10. Helitrox Instructor

10.1 Introduction

The Helitrox Instructor course provides the training required to competently teach the methods and procedures for planned stage decompression diving utilizing Helium in the breathing mixture. The objective of this course is to train instructors how to teach standard staged decompression diving not exceeding a maximum depth of 45 metres / 150 feet. Enriched air nitrox (EAN) and Helium mixes with no greater than 20% He content, and up to 100% oxygen for decompression diving are permitted. Breathing gas mixtures containing more than 20% Helium or less than 21% oxygen *are not permitted (+/- 1%).*

10.2 Qualifications of Graduates

Upon completion of this course, graduates may teach Helitrox divers provided:

1. The diving activities approximate those of training
2. The area of activities approximate those of training
3. Environmental conditions approximate those of training

10.3 Who May Teach

1. Any active TDI Helitrox Instructor Trainer may teach this course

10.4 Candidate to Instructor Ratio

Academic

1. Unlimited, so long as adequate facility, supplies and additional time are provided to ensure comprehensive and complete training of subject matter

Open Water

1. A maximum of 4 instructor candidates per active TDI Instructor Trainer are allowed; it is the instructor trainer's discretion to reduce this number as conditions dictate

10.5 Candidate Prerequisites

1. Minimum age 2l
2. Minimum certification as a TDI Trimix Diver or Helitrox diver and a TDI Advanced Nitrox and Decompression Procedures Instructor, or equivalent
3. Proof of 10 certified advanced nitrox or decompression procedures divers; minimum of 5 must be decompression procedures divers
4. Provide proof of 250 logged dives with a minimum of 20 logged Helitrox or Trimix decompression dives outside of training, 10 of these dives must be in the last 12 months

10.6 Course Structure and Duration

Open Water Execution

1. Four decompression dives with a minimum accumulated bottom time of 100 minutes
2. All dives must be deeper than 30 metres /100 feet; two dives must be at least 40 metres/130 feet

Note: All dives must contain Helium mixtures with contents consistent with course parameters.

Course Structure

1. TDI allows instructor trainers to structure courses according to the number of students participating and their skill level

Duration

1. The recommended number of classroom and briefing hours is 8

10.7 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

10.8 Training Material

Required material

1. *TDI Decompression Procedures* Student Manual and Instructor Guide
2. *TDI Extended Range/Trimix* Student Manual and Instructor Guide

Optional Material

1. Corresponding TDI PowerPoint® presentations
2. *TDI Advanced Trimix* Manual

10.9 Required Equipment

The following equipment is required for each student:

1. Primary cylinder(s); cylinder volume appropriate for planned dive and student gas consumption
2. Decompression mix cylinder(s) Cylinder volume appropriate for the planned dive and student gas consumption with submersible pressure gauge.

3. Labeled in accordance with TDI Standards.
4. Depth gauge and automatic bottom timer **and** *I* **or** dive computer programmable with appropriate breathing mixture(s)
5. Regulator(s)
6. Primary and alternate 2nd stage required on all primary cylinders
7. Submersible pressure gauges are required on all primary cylinders
8. Buoyancy compensator device(s) (BCD(appropriate for equipment configuration
9. Line cutting device
10. Jon-line and other rigging lines as dictated by site conditions
11. Ascent reel with lift bag /surface marker buoy appropriate for maximum planned depth, minimum of 12kg / 25lb lift bag
12. Oxygen analyzer and helium analyzer; may be supplied by the instructor
13. Exposure suit adequate for the open water environment
14. Underwater Slate

10.10 Required Subject Areas

The TDI *Decompression Procedures and Extended Range/Trimix* Manuals are mandatory for use during this course but instructor trainers may use any additional text or materials that they feel help present these topics. The following topics must be covered during this course:

1. Overview of decompression "safety stops" compared to required stops
2. Physics
    a. Pressure review
3. Physiology
    a. Mechanics of bubble formation
    b. Advantages of hyperoxic mixes for decompression
    c. Advantages of helium mixes for bottom gas
    d. Hypoxia
    e. Oxygen toxicity
        i. Whole Body (OTUs)
        ii. Central Nervous System (CNS)
    f. Nitrogen Narcosis
    g. Nitrogen and Helium Absorption and Elimination
    h. Carbon Dioxide Toxicity
    i. Carbon Monoxide Toxicity
    j. Helium
        i. HPNS
        ii. Effects on respiration
        iii. Effects as an insulator
    k. Counter Diffusion

