

## 3.2.7 Closed-Circuit Rebreather Technical Diver Level 1

### 3.2.7.1 Course Outcomes

GUE's Closed-Circuit Rebreather Technical Diver Level 1 course is designed to prepare divers for the rigors of technical diving and to familiarize them with the use of different breathing and decompression mixtures. Additional course outcomes include: cultivating, integrating, and expanding the essential skills required for safe technical diving; problem identification and resolution; the use of GUE-approved closed-circuit rebreather and double tank configurations and the potential failure problems associated with them; the use of nitrox for accelerated and general decompression strategies and bailout; the use of helium to minimize narcosis; and the applications of single decompression stage diving with respect to decompression and bailout procedures.

### 3.2.7.2 Prerequisites

Applicants for a CCR-T1 course must abide by [Training Prerequisites \(2.1.4.1\)](#), plus:

- a. Be a minimum of 18 years of age. Documented parental or legal guardian consent must be submitted to GUE HQ when the participant is a minor.
- b. Hold a GUE Closed-Circuit Rebreather Fundamentals certification.
- c. Have conducted at least 50 non-training dives in the GUE CCR configuration following completion of GUE Closed-Circuit Rebreather Fundamentals certification. Dive experience must be verified through submission of a dive log to the instructor.
- d. If using a drysuit during the course, have conducted at least 25 non-training dives in a drysuit or have conducted 15 non-training dives utilizing a drysuit following completion of GUE Drysuit Primer certification.

### 3.2.7.3 Course Content

The Closed-Circuit Rebreather Technical Diver Level 1 course is normally conducted over six days. It requires a minimum of seven dive sessions and at least forty-eight hours of instruction, encompassing lectures, land drills, and at least ten hours of dive time.

### 3.2.7.4 Closed-Circuit Rebreather Technical Diver Level 1 Specific Training Standards

- a. Student-to-instructor ratio is not to exceed 3:1.
- b. Maximum depth of 170 ft/51 m.
- c. Dives must not be planned to incur more than 30 minutes of unadjusted decompression time, as established by GUE's DecoPlanner.
- d. No overhead diving.
- e. The oxygen supply valve must never be closed completely during drills.
- f. Students must complete GUE Rescue Primer or equivalent from a recognized training agency prior to certification.

### 3.2.7.5 Required Training Materials

GUE training materials and recommended study as determined by the course study packet available online or via download after GUE course registration.

### 3.2.7.6 Academic Topics

- a. Introduction: GUE organization and course overview (objectives, limits, expectations)
- b. Dive planning, minimum gas, gas strategies, and gas management
- c. Gas properties: breathing gasses, oxygen, narcosis, and hypercapnia
- d. Decompression theory: history, overview, and decompression sickness
- e. Practical decompression: general guidelines, DecoPlanner, ratio deco, and other considerations
- f. Inherent risks of using closed-circuit rebreathers
- g. Closed-circuit rebreather operation, alarms, and warnings
- h. Breathing gas dynamics, hyperoxia, hypoxia, hypercapnia, and gas density
- i. Absorbent material: properties and canister endurance
- j. Gas management: consumption, use, requirements, and reserves
- k. Emergencies: accident prevention and management

### 3.2.7.7 Land Drills and Topics

- a. Reel and guideline use
- b. Dive team formation, communication, and protocols
- c. Rebreather assembly, set-up, checklist and pre-breathe
- d. CCR valve drills
- e. Diluent flush techniques, including two-handed, one-handed, and exhalation-triggered ADV diluent gas addition
- f. CCR failure management
- g. OC failure management and implications for CCR operations
- h. Bailout and out-of-gas procedures
- i. Gas switch procedure
- j. Unconscious diver recovery

### 3.2.7.8 Required Dive Skills and Drills

Students must demonstrate competence in the following skills to attain GUE Closed-Circuit Rebreather Technical Diver Level 1 certification:

- a. Must be able to swim at least 400 yds/375 m in less than 14 minutes without stopping. This test should be conducted in a swimsuit and, where necessary, appropriate thermal protection.
- b. Must be able to swim a distance of at least 60 ft/18 m on a breath hold while submerged.
- c. Demonstrate a safe and responsible demeanor throughout all training.
- d. Demonstrate basic equipment proficiency and an understanding of the GUE CCR equipment configuration.
- e. Demonstrate proficiency in safe diving procedures, including assembly and set-up; checklist and pre-breathe; GUE EDGE; flow check; in-water activity; and post-dive assessment, breakdown, and maintenance.
- f. Demonstrate awareness of team members' closed-circuit rebreather function and an overall concern for safety, responding quickly to visual or audible indications and dive partner needs during diving and failures.
- g. Demonstrate proficiency in underwater communication.

