connect) gas supply hose.
5. Buoyancy compensator device (BCD) with power inflator
6. Exposure suit adequate for diving environment
7. Access to an oxygen analyzer (instructor may supply)
8. Mask and fins
9. Minimum of 2 cutting devices
10. Slate and pencil
11. Three battery powered lights; 1 primary and 2 back-ups, each with a with burn time suitable for the planned dive time
12. Safety reel with a minimum of 37 metres / 125 feet of guideline
13. Gap reel with 15 metres / 50 feet of guideline
14. One primary cave-diving reel with length appropriate for intended dive

15. Computer, watch or bottom timer and depth gauge
16. Slate or wet notes with a pencil
17. Submersible dive tables or backup dive computer
18. Three directional line arrows
19. Three non-directional marker
20. Any staged decompression cylinders must be properly labeled

Instructor must use full cave diving equipment during all water exercises

37.9 Required Subject Areas

The following topics must be covered during this course:

1. Policy for Cave 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. Scrubber options
 - d. Buoyancy compensator device (BCD) / harness 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 and rebreather weighting
 - c. Line following
 - d. Propulsion techniques
6. Physiology
 - a. Breathing techniques
 - b. Stress management
 - c. Decompression theory and its application to cave diving
7. Cave Environment
 - a. Geology
 - b. Bottom
 - c. Ceiling

- d. Local access requirements
- e. Land owner relations
- 8. Conservation
- 9. Problem Solving
 - a. Emergency procedures
 - b. Equipment failure
 - c. Silting conditions
- 10. Accident Analysis
- 11. Review of Dive Tables and Decompression Theory
- 12. Cave diving with Open Circuit divers
 - a. Bailout configuration requirements
 - b. Out of air emergencies
- 13. Cave Diving Etiquette

37.10 Required Skill Performance and Graduation Requirements

At NO point is the student to be unable to monitor their PO₂ 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 back light to view PO₂, 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 gas sharing while following a guideline
 - d. Conduct bail out exit including gas sharing simulating zero visibility and using touch contact while following a guideline
- 2. Use of safety reel in:
 - a. Lost diver procedures
 - b. Lost line drill

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

- 1. Demonstrate adequate pre-dive planning
- 2. Equipment check and equipment matching
- 3. Bubble check
- 4. Demonstrate:
 - a. Specialized propulsion techniques in varying types of flow

- b. Proper:
 - i. Buoyancy control
 - ii. Body posture
 - iii. Stress analysis (detection and management)
 - iv. Oxygen partial pressure management
 - v. Overall rebreather instruments analysis

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

1. Properly:
 - a. Deploy a guideline
 - b. Use directional and non directional line markers
 - c. Follow a guideline
 - d. Follow a guideline simulating loss of visibility
2. Perform bailout exit practicing gas sharing 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. Execute conservation and awareness techniques
6. Use referencing as back-up navigation
7. Demonstrate adequate anti-silting techniques
8. Simulate a primary light failure, and use back light to exit the cave
9. Demonstrate lost line drills using instrumentation lighting only
10. Demonstrate lost diver drills
11. Demonstrate to use of reels to perform jumps and gaps required in circuits and traverses to maintain a continuous guideline to open water
12. Exit the cave flying the rebreather in SCR mode
13. Exit the cave simulating solenoid failure (if applicable)
14. Demonstrate advanced navigation techniques including a minimum of:
 - a. 4 jumps
 - b. 2 circuits
15. Demonstrate rebreather unit specific skills in compliance with current level of rebreather certification as outlined in the TDI course curriculum

In order to complete this course, students must:

1. Satisfactorily complete the TDI Cave Diver Course written examination
2. Perform all land drills and cave dive requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution
4. Maintain an appropriate level of awareness and respect for the cavern environment
5. Log all dives