   l. Hyperthermia
   m. Hypothermia
   n. Ascent / Descent rates
   o. Psychological aspects
      i. Task loading
      ii. Stress
      iii. Panic
      iv. Time Management
      v. Equipment
4. Decompression Options
   a. Air
   b. Nitrox
   c. Oxygen
5. Equipment Considerations
   a. Twin cylinder or single cylinder option, valve options
   b. Stage cylinder options
   c. Regulator Options
   d. Harness / BCD options
   e. Computer, depth gauge, bottom timer options
   f. Ascent and navigation reels
   g. Lift bags/surface marker buoys for drifting or free decompression
   h. Jon-line or Garvin clips
   i. Proper weighting and buoyancy control during dive phase and decompression
6. Dive Tables vs. Computers
   a. Introduction and review of different models (Bühlmann, DCIEM, US Navy, etc)
   b. Proper use of electronic multi-level dive computers for dive planning and decompression
      i. Mix adjustable
      ii. 0_2 integrated
7. Dive Planning
   a. Standard Operation
      i. Gas requirements
      ii. Oxygen limitations
      iii. Nitrogen limitations
      iv. Helium limitations
   b. Emergency planning
      i. Omitted decompression
      ii. Decompression sickness
      iii. Equipment failure
8. Procedures
   a. Primary and Decompression Gas

i. Normal operations
ii. Failure, loss or inadequate emergency procedures
iii. Analysis and logging
iv. Safeguards on decompression supply regulators
v. Rigging and deployment of decompression equipment

b. Descent
   i. Methods of entry, down lines or free decent
   ii. Organization of equipment carried on diver

c. Ascent
   i. Variable rates
   ii. Trim and compensation

d. Fixed or Drifting Decompression Methods
   i. Up-lines fixed to bottom
   ii. Reels and lift bags/surface marker buoys
   iii. Free drifting stages or boat supplied
   iv. Self-contained versus surface supply / rendezvous gas cylinders

e. Support
   i. From shore
   ii. From descent line or fixed platform
   iii. From live-aboard boat

10.11 Required Skill Performance and Graduation Requirements

The following skills must be completed by the instructor candidate to demonstration quality:

1. Proper analysis of all gas mixtures to be used

Land Drills:

1. Selection and preparation of equipment suitable for soft overhead environment
2. Conduct team oriented drills (buddy checks) for lift bag deployment
3. Conduct team oriented drills (buddy checks) for gas switching procedures
4. Gas matching among buddy team
5. Demonstrate familiarity with basic hand signals
6. Demonstrate adequate pre-dive planning
   a. Limits based on personal and team gas consumption.
   b. Exact dive and decompression profile.

Pre-dive Drills:

1. Use START* before every dive
2. Stress analysis and mitigation

In-water Drills:

1. Demonstrate buoyancy control (ability to hover at fixed position in water column without moving hands or feet)
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Demonstrate comfort swimming on surface and at depth carrying single decompression stage bottle
4. Demonstrate ability to drop and retrieve single decompression cylinder while maintaining position in the water column
5. Demonstrate ability to deploy a lift bag solo and as member of team
6. Demonstrate controlled / staged ascent on lift bag / emergency ascent line (lost ascent line)
7. Remove and replace mask (deploy backup mask)
8. Demonstrate appropriate reaction to gas hemorrhage from manifold or first stage, SPG and primary regulator
9. React to BCD inflator malfunction (disconnect LP hose, dump gas and orally inflate BCD/Wing to neutral buoyancy)
10. Demonstrate ability to confirm gas switch(es) at depth with buddy/team members
11. Buddy breathing deco gas for at least one minute
12. Switch to back-up mask (remove and replace mask)
13. Demonstrate appropriate reaction to simulated free-flowing deco regulator
14. Demonstrate appropriate modifications to deco schedule in decompression emergency (over time, over depth) (to be simulated)
15. Demonstrate tired diver tow at depth and on surface (30 meters / 90 feet lateral each)
16. Complete a horizontal breath hold swim at depth for 15 meters / 45 feet
17. Properly execute the planned dive within all pre-determined limits
    a. Assembly of diver carried equipment
    b. Proper descent / ascent rates
    c. Proper staged stop procedures
    d. Monitoring of decompression status equipment (tables, computers, equipment)
18. Contingency Situations and Problem Solving (as appropriate by instructor)
    a. Omitted decompression
    b. Extended bottom time profiles with increased decompression and re-calculated schedules
    c. Failure to deploy lift bag and reel
    d. Missed up-line or missed boat anchor
    e. Loss of decompression gas
19. A safety stop of at least 3 minutes shall be conducted on all no-decompression dives and proper staged decompression stops whenever and wherever mandated.
20. Demonstrate (simulated) emergency gas sharing at a stationary depth not to exceed 30 metres / 100 feet
21. Demonstrate emergency deployment of a backup regulator or bail-out scuba system containing bottom mix at a depth not to exceed 30 metres/100 feet
22. Demonstrate the proper deployment, management and use of the bottom mix, decompression mix and travel mix (if used), including but not limited to:
    a. Conservative gas management
    b. Depth control to avoid descending too deep for mix

c. Show appropriate and timely responses to instruction / signals from the instructor and demonstrate buoyancy control and awareness throughout the dive

In order to complete this course, candidates must:

1. Satisfactorily complete the TDI Decompression Procedures Course written examination
2. Satisfactorily complete the TDI Trimix course written examination and be able to adequately explain each answer to a prospective student
3. Complete all open water requirements safely and efficiently
4. Demonstrate mature, sound judgment concerning dive planning and execution
5. Demonstrate proficiency in teaching the TDI Helitrox Diver course
6. Present at least 1 graded presentation on a Helitrox topic