- h. Demonstrate proficiency with the use of the closed-circuit rebreather and open-circuit during ascents, descents, and bottom phase of the dive.
- i. Demonstrate good buoyancy and trim, i.e., approximate reference is a maximum of 20 degrees off horizontal while remaining within a range of 3 ft/1 m from target depth.
- j. Demonstrate proficiency in gas failure procedures, including valve manipulation (fixable, non-fixable, and erroneous failures), gas sharing, and regulator switching as appropriate and their implications to CCR operations and team resilience.
- k. Demonstrate proficiency in the ability to deploy a surface marker buoy (SMB) while using a spool.
- l. Demonstrate proficiency in switching to a backup mask.
- m. Demonstrate the ability to manage a flooded closed-circuit rebreather while discharging excess water.
- n. Demonstrate the ability to diagnose and correctly respond to simulated closed-circuit rebreather problems, including the capacity for higher level responses beyond bailing out and ascending.
- o. Demonstrate proficiency with a single decompression cylinder.
- p. Demonstrate proficiency in effective decompression techniques, including depth and time management.
- q. Demonstrate the ability to switch and maintain desired pO<sub>2</sub> setpoints electronically and manually throughout a dive.
- r. Efficiently and comfortably demonstrate how to donate gas to an out-of-gas diver while using the closed-circuit rebreather.
- s. Demonstrate diver rescue techniques, including effective underwater management of an unconscious diver.

### 3.2.7.9 Equipment Requirements

GUE CCR configuration as outlined in Appendix A.

Prior to the commencement of the class, students should consult with a GUE representative to verify equipment requirements and the appropriateness of any selected equipment.

## Appendix A - GUE Equipment Configuration

**The GUE base equipment configuration is comprised of:**

- a. Tanks/cylinders: Students may use a single tank/cylinder with a single- or dual-outlet valve. Students may also use dual tanks/cylinders connected with a dual-outlet isolator manifold, which allows for the use of two first stages. Dual tanks/cylinders connected with a dual-outlet, non-isolator manifold can be used, but only in recreational (minimum decompression) diving, and are considered an alternative for a single tank/cylinder. Consult course-specific standards and your instructor to verify size requirements.
- b. Regulators:
  - i. Single tank: The first stage must supply a primary second stage via a 5 to 7 ft/1.5 to 2 m hose. A backup second stage must be necklaced and supplied via a short hose. The first stage must also supply an analog pressure gauge, inflation for the buoyancy compensator (BC), and (when applicable) inflation for a drysuit.

- ii. Double tank: One first stage must supply a primary second stage via a 5 to 7 ft/1.5 to 2 m hose (7 ft/2 m hose is required for all cave classes), and inflation for the buoyancy compensator (BC). The other first stage must supply a necklaced backup second stage via a short hose, an analog pressure gauge, and (when applicable) inflation for a drysuit.
- c. Backplate system:
  - i. Is held to the diver by one continuous piece of webbing. This webbing is adjustable and uses a buckle to secure the system at the waist.
  - ii. A crotch strap is attached and looped through the waistband to prevent the system from riding up a diver's back.
  - iii. The continuous webbing must support five D-rings;
    - 1. The first placed at the left hip
    - 2. The second placed in line with a diver's right collarbone
    - 3. The third placed in line with the diver's left collarbone
    - 4. The fourth and fifth are placed on the front and back of the crotch strap when divers plan to use advanced equipment such as DPVs.
  - iv. The harness below the diver's arms has small restrictive bands to allow for the placement of backup lights. The webbing and system retains a minimalist approach.
- d. Buoyancy compensation device (BC):
  - i. A diver's BC is back-mounted and minimalist in nature.
  - ii. It is free of extraneous strings, tabs, or other material.
  - iii. There are no restrictive bands or restrictive elastic affixed to the buoyancy cell.
  - iv. Wing size and shape is appropriate to the cylinder size(s) employed for training.
- e. At least one time/depth measuring device
- f. Wrist-mounted compass
- g. Mask and fins: Mask is low-volume; fins are rigid, non-split.
- h. Backup mask
- i. At least one cutting device
- j. Wetnotes with at least one pencil
- k. Exposure suit appropriate for the duration of exposure
- l. Surface marker buoy (SMB) with spool: Where required, the SMB should be appropriate for environmental conditions and deployed using a spool with at least 100 ft/30 m of line.

