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# INTRODUCTION

## INTENT

This document describes the minimum requirements that need to be met for a student to learn how to use a closed circuit rebreather (“CCR”) for all course levels from using air diluent at 30 meters up to trimix for a maximum depth up to 100 meters.

These standards are meant to be minimum requirements across all units regardless of manufacturer. Individual manufacturers reserve the right to add additional requirement for CCR divers to learn how to use their rebreathers safely, including unit-specific procedures and additional classroom or in-water training. Training organizations may add additional requirements to these minimum training standards.

RESA is publishing these minimum training standards so that every rebreather student and diver will have an understanding and expectation of what should be taught in their CCR diver classes. If topics are skipped during training, the student will know that they are not being provided with a full program of learning. These RESA minimum training standards are an integral part of the manufacturers’ minimum standards.

RESA encourages training organizations to meet these minimum standards in their instruction of rebreather divers. These are the global industry standards for CCR education and training, and it is the intention of RESA’s members that these minimum standards shall be met or exceeded regardless of the location where training is received or the individual organization or instructor providing training. If there is a discrepancy between the RESA minimum standards and the minimum training standards of any training agency or organization, the RESA standards shall supersede the conflicting standard(s).

Dive safely!

RESA

# CCR DIVER

## INTENT

The CCR Diver program provides divers with the knowledge and training necessary to independently plan and conduct unit specific no decompression closed-circuit rebreather (CCR) dives to a maximum depth of 30 meters, using a manufacturer approved CCR unit with air as diluent utilizing CCR Diving procedures with a dive buddy diving on a rebreather or diving open circuit.

## REQUIRED INSTRUCTOR RATING

An active status unit-specific CCR Instructor or higher may conduct the unit-specific CCR Diver program.

## TEACHING RATIOS

- The maximum number of students for CCR training is 3:1
- The maximum number of students for no-decompression CCR training where one (1) student is making a crossover or doing a refresher is 4:1

## STUDENT PREREQUISITES

- Nitrox certification
- Have logged 20 open water dives
- Minimum age: 18

## DURATION

- Recommended hours for course completion: 40
- Minimum number of days: 4
- Minimum number of hours for Academics and Dry practical: 8

## MATERIALS AND EQUIPMENT

### **The minimum required student and instructor equipment for this program includes:**

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency and is properly functioning
- Has no non-manufacturer approved modifications
- A single off-board bailout gas suitable for a safe return to the surface from the planned maximum depth including all safety and decompression stops in the event of an emergency
- For Open water and lake environments with the exception of cave/overhead environments a Delayed Surface Marker Buoy (DSMB) and a spool / reel appropriate for the planned dive depth.
- A cutting device
- Access to an appropriate gas analyzer

### **The minimum required student and instructor materials for this program includes:**

- Manufacturer's unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)
- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)
- Manufacturer's sign off sheet/course completion document

**All skills must be demonstrated by the instructor on the specific unit being trained.**

**Academics**

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Practical mechanics of a CCR
  - Assembly and disassembly
  - Unit Specific Check list
  - Design and overview of the unit
  - Absorbent canister
  - Breathing loop
  - Manufacturer's supported add-ons: BOV, ADV, etc
  
2. Loop volume - minimum / optimum
  
3. Gas Physiology
  - Oxygen risks, Hypoxia, Hyperoxia
  - Carbon dioxide (CO<sub>2</sub>) toxicity, Hypercapnia
  - Nitrogen absorption
  
4. Proper scrubber filling; in accordance with manufacturer's recommendation
  - Manufacturer's recommended scrubber medium
  
5. Electronic or Manual Systems Design and Maintenance
  - Oxygen (O<sub>2</sub>) metabolizing calculations
  - Oxygen Sensors, limitations, care and replacement regime
  - System electronics functionality and calibration procedures
  
6. Dive Tables
  - Constant partial pressure of oxygen (PPO<sub>2</sub>) theory
  - Central nervous system (CNS) and Oxygen Tolerance Unit (OTU) tracking and awareness
  
7. Dive Computers
  - Mix adjustable
  - Constant PO<sub>2</sub>
  - Decompression conservatism / Gradient factor selection
  - Oxygen (O<sub>2</sub>) integrated
  
8. Dive Planning
  - Operational planning
  - Gas consumption
  - Scrubber duration
  - Gas requirements including bailout scenarios
  - Oxygen limitations
  - Nitrogen limitations

