13. Advanced Trimix Diver

13.1 Introduction

The TDI Advanced Trimix course provides the training required to competently and safely utilize breathing gases containing helium for dives that require staged decompression, utilizing nitrox and / or oxygen (O_2) mixtures during decompression to a maximum depth of 100 metres / 330 feet. The objective of this course is to train divers in the benefits, hazards and proper procedures of utilizing custom oxygen / helium / nitrogen mixtures as breathing gases.

13.2 Qualifications of Graduates

Upon successful completion of this course, graduates may engage in technical diving activities utilizing custom Trimix mixtures without direct supervision provided:

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

13.3 Who May Teach

Any active TDI Advanced Trimix Instructor may teach this course

13.4 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. N/A

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

13.5 Student Prerequisites

1. Minimum age 18
2. Minimum certification TDI Extended Range Diver or TDI Trimix Diver, or equivalent
3. Provide proof of a minimum 100 logged dives with 25 deeper than 30 metres / 100 feet
4. Provide proof of prior logged experience w/ double cylinders and any other unfamiliar equipment such as a dry suit

13.6 Course Structure and Duration

Open Water Execution

1. Four dives with a minimum accumulated bottom time of 100 minutes
2. At least 2 dives should be deeper than 70 metres / 230 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 8

13.7 Administrative Requirements

The following are the administrative tasks:

1. Collect the course fees from all the students
2. Ensure that the students have the required equipment
3. Communicate the training 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

13.8 Training Material

Required material

1. *TDI Advanced Trimix Diver* Manual or eLearning course

Optional Material

2. *TDI Advanced Trimix* PowerPoint Presentation
3. *TDI Advanced Trimix* Cue Cards
4. *TDI Advanced Trimix Evaluation* Slate

13.9 Required Equipment

The following equipment is required for each student:

1. Bottom mix cylinder(s)
    a. Cylinder volume appropriate for planned dive and student gas consumption
    b. Dual outlet valve, double manifold or independent doubles
    c. Labeled in accordance with local practices and/or regulations
2. Travel mix cylinder(s)
    a. Cylinder volume appropriate for planned dive and student gas consumption
    b. Labeled in accordance with TDI Standards
3. Decompression mix cylinder(s)
    a. Cylinder volume appropriate for planned dive and student gas consumption
    b. Labeled in accordance with local practices and/or regulations
4. Suit inflation cylinder, required for dry suit divers only
5. Regulators
    a. Primary and primary redundant required on all bottom mix cylinder(s)
    b. Submersible pressure gauges are required on all primary bottom mix cylinders
    c. A contingency use long hose second stage should be designated and appropriately rigged to facilitate air sharing at depth if necessary
    d. It is strongly recommended that all 4 required regulators be all DIN or all 4 yoke
6. Buoyancy compensator device(s) (BCD) adequate for equipment configuration
7. Redundant depth and timing devices; air decompression computers allowed for use as depth and timing devices

8. Redundant light system if required by site
9. Ascent reel with lift bag/surface marker buoy
    a. Adequate for maximum planned depth
    b. Adequate lift and size for the dive environment
10. Exposure suit adequate for the open water environment
11. Line cutting device
12. Underwater slate, for decompression / contingency tables
13. Helium analyzer, recommended

13.10 Required Subject Areas

The *TDI Advanced Trimix* Manual or eLearning is 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. Physics
    a. Pressure review
2. Physiology
    a. Hypoxia
    b. Oxygen (O_2) toxicity
        i. Whole Body (OTUs)
        ii. Central nervous system (CNS)
    c. Nitrogen narcosis
    d. Nitrogen and helium absorption and elimination
    e. Carbon dioxide (CO_2) toxicity
    f. Carbon monoxide (CO) toxicity
    g. Helium
        i. HPNS
        ii. Effects on respiration
        iii. Effects as an insulator
    h. Counter diffusion
    i. Hyperthermia
    j. Hypothermia
3. Decompression Options
    a. Air
    b. Nitrox
    c. Helium

4. Equipment Considerations
    a. Cylinder options
    b. Stage cylinders options
    c. Suit inflation options
    d. Regulator options
    e. Harness / BCD options
    f. Computer / depth gauge bottom timer options
    g. Ascent and navigation reels
    h. Lift bags/surface marker buoys
    i. Lights
    j. Redundant mask and knife
    k. Jon-line
5. Dive Tables
    a. Computer generated tables
    b. DCIEM Helitrox Tables and / or other published tables
6. Dive Planning
    a. Operational planning
        i. Support
        ii. Teams
    b. Team planning
        i. Gas requirements
        ii. Oxygen limitations
        iii. Inert gas limitations
    c. Emergency planning
        i. Omitted decompression
        ii. Oxygen toxicity
        iii. Analysis and logging
        iv. General
7. Procedures
    a. Bottom, travel and decompression gas
        i. Normal operations
        ii. Failure, loss or inadequate emergency procedures
        iii. Analysis and logging

13.11 Required Skill Performance and Graduation Requirements

The following open water skills must be completed by the student during open-water dives. It is recommended that all dives be conducted between 55 metres / 180 feet and 100 metres / 330 feet.

1. Skills review from previous TDI skills requirements including all skills from entry-level mix or extended range

Land Drills

1. Demonstrate familiarity with basic and intermediate hand signals
2. Selection and preparation of equipment suitable for soft overhead environment with long decompression obligations
3. Conduct team oriented drills for lift bag deployment and gas switching procedure
4. Drills for buddy rescue
5. Properly analyze all gas mixtures to be used

Pre-dive Drills

1. Use START* before every dive
2. Stress analysis and mitigation
3. Gas matching among buddy team
4. Demonstrate adequate pre-dive planning
    a. Limits based on personal and team gas consumption
    b. Limits based on oxygen exposures at planned depths for actual mixes
    c. Limits based on inert gas absorption at planned depths with actual mixes

***START is S-drill (OOA drill and Bubble Check), Team (buddy equipment checks), Air (gas matching), Route (entry/exit and planned path underwater), Tables (depth, duration, waypoints and schedule).**

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 competence managing three stage cylinders, either 3 deco gas or 2 deco and extra bottom gas, including drop and recovery while maintaining position in the water column

4. Ability to manage multiple failures in adverse conditions
5. Complete a horizontal breath-hold swim at depth for 20 metres / 66 feet with mask off or blacked out
6. Deploy lift bag while sharing air on buddy's long hose
7. Properly execute the planned dive within all pre-determined limits
8. Demonstrate the proper navigational techniques for the specific dive
9. On 2 of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
10. Demonstrate the proper procedures for switching and isolating a malfunctioning primary regulator; this exercise should not be practiced deeper than 40 metres / 130 feet

In order to complete this course, students must:

1. Satisfactorily complete the TDI Advanced Trimix Course written examination
2. Complete all open water requirements safely and efficiently
3. Demonstrate mature, sound judgment concerning dive planning and execution