

21. KISS GEM Level 1 Instructor

21.1 Introduction

This is the instructor level certification course for instructors wishing to teach the TDI KISS GEM Level 1 rebreather course. The objective of this course is to train instructors to teach recreational rebreather diving, and to develop basic rebreather diving teaching skills appropriate to diving within the normal recreational depth limits for no decompression diving to 30 metres / 100 feet using between 32-40% Nitrox Gas.

21.2 Qualifications of Graduates

Upon successful completion of this course, graduates may teach the TDI KISS GEM Level 1 Rebreather course not to exceed the depth maximum of 30 metres / 100 feet with Nitrox Gases between 32-40%.

21.3 Who May Teach

Any active TDI KISS GEM Level 1 Instructor Trainer may teach this course.

21.4 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

Confined Water (swimming pool-like conditions)

1. A maximum of 4 students per instructor trainer; it is the instructor trainer's discretion to reduce this number as conditions dictate

Open Water (ocean, lake, quarry, spring, river or estuary)

1. A maximum of 4 students per instructor trainer; it is the instructor trainer's discretion to reduce this number as conditions dictate

21.5 Student Prerequisites

1. Minimum age 18
2. Provide proof of:
 - a. Certified TDI KISS GEM Level 1 Diver
 - b. Certified TDI Nitrox Instructor, or equivalent
 - c. 200 verified logged dives, 50 using nitrox
3. Assist with at least one complete TDI KISS GEM user course to the satisfaction of the instructor trainer
4. Provide proof of 50 logged rebreather dives on approved rebreathers, with a minimum of 50 accumulated hours; 25 dives and 25 hours must be on a KISS GEM diving system.

Or

1. If the candidate is already a certified TDI SCR or CCR instructor, in place of #4 above, provide proof of 25 verified logged GEM rebreather dives with a minimum of 25 accumulated hours

21.6 Course Structure and Duration

Confined Water Execution

1. A minimum of 1 confined water session with a minimum of 60 accumulated minutes

Open Water Execution

1. A minimum of 5 dives with a minimum of 200 accumulated minutes

Course Structure

1. TDI allows the instructor trainers to structure programs accordingly; adequate time to ensure comprehension and ability to perform skills required

Duration

1. The minimum number of classroom and briefing hours is 6. The minimum course duration is 2 days. The minimum number of equipment overview hours is 2

21.7 Administrative Requirements

The following are the administrative tasks:

1. Collect the course fees from all the instructor candidates
2. Ensure that the instructor candidates have the required equipment
3. Communicate the training schedule to the instructor candidates
4. Have the instructor candidates:
 - a. Complete the *TDI Liability Release and Express Assumption of Risk form*
 - b. Submit the *TDI Medical Statement Form* signed by a licensed physician

Upon successful completion of the course the instructor trainer must:

1. Issue the appropriate TDI certification by submitting the appropriate TDI Dive Leader Registration form to TDI Headquarters

21.8 Training Material

Required Material

1. KISS GEM owner's manual
2. TDI KISS GEM PowerPoint Slides
3. *TDI Standards and Procedures Manual*

Optional Material

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

21.9 Required Equipment

The following equipment is required for each student:

1. A complete GEM rebreather, the instructor candidate must own or have access to their own, GEM unit in order to take the course, and to teach it in the future
2. Printed checklists from the GEM owner's manual
3. GEM rebreather owner's manual
4. A minimum of 1 integrated PO₂ monitoring for each GEM

5. Access to oxygen analyzer (instructor may supply)
6. Appropriate CO₂ absorbent (ExtendAir™ cartridge or equivalent) for the dives to be conducted
7. Underwater slate
8. Depth gauge and automatic bottom timer AND/OR Nitrox dive computer
9. Mask and fins
10. Exposure suit, appropriate for the open water environment
11. Appropriate weight
12. Toolkit with appropriate spares (instructor may supply)
13. Disinfectant (instructor may supply)
14. One line cutting device

21.10 Required Subject Areas

Instructor trainers must use the *TDI Diving Rebreathers Student Manual*, instructor guide, manufacturer's manual and the current *TDI Standards and Procedures Manual*, but may also use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. History and Evolution of Rebreathers
2. Comparison of Open Circuit, Closed Circuit, and Semi-closed Circuit Units
3. Practical Mechanics of the GEM Rebreather System
 - a. Assembly and disassembly of the GEM rebreather
 - b. Layout and design
 - c. Scrubber replacement
 - d. Pre-dive safety check sequence
 - e. System maintenance and storage
 - f. Breathing loop decontamination procedures
4. Review of Nitrox
 - a. Dalton's Law (triangle)
 - b. Optimum nitrox mix
 - c. Oxygen tracking
 - d. Gas preparation and analysis