**The GUE PSCR configuration is comprised of:**

- a. GUE base equipment configuration (except Tanks/Cylinder)
- b. One primary and two backup lights
- c. A GUE-approved passive semi-closed circuit rebreather
- d. Modified tank configuration as appropriate for use with a GUE-approved passive semi-closed circuit rebreather
- e. Modified regulator configuration as appropriate for use with a GUE-approved passive semi-closed circuit rebreather

**The GUE CCR configuration is comprised of:**

- a. GUE base equipment configuration (except Tanks/Cylinder)
- b. One primary and two backup lights

- c. A GUE-approved closed-circuit rebreather
  - i. Where required, students must own a GUE-approved closed-circuit rebreather before attending the course; they can, however, use a rented or borrowed unit during the course.
  - ii. The closed-circuit rebreather used by the student, with all associated components, must be fully functional (pass all tests on the rebreather pre-dive checklist) and serviced according to manufacturer specifications.
  - iii. All oxygen sensors must be less than one year from manufacturing date.
  - iv. Both the rebreather controller and SOLO board must be updated with the latest software and firmware versions published by the manufacturer.
- d. Modified tank configuration as appropriate for use with a GUE-approved closed-circuit rebreather
- e. Modified regulator configuration as appropriate for use with a GUE-approved closed-circuit rebreather
- f. Spare parts and consumables, including one set of controller, HUD, and solenoid batteries; one oxygen sensor; and one DSV/BOV mouthpiece.
- g. If using a drysuit inflation cylinder attached to the backplate, extended inflation cylinder straps need to be used to ensure that it does not interfere with or restrict the counterlung's function.

**The GUE Sidemount configuration is comprised of:**

- a. GUE base equipment configuration (except Tank/cylinders, Regulators, Backplate, BC)
- b. One primary and two backup lights
- c. Tanks/cylinders: Students are required to use independent cylinders with single valves and without manifolds, which allow for the use of one first stage each. Stage cylinders with [proper cylinder marking \(2.2, e\)](#) will also be utilized.
- d. Regulators: One of the second stages must be on a 7 ft/2 m hose. Both first stages must supply a pressure gauge and provide inflation for a drysuit (where applicable) and a wing.
- e. Sidemount harness: A diver's sidemount setup should be back-mounted and minimalist in nature. Wing size and shape should be appropriate to the cylinder size(s) employed for training.

**Additional Course-Specific Equipment**

- a. Where required, back gas and stage cylinders with [proper cylinder marking \(2.2, e\)](#) will also be utilized in accordance with the GUE General Training Standards, Policies, and Procedures document and configured in line with GUE protocols.
- b. When drysuit inflation systems are applicable, they should be sized appropriately for the environment; small tanks are placed on the left side of the backplate with larger supplies affixed to the diver's left back gas tank.
- c. Underwater lights:
  - i. When required, backup lights should be powered by alkaline batteries (not rechargeable) and stowed on the D-rings at a diver's chest (except when diving sidemount).
  - ii. Backup lights should have a minimal amount of protrusions and a single attachment at the rear.
  - iii. Backup lights should feature a twist-on/off switch for operation

- iv. The primary light should consist of a rechargeable battery pack and be fitted with a Goodman-style light handle.
- v. When burn time requirements create the need for an external battery pack, it should reside in a canister mounted on the diver's right hip.
- d. Guideline devices, as required during cave diving activities:
  - i. A primary reel is required for all cave diving and provides a minimalist form factor with a handle designed to support a Goodman or "hands free" handle operation. The primary reel must contain at least 150 ft/45 m of line.
  - ii. A safety spool is required for each diver while cave diving and must contain at least 150 ft/45 m of line.
  - iii. A jump or gap spool is required during Cave 2 diving and must contain at least 75 ft/23 m of line.
- e. Where required, GUE-approved DPV must:
  - i. Be a tow-behind style with adjustable speed and clutch mechanism.
  - ii. Include an attached cord at the back with bolt snap to be clipped on the front crotch strap D-ring.
  - i. Include a leash attached to the front to be used for towing.