



## **18. TDI – Mixed Gas Closed Circuit Rebreather Diver Course, Unit Specific to Ambient Pressure Inspiration (“INSPIRATION”)**

### **18.1 Introduction**

This is the highest level certification course for recreational divers wishing to utilize the Inspiration Closed Circuit Rebreather for mixed gas diving. The objective of this course is train recreational divers in the benefits, hazards and proper procedures for mixed gas rebreather diving on the Inspiration CCR and to develop advanced rebreather diving skills appropriate to technical diving to depths greater than the recreational limit of one hundred thirty (130) fsw / forty (40) msw).

### **18.2 Qualifications of Graduates**

Upon successful completion of this course, graduates may engage in technical diving activities utilizing the Inspiration rebreather to a maximum of two hundred (200) fsw / sixty (60) msw, utilizing any diluent appropriate to the dive plan. If however, the student has open circuit trimix experience of fifteen (15) dives beyond one hundred sixty five (165) fsw / fifty (50) msw following a Trimix Course then the Instructor may decide to qualify the student up to three hundred (330) fsw / one hundred (100) msw in line with their open circuit qualification. This must be undertaken only when the candidate is deemed to be suitably qualified for deep rebreather diving beyond two hundred (200) fsw / sixty (60) msw. Accompanying proof must be submitted to TDI HQ with the application to do the course.

### **18.3 Who May Teach**

Who may teach this course:

1. An active TDI Closed Circuit Rebreather Instructor or Instructor Trainer with an **Inspiration Mixed Gas Instructor** rating.
2. A “certified assistant” is a TDI or equally qualified Divemaster with an Inspiration mixed gas user qualification and a minimum of 120 hours logged diving on the Inspiration.
3. The Mixed Gas Instructor rating is awarded to a TDI Instructor who has the following:
  - A. TDI Inspiration Instructor with fifteen (15) students taught and one year teaching experience on the Inspiration.
  - B. Plus - Open Circuit Trimix Instructor (100 metre full rating) with fifteen (15) students taught and one further year teaching experience of Trimix open circuit.
  - C. Properly verified and logged proof of thirty (30) mixed gas dives on a rebreather with fifteen (15) logged beyond two hundred fifteen (215) fsw / sixty five (65) msw.
  - D. Applied to SDITDI Training Board for the qualification. Proof of each of the above MUST accompany the application.



**The above method (3) will only be issued by the SDI TDI Training Board.**

Or

4.

- I. An Inspiration Instructor with fifteen (15) students taught and one year teaching experience on the Inspiration.
- II. Logged proof of thirty (30) mixed gas dives on a rebreather with fifteen (15) logged beyond two hundred fifteen (215) fsw / sixty five (65) msw with at least one years added experience since gaining the Advanced Level Trimix qualification.
- III. Attendance on a CCR Rebreather Mixed Gas Instructor course undertaken on a properly conducted workshop whilst assisting a HQ approved Instructor Trainer teaching a minimum of four (4) Inspiration Mixed Gas students.
- IV. Gained a minimum of pass in all areas of evaluation from the Instructor Trainer.

## **18.4 Student – Instructor Ratio**

Academic:

1. Unlimited, so long as adequate facility, supplies and time are provided to insure comprehensive and complete training.

Confined Water (Swimming pool-like conditions):

1. A maximum of two (2) students per active TDI Instructor is allowed or four (4) with a certified assistant (see above; *Who may teach* and TDI Divemaster standards).