5. Gas Physiology
 - a. Oxygen toxicity
 - b. Hyperoxia
 - c. Hypoxia
 - d. Asphyxia
 - e. Hypercapnia
 - f. Nitrogen absorption
 - g. CO₂ toxicity
 - h. Gas consumption
 - i. Cylinder sizes
 - ii. Depth and workload
6. Formula Work
 - a. Cylinder size/duration equation
 - b. Equivalent air depth
7. Dive Tables
 - a. Equivalent air depth
 - b. CNS toxicity tables
 - c. NDL tables
8. Dive Computers
 - a. Mix adjustable
 - b. Oxygen integrated
 - c. PO₂ monitoring devices
9. Dive Planning
 - a. Operational planning
 - b. Gas requirements including bailout scenarios
 - c. Oxygen limitations
 - d. Nitrogen limitations
 - e. PSCR and FO₂ drop
10. Problem Solving
 - a. Canister flooding
 - b. Mouthpiece loss
 - c. Scrubber exhaustion
 - d. Battery or sensor failure
 - e. Breathing bag rupture
 - f. Open circuit bailout
 - g. Hyperoxia scenario
 - h. Hypoxia scenario
 - i. Hypercapnia scenario
 - j. Post problem maintenance of equipment

21.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed 1.4 ATM PO₂. The following skills must be demonstrated to instructor quality by all instructor candidates.

Equipment Skills

1. Mouthpiece servicing skills

Confined Water Skills

1. Complete GEM pre-dive checklist
2. Pre-dive checks
 - a. Scrubber packing
 - b. Unit assembly
 - c. One-way valve check
 - d. Positive and negative pressure tests
3. Properly analyze supply cylinder
4. Proper fitting and adjustment of counter-lung system
5. Correct starting orientation of mouth piece
6. Perform in water bubble check
7. Open-loop breathing
8. Perform 1 bail-out ascent from a depth not shallower than 1.5 metres / 5 feet
9. Perform a complete unit disassembly and cleaning

Note: All pool dives must be conducted with a minimum of 40% (+/- 1%) oxygen in the source cylinder.

Open Water Skills

1. Properly analyze gas mixture
2. Perform pre-dive check sequence with use of manufacturer's checklist
3. Demonstrate a leak check and repair scenario
4. Properly pack scrubber canister
5. Properly execute set-up and breakdown of the GEM
6. Demonstrate adequate pre-dive planning
 - a. Limits based on system performance
 - b. Limits based upon oxygen exposures at planned depth with mix
 - c. Limits based upon nitrogen absorption at planned depth with mix
7. Properly execute the planned dives within all pre-determined limits

8. Demonstrate the proper adjustment of the counter-lung system underwater
 - a. Adjustment of V-Straps (or lower strap assembly), including removal and replace
 - b. Adjustment of the counter-lung bungees
9. Properly execute a recovery from a system failure and switch to bail-out stationary
10. Properly execute a recovery from a system failure and switch to bail-out hovering a minimum of 2 times, one of the bail-out scenarios the diver must switch to open circuit and complete dive and safety stop on open circuit; direct ascent must begin when diver switches to open circuit, this scenario should be conducted no deeper than 18 metres / 60 feet
11. Properly demonstrate hose clearing technique after each bail-out scenario
12. Proper PO₂ monitoring on all dives
13. Properly execute a mask clearing exercise with emphasis on minimal gas loss
14. Open-loop or OC from 6 metres / 20 feet to surface
15. Demonstrate comfort setting up and diving the unit
16. Demonstrate good buoyancy control during the dive
17. Safely and properly execute a buddy out of air scenario, it is preferable the buddy be on a SCR unit also
18. Diver will demonstrate actual safety stops at pre-determined depths
19. Properly execute cleaning and maintenance of the GEM rebreather, including breathing loop decontamination

In order to complete this course, students must:

Complete all open water requirements safely and efficiently

1. Demonstrate mature, sound judgment concerning dive planning and execution
2. Pass the diver exam with 80% answered correctly and 100% remediation

In order to complete this course, instructors must:

1. Satisfactorily complete the TDI KISS GEM course written examination with a minimum score of 100 percent, without reference and be able to adequately explain each answer to a prospective student
2. Demonstrate mature, sound judgment concerning training, dive planning and execution
3. Complete all open water requirements safely and efficiently
4. Demonstrate proficiency in teaching the TDI KISS GEM Diver Program
5. Present a minimum of 1 graded presentation on a KISS GEM topic