## 9. Emergency Procedures

- Flooded loop
- Cell warnings
- Battery warnings
- Electronic failures

## Skills

1. Pre-dive checks
  - Specific Unit Checklist
  - Unit build-up
  - Scrubber canister filling
  - Breathing loop check including mouthpiece one way valves and positive and negative check
2. Verify diluent and oxygen (O<sub>2</sub>) cylinder contents using gas analyzers
3. Demonstrate correct pre-dive planning procedures including
  - Limits based on system performance
  - Limits based on oxygen exposures at chosen PO<sub>2</sub> levels
  - Limits based on nitrogen absorption at planned depth and PO<sub>2</sub> set point
  - Appropriate selection of decompression conservatism / gradient factors for the planned dive
  - Thermal constraints
4. Mouthpiece familiarity skills
5. Stop at 3-6 meters on descent for leak bubble check
6. Counterlung & Over Pressure Valve adjustment, if applicable
7. Emergency procedures
  - Practical bailout skills
  - Gas shutdowns and loss of gas
  - Broken hoses
  - Flooded absorbent canister
  - Carbon dioxide (CO<sub>2</sub>) breakthrough
  - Low oxygen drills
  - High oxygen drills
  - Flooding loop
  - Electronics and battery failure
8. Practice transferring to open circuit bailout
9. Rescue skill session as outlined by the training agency
10. Use of a buoyancy control system

11. Electronics systems monitoring for PO<sub>2</sub> levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available.
12. Manual PO<sub>2</sub> control
13. Use and adjustment of Head Up Display(s) – position/brightness/color
14. Use and adjustment of PO<sub>2</sub>/depth/time display(s) – position/brightness/color
15. Use of lift bag / DSMB and reel (where relevant and applicable)
16. Mask removal and replacement
17. Proper execution of the dive within all pre-determined dive limits
18. Demonstration of safety stops at pre-determined depths
19. Constant loop volume management
20. Cell validation checks with appropriate use of diluent and oxygen
21. Post dive clean of unit
  - Mouth piece and hoses
  - Clean and disinfect unit
  - Inspect components of unit
22. Diver maintenance of unit
  - Cell removal and replacement
  - Mouthpiece care
  - Replacing or re-charging of batteries



## EXTRA REQUIREMENTS FOR COMPLETION

Notes

- Demonstrate an adequate level of fitness by completing a minimum of a 50m surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program.
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete a minimum of seven (7) training dives, including confined water skill development of at least one (1) hour, and six (6) core open water training dives with a minimum run time of 30 minutes each.
- Complete at least a minimum of 420 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of five years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of five years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

*Dive logs and student-signed course completion form are to be submitted to the manufacturer of the specific unit on request*

## DEPTH LIMITATIONS

- Open Water Training Dives shall be initially shallow, progressively increasing in depth.
- Two (2) dives must be deeper than 20 meters for certification
- All dives must be conducted at a depth shallower than 30 meters.

## NOTES

- All training dives must be planned within the no-decompression limits of the Combined Air/EAN Tables or the student's personal dive computer or computer-generated decompression profiles.
- Bailout cylinder gas is to be based on a maximum PPO<sub>2</sub> of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a ppO<sub>2</sub> higher than 1.1 bar at the bottom.
- The maximum loop set point is 1.3 bar.

### **Diving in an overhead environment**

- This course shall not be conducted in an overhead environment

## SEQUENCE

Open Water Training Dives 1 and 2 may only be conducted after completing the equipment configuration section, the surface diver tow and all confined water sessions.

## CERTIFICATION

The unit specific CCR Diver certification entitles the holder to dive with a buddy, diving on a rebreather or diving open circuit, utilizing CCR diving procedures to make non decompression dives to depths of up to 30 meters, providing that dives are conducted in environments similar to those of the diver's training and experience.

# CCR DECOMPRESSION DIVER

## INTENT

The intent of the Decompression CCR Diver program is to provide divers with the training necessary to independently plan and conduct unit specific decompression dives using air or Trimix with a minimum of 20% oxygen and a maximum of 35% Helium, to a maximum depth of 40 meters with air diluent or 45 meters with Trimix, using decompression mixtures of up to 100% oxygen and utilizing CCR diving procedures with a dive buddy diving on a rebreather or diving open circuit.

*Note: The CCR Decompression Diver with Trimix curriculum is near identical to the Air-diluent program. Air should only be used if Helium is not an option.*

## REQUIRED INSTRUCTOR RATING

An active status unit-specific Decompression CCR Instructor or higher may conduct the unit-specific Decompression CCR Diver program. The instructor must be qualified as a unit-specific CCR Trimix 45m Instructor or higher to conduct the Decompression CCR Diver program with Trimix (min 20% O<sub>2</sub> and maximum 35% He) as diluent.

