28. KISS GEM Level 1 Diver

28.1 Introduction

This is the entry-level certification course for recreational divers wishing to utilize the GEM semi-closed circuit rebreather in recreational diving. The objective of this course is to instruct divers in the procedures, benefits and hazards of semi-closed circuit diving using the GEM.

28.2 Qualifications of Graduates

Upon successful completion of this course graduates may engage in no-decompression diving utilizing the GEM semi-closed circuit rebreather with a nitrox mix of between 32% and 40% to a maximum depth of 30 metres / 100 feet with a PO_2 not to exceed 1.4 ATA based on cylinder contents.

28.3 Who May Teach

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

28.4 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

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

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

28.5 Student Prerequisites

1. Minimum age of 18
2. Provide proof of:
    a. SDI Nitrox Diver or equivalent at the discretion of the instructor
    b. SDI Advanced Diver or equivalent at the discretion of the instructor

28.6 Course Structure and Duration

Confined Water Execution

1. A minimum of 1 confined water dive with a minimum of 60 minutes of accumulated bottom time

Open Water Execution:

1. A minimum of 5 dives with a minimum of 200 accumulated minutes; two dives must be deeper than 15 metres/50 feet

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; minimum course duration 3 days.

Crossovers:

For divers that have already received training on a TDI approved SCR, they must meet all GEM standards with the exception of the following:

1. Minimum of 3 open water dives for a minimum accumulated bottom time of 120 minutes. The 60 minutes of confined water time is still required

28.7 Administrative Requirements

Administrative Tasks:

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

28.8 Training Material

Required material

1. KISS GEM owner's manual
2. *TDI KISS GEM* PowerPoint Slides

Optional Material

1. TDI plastic EAD and PO_2 tables

28.9 Required Equipment

The following equipment is required for each student:

1. A complete GEM rebreather
2. Printed checklists from the GEM owner's manual
3. GEM rebreather owner's manual
4. A minimum of 1 integrated PO_2 monitoring for each GEM
5. Access to oxygen analyzer (instructor may supply)
6. Adequate CO_2 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

28.10 Required Subject Areas

The KISS GEM Owner's Manual and KISS GEM PowerPoint Slides are mandatory for use during this course but instructors may 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
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. CO_2 toxicity
    h. Gas consumption
        i. Cylinder sizes
        ii. Depth and workload
6. Formula work / metabolic consumption
    a. Cylinder size/duration equation
    b. Equivalent air depth
7. Dive Tables
    a. Inspired O_2 table
    b. Equivalent air depth.
8. Dive Computers
    a. Mix adjustable
    b. O_2 integrated
    c. PO_2 monitoring devices

9. Dive Planning
    a. Operational planning
    b. Gas requirements including bailout scenarios
    c. Oxygen limitations
    d. Nitrogen limitations
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

28.11 Required Skill Performance and Graduation Requirements

The dive depth shall not exceed one point four (1.4 ATM) PO_2. The following skills must be completed by the student during open water dives:

Confined Water Skills:

1. Complete GEM Pre-dive Checklist
2. Pre-dive checks (minimum 1 time)
    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. Perform 1 stationary bail-out
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 a minimum of 5 times
3. Demonstrate a leak check and repair scenario
4. Properly pack scrubber canister a minimum of 2 times
5. Properly execute set-up and breakdown a minimum of 5 times
6. Demonstrate adequate pre-dive planning limits based:
    a. On system performance
    b. Upon oxygen exposures at planned depth with mix
    c. Upon nitrogen absorption at planned depth with mix
7. Demonstrate switching to open loop or open circuit when depth is 6 metres/20 feet or shallower
8. Properly execute the planned dives within all pre-determined limits
9. Demonstrate the proper adjustment of the counter-lung system underwater
    a. Adjustment of straps, including removal and replacement
    b. Adjustment of the counter-lung bungees if not previously adjusted
10. Properly execute a recovery from a system failure and switch to bail-out stationary a minimum of 2 times per dive
11. 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
12. Properly demonstrate hose clearing technique after each bail-out scenario
13. Proper PO_2 monitoring on all dives
14. Properly execute a mask clearing exercise with emphasis on minimal gas loss
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 an 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:

1. Complete all open water requirements safely and efficiently
2. Demonstrate mature, sound judgment concerning dive planning and execution
3. Pass the diver final exam with 80% answered correctly and 100% remediation