Open Water (Ocean, lake, quarry, spring, river or estuary):

1. A maximum of two (2) students per active TDI Instructor is allowed or four (4) with a certified assistant.
2. The ratio should be reduced as required due to environmental or operational constraints

## **18.5 Student Pre-Requisites**

The student must:

1. Be a minimum age of eighteen (18).
2. Have a verified log of a minimum of one hundred (100) rebreather hours distributed over a minimum of one hundred (100) dives on the Inspiration. Fifty (50) % of those dives deeper than sixty six (66) fsw / twenty (20) msw. All to be deeper than twenty (20) fsw / six (6) msw.
3. Minimum certification level of TDI Trimix Diver or equivalent trimix diver from other agencies recognized by TDI. **The trimix course may be combined with the rebreather course but will be to the Intermediate 60 metre (200ft) qualification only.**
4. Have completed and qualified the TDI Air Diluent Rebreather Course or equivalent from agencies recognized by TDI.



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## **18.6 Course Structure and Duration**

Open Water Execution:

1. Six (6) Dives to include two (2) shallow water equipment configuration and drills practice one being a maximum one hundred thirty one (131) fsw / forty (40) msw air diluent dive but using new configurations of equipment.
2. If the course is to be combined with the Trimix Diver requirements then a further two (2) dives must be undertaken (for a total of eight (8) to complete the course.
3. All subsequent dives to build incrementally in no greater than thirty three (33) fsw / ten (10) msw steps.
4. Only two (2) dives are on air diluent all others are to be mixed gas dives and deeper than 40 metres (131fsw).

Course Structure:

1. TDI allows instructors to structure courses according to the number of students participating and their skill level.
2. The exam may be given orally if not available in a language the student understands.

Duration:

1. Minimum of six (6) hours for academic development and a further two (2) hours for equipment configuration workshop.

## **18.7 Administrative Requirements**

The following is 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 Liability Release and Medical history forms.
5. The Instructor should review the Liability Release and Medical Forms before starting on the course.

Upon successful completion of the course the Instructor must:

1. Complete the Student Registration Form and send the Registration Form to TDI HQ.
2. Award card and certificate.

## **18.8 Required Equipment**

The following are required for this course:

1. TDI Rebreather Manual.
2. TDI Mixed Gas Diver Manual.
3. Manufacturer Specific Manual.
4. Ambient Pressure manufacturers update.

The following equipment is required for each student:

1. An Inspiration rebreather. This should be the students own unit.



2. Bailout gas supply in a minimum of two (2) separate off-board oxygen clean cylinders of no less than 21cu/ft – 3litre capacity but information in Skill Performance point 4 must be used in calculating the necessary requirements for a dive.
3. Two (2) open circuit regulators and gauges fitted to the configuration.
4. Mask, fins & a suitable line-cutting device.
5. Slate & pencil.
6. Minimum two (2) x Depth gauge and timer.
7. Lift bag and reel with a minimum of two hundred (200) feet / sixty (60) metres of line and twenty five to forty five (25 – 40) / twelve to twenty (12 –20) kg lift.
8. Second lift bag and reel with a minimum of one hundred (100) feet / thirty (30) metres of line and twenty five (25) lb / twelve(12) kg lift.
9. Exposure suit adequate for the open water environment where training will be conducted.
10. Access to an oxygen analyzer.
11. Access to a helium analyser
12. Adequate weight.

## **18.9 Required Subject Areas**

The TDI Rebreather manual is required for use as a review/recap document. The Instructor may use any additional text or materials they feel will represent the topic in an educational manner. The following topics must be covered during the course.

1. Gas Physiology.
  - A. Oxygen toxicity.
  - B. Nitrogen absorption.
  - C. Helium absorption.
  - D. CO<sub>2</sub> toxicity.
  - E. Gas consumption.
  - F. Gas mixing.
2. Formula Work.
  - A. O<sub>2</sub> metabolizing calculations.
  - B. Equivalent Narcosis Depth theory.
  - C. CNS tracking.
  - D. OTU Tracking.
  - E. Gas management.
3. Dive Tables.
  - A. Creation of custom dive tables appropriate to dive depths.
  - B. Creation of lower PO<sub>2</sub> diluent to support loop flushing and bailout at depth.
4. Dive Computers.
  - A. Mix adjustable.
  - B. Constant PPO<sub>2</sub>.
  - C. O<sub>2</sub> integrated.
5. Dive Planning.
  - A. Operational Planning.
    - I. Gas requirements including bailout scenarios.
    - II. Oxygen limitations.



