

### 3.1.16 Scientific Diver

#### 3.1.16.1 Course Outcomes

GUE's Scientific Diver course is designed to create divers who are capable of acting as a member of a scientific diving team using proper equipment and techniques. Upon course completion, students will also possess a basic knowledge and understanding of legalities and responsibilities relevant to scientific diving. Other course outcomes include: competence with search methods and survey methods, both surface and sub-surface; ability to accurately locate and mark both objects and sites; basic use of lift bags and airlifts to be used in controlled lifts, excavations, and sampling; basic rigging and line work, including the construction and deployment of transects and search grids; underwater navigation methods using suitable techniques; recording techniques; acting as surface tender for a roped diver; and using appropriate sampling techniques for the scientific discipline being pursued.

#### 3.1.16.2 Prerequisites

Applicants for a Scientific Diver course must abide by [Training Prerequisites \(2.1.4.1\)](#), plus:

- a. Be a minimum of 16 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 Open Water Diver, GUE Performance Diver, or GUE Fundamentals certification.
- c. Have conducted at least 25 non-training dives following completion of either GUE Open Water Diver, GUE Performance Diver, or GUE Basic Fundamentals<sup>1</sup> certification.
- d. If using doubles during the course, have conducted at least 15 non-training dives in the GUE double tank configuration or have conducted 10 dives utilizing doubles following completion of GUE Doubles Primer certification.
- e. If using a drysuit during the course, have conducted at least 15 non-training dives in a drysuit or have conducted 10 non-training dives utilizing a drysuit following completion of GUE Drysuit Primer certification.

#### 3.1.16.3 Course Content

The Scientific Diver course is normally conducted over five days. It requires a minimum of six dives and at least forty hours of instruction, encompassing lectures, land drills, and in-water work.

#### 3.1.16.4 Scientific Diver Specific Training Standards

- a. Student-to-instructor ratio is not to exceed 4:1.
- b. Maximum depth of 100 ft/30 m or the limit of the student's certification, whichever is shallower.
- c. All dives must be within minimum decompression limits (MDLs), i.e., no required stops.
- d. No overhead diving.

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<sup>1</sup> Including GUE Fundamentals with Recreational rating issued under past versions of Standards.

### 3.1.16.5 Training Materials

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

### 3.1.16.6 Academic Topics

- a. Introduction: GUE organization and course overview (objectives, limits, expectations).
- b. Course overview
- c. History of scientific diving
- d. Citizen science
- e. Project Baseline
- f. The scientific method
- g. Ethics in science
- h. Underwater sciences: biology, archaeology, geology, and hydrology
- i. Methods: tools of the trade, site marking, sketching, transects and baselines, quadrats, photomosaics, visual and video census
- j. Dive planning and data management: project planning, data management, database use, reporting

### 3.1.16.7 Land Drills and Topics

- a. Site marking and assessment: review of basic navigation skills, line work (reels and spools), line survey
- b. Methodology: acting as tender for roped diver, site sketch, mark and measure, baseline/transect, photoquadrats, photomosaic, video and visual census, offset measures, density cover, drawing grids
- c. Data management: archiving data, drafting a map, site report

### 3.1.16.8 Required Dive Skills and Drills

Students must demonstrate competence in the following skills to attain GUE Scientific Diver certification:

- a. Must be able to swim at least 300 yds/275 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 50 ft/15 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 equipment configuration.
- e. Demonstrate proficiency in safe diving techniques, including pre-dive preparation, in-water activity, and post-dive assessment.
- f. Demonstrate awareness of team member location and a concern for safety, responding quickly to visual indications and dive partner needs.
- g. Demonstrate proficiency in underwater communication.
- h. Demonstrate safe ascent and descent procedures.
- i. Demonstrate good buoyancy and trim, i.e., approximate reference is a maximum of 30 degrees off horizontal while remaining within a range of 5 ft/1.5 m from target depth.

- j. Comfortably demonstrate at least three propulsion techniques that would be appropriate in a delicate and/or silty environment, including comprehension of the components necessary for a successful backward kick..
- k. Demonstrate a pendulum search while acting as surface tender for roped diver.
- l. Demonstrate proficiency in marking and measuring organisms, artifacts, and other objects.
- m. Demonstrate proficiency in the use of tools, including airlifts and lift bags.
- n. Demonstrate proficiency in multiple mapping methods, including a sketch using a circular or radial search, assembly of a sampling grid, and offsets/ triangulations.
- o. Demonstrate proficiency in estimating abundance/coverage through visual census (while swimming or stationary), the photoquadrat method, estimated percent coverage (either with square or with transect), and video transects (either swimming or stationary).
- p. Demonstrate proficiency in establishing transects with a tape measure or with a reel/spool.

### 3.1.16.9 Equipment Requirements

GUE base equipment configuration as outlined in Appendix A, plus:

- a. At least one additional spool
- b. One reel per team
- c. Ruler of 10 to 20 in/25 to 50 cm
- d. Grid/graph paper
- e. One laptop per team
- f. Two underwater cameras (ideally GoPro) per team
- g. Tape measure with a minimum length of 5 ft/1.5 m
- h. Tape measure with a minimum length of 100 ft/30 m

Prior to the commencement of 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.