

12. Trimix Diver

12.1 *Introduction*

The TDI 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 mixtures during decompression to a maximum depth of 60 Metres/200 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. Gas mixes are not to have any less than 18 percent oxygen (O₂) and a minimum of 25% helium (He).

12.2 *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 areas of activities approximate those of training.
3. Environmental conditions approximate those of training.
4. Oxygen (O₂) percentages are 18 percent or higher.

12.3 *Who May Teach*

Any active TDI Trimix Instructor may teach this course.

12.4 *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.

12.5 Student Prerequisites

1. Minimum age 18.
2. Minimum certification as a TDI Advanced Nitrox Diver and TDI Decompression Procedures Diver, or equivalent.
3. Provide proof of a minimum of 100 logged dives.

12.6 Course Structure and Duration

Open Water Execution:

1. Four decompression dives using trimix as bottom gas are required with a minimum accumulated bottom time of 100 minutes.
2. Two of the dives should be deeper than 40 Metres/130 Feet.
3. A maximum of 2 dives from the Advanced Wreck course may be credited towards the total dives required, at the instructor's discretion, provided the Advanced Wreck and Trimix courses are being taught concurrently and the credited dives are made using trimix.

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.

12.7 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.

12.8 Training Material

Required Material:

1. *TDI Extended Range/Trimix Diver Manual* or eLearning.

Optional Material:

1. *TDI Extended Range/Trimix PowerPoint*.
2. *TDI Trimix Cue Cards*.
3. *TDI Trimix Evaluation Slate*.

12.9 Required Equipment

The following equipment is required for each student:

1. Bottom mix cylinder(s):
 - a. Cylinder volume appropriate to complete all planned decompression on bottom mix.
 - b. Dual outlet valve, double manifold or independent doubles.
 - c. Labeled in accordance with local practices and/or regulations.
2. Decompression mix cylinder(s):
 - a. Cylinder volume should contain a minimum of 1.5 times the gas required for the planned decompression.
 - b. Labeled in accordance with local practices and/or regulations.
3. Suit inflation cylinder, required for dry suit divers only.
4. 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 the 3 required regulators be all DIN or all yoke.
5. Buoyancy compensator device(s) (BCD) adequate for equipment configuration.

6. Redundant depth and timing devices.
7. Air decompression computers are allowed for use as depth and timing devices, provided they have a gauge mode.
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.

12.10 Required Subject Areas

The TDI Extended Range/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 (O₂) toxicity:
 - i. Whole Body (OTU's).
 - ii. Central nervous system (CNS).
 - c. Nitrogen narcosis.
 - d. Nitrogen and helium absorption and elimination.
 - e. Carbon dioxide (CO₂) 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 Heliox Tables 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.

12.11 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 30 Metres/100 Feet and 60 Metres/200 Feet. Gas mixes are not to have any less than 18 percent oxygen (O₂):

1. Skills review from previous TDI skills requirements.

Land Drills:

1. Demonstrate familiarity with basic and intermediate hand signals.
2. Select and prepare 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.
6. 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.

Pre-dive Drills:

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

*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. Show good awareness of buddy and other team members through communications, proximity and team-oriented dive practices.
2. Demonstrate competence managing 2 stage cylinders, either 2 deco gas or 1 deco and 1 extra bottom gas, including drop and recovery while maintaining position in the water column.
3. Demonstrate ability to confirm gas switches at depth with buddy/team members.
4. Demonstrate lift bag deployment from depth and use of bag as back-up buoyancy device.
5. Demonstrate air-sharing ascent from depth while one member of buddy team is without mask, both as donor and recipient.
6. Create contingency decompression schedule after simulated loss of decompression gas.
7. Remove and replace mask, deploy backup mask.
8. Demonstrate controlled ascent with simulated toxed diver including surface tow at least 30 Metres/100 Feet with equipment removal on surface, in water too deep to stand in.
9. Complete a horizontal breath-hold swim at depth for 15 Metres/50 Feet with mask off or blacked out.
10. Properly execute the planned dive within all predetermined limits.
11. Demonstrate the proper navigational techniques for the specific dive.
12. On 2 of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression.
13. Demonstrate the proper procedures for switching and isolating a malfunctioning primary regulator. This exercise should not be practiced deeper than 40 Metres/130 Feet.
14. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or Feet.

In order to complete this course, students must:

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