- III. Nitrogen limitations.
- IV. Helium limitations.
- 6. Equipment Maintenance
  - A. Fuel Cell Management.
  - B. Loop configurations.
  - C. Additional fitted equipment and modifications
    - I. Auto Diluent Addition.
    - II. Dual Mode Mouthpieces.
    - III. Head Up Display.
    - IV. Additional Manual Injectors.
    - V. Integrating Oxygen Monitors for Dive Computers.
    - VI. Third party electronics available.

### **18.10 Required Skill Performance And Graduation Requirements**

The following open water skills must be completed by the student during open-water dives with the following course limits:

1. No dives deeper than two hundred fifty (250) fsw / seventy five (75) msw.
2. No dives shallower than one hundred thirty one (131) fsw / forty (40) msw other than the two (2) air diluent configuration dives.
3. Equivalent narcosis depth not to exceed one hundred thirty one (131) fsw / forty (40) msw with a strong working recommendation of one hundred (100) fsw / thirty (30) msw if dive is beyond one hundred sixty five (165) / fifty (50) msw.
4. Calculate all off-board gas at 40 liters (1.41 cubic feet) per minute usage to cover stress situations.
5. Dive PO<sub>2</sub> not to exceed manufacturer recommendation or a working limit of 1.4 bar.
6. All dives to be completed within appropriate fixed PO<sub>2</sub> decompression tables.
7. All dives to be completed within CNS% limits with a recommend maximum of eighty (80) % of the total PO<sub>2</sub> CNS limit.
8. The student is only certified for CCR mixed gas diving on the Inspiration rebreather.

#### **Open Water Skills:**

1. Verify diluent and O<sub>2</sub> cylinder contents using O<sub>2</sub> analyzer where appropriate.
2. Demonstrate correct pre dive planning procedures including:
  - A. Limits based on system performance.
  - B. Limits based on oxygen exposures at chosen PPO<sub>2</sub> levels.
  - C. Limits based on nitrogen absorption at planned depth and PPO<sub>2</sub> (Setpoint) level.
  - D. Limits based on helium absorption.
  - E. Correct narcotic depth planning and diluent selection to allow cell flushing at target depth.
3. Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried.
4. Gas shutdowns and loss of gas, correct choice and switching to off board gases.
5. Broken hoses – disaster scenario's.
6. Flooded absorbent canister.
7. Oxygen rebreather mode at less than twenty (20) fsw / six (6) msw stops.
8. Controlled use of BC/suit for buoyancy control.
9. Pre dive checks.



10. Stop at ten to eighteen (10 – 18) ft / three to five (3 – 5) msw on descent for leak bubble check and diluent flush.
11. Remove and replace side mounted stage cylinders under water.
12. Deployment of a delayed SMB at depth and mid water.
13. Electronics systems monitoring for PPO<sub>2</sub> levels.
14. Proper execution of the dive within all pre-determined dive limits.
15. Demonstration of decompression stops at pre-determined depths.
16. Post dive clean of unit to avoid contamination and spread of disease.

In order to complete the course and achieve the Ambient Pressure Inspiration Mixed Gas Rebreather rating the student must:

1. Complete to the Instructors satisfaction all confined and open water skill development sessions.
2. Demonstrate mature, sound judgment concerning dive planning and execution.
3. Satisfactorily complete a written examination with a pass mark of greater than eighty (80) %.
4. Course must be completed within four (4) weeks from the starting date.
5. Complete a refresher course following a period of inactivity greater than three (3) months following the course.
6. The Instructor must stipulate the maximum depth based on observation during the course and previous logged and submitted experience – two hundred (200) fsw / sixty (60) msw or three hundred & thirty (330) fsw / one hundred (100) msw.