## TEACHING RATIOS

- The maximum number of students for CCR training is 3:1
- The maximum number of students for no-decompression CCR training where one (1) student is making a crossover or doing a refresher is 4:1

## STUDENT PREREQUISITES

- An advanced level of Nitrox understanding. This is to include but not limited to the use of gases up to 100% Oxygen for decompression, tracking of CNS and OTU's, gas planning and accelerated decompression.
- Have logged 40 open water dives
- Minimum Age: 18

## OR

- CCR diver with minimum 20 dives / 20 hours on the specific unit
- Minimum age: 18

## DURATION

- Recommended hours for course completion: 40
- Minimum number of days: 4
- Minimum number of hours for Academics and Dry practical: 8

**The minimum required student and Instructor equipment for this program includes:**

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency, is properly functioning and is appropriate for bailout and accelerated decompression diving
- Has no non-manufacturer approved modifications
- A single off-board bailout gas suitable for a safe return to the surface from the planned maximum depth including all safety and Decompression stops in the event of an emergency
- Backup OC/CCR computer for bailout in the event of a system failure
- For Open water and lake environments with the exception of cave/overhead environments a Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A back up Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A cutting device
- Access to appropriate gas analyzers

**The minimum required student and instructor materials for this program includes:**

- Manufacturer's unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)
- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)
- Manufacturer's sign off sheet/course completion document

All skills must be demonstrated by the instructor on the specific unit being trained.

## REQUIREMENTS FOR COMPLETION

**Academics**

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Practical mechanics of a CCR
  - Assembly and disassembly
  - Unit Specific Check list
  - Design and overview of the unit
  - Absorbent canister
  - Breathing loop
  - Manufacturer's supported add-ons: BOV, ADV, etc
2. Loop volume - minimum / optimum
3. Gas Physiology
  - Oxygen risks, Hypoxia, Hyperoxia
  - Carbon dioxide (CO<sub>2</sub>) toxicity, Hypercapnia
  - Nitrogen absorption
  - Advantages of Trimix with 20% Oxygen and 35% Helium

4. Proper scrubber filling; in accordance with manufacturer's recommendation
  - Manufacturer's recommended scrubber medium
  
5. Electronic or Manual Systems Design and Maintenance
  - Oxygen (O<sub>2</sub>) metabolizing calculations
  - Oxygen Sensors, limitations, care and replacement regime
  - System electronics functionality and calibration procedures
  
6. Dive Tables
  - Constant partial pressure of oxygen (PPO<sub>2</sub>) theory
  - Central nervous system (CNS) and Oxygen Tolerance Unit (OTU) tracking and awareness
  
7. Dive Computers
  - Mix adjustable
  - Constant PO<sub>2</sub>
  - Decompression conservatism / Gradient factor selection
  - Oxygen (O<sub>2</sub>) integrated
  
8. Dive Planning
  - Operational planning
  - Gas consumption
  - Scrubber duration
  - Gas requirements including bailout scenarios
  - Oxygen limitations
  - Nitrogen limitations
  
9. Emergency Procedures
  - Flooded loop
  - Cell warnings
  - Battery warnings
  - Electronic failures

**Skills**

1. Pre-dive checks
  - Specific Unit Checklist
  - Unit build-up
  - Scrubber canister filling
  - Breathing loop check including mouthpiece one way valves and positive and negative check
  
2. Verify diluent and oxygen (O<sub>2</sub>) cylinder contents using appropriate gas analyzers

3. Demonstrate correct pre-dive planning procedures including
  - Limits based on system performance
  - Limits based on oxygen exposures at chosen PO<sub>2</sub> levels
  - Limits based on nitrogen absorption at planned depth and PO<sub>2</sub> set point
  - Appropriate selection of decompression conservatism / gradient factors for the planned dive
  - Thermal constraints
4. Mouthpiece familiarity skills
5. Stop at 3-6 meters on descent for leak bubble check
6. Counterlung & Over Pressure Valve adjustment, if applicable
7. Emergency procedures
  - Practical bailout skills
  - Gas shutdowns and loss of gas
  - Broken hoses
  - Flooded absorbent canister
  - Carbon dioxide (CO<sub>2</sub>) breakthrough
  - Low oxygen drills
  - High oxygen drills
  - Flooding loop
  - Electronics and battery failure
8. Practice transferring to open circuit bailout
9. Rescue skill session as outlined by the training agency
10. Use of a buoyancy control system
11. Electronics systems monitoring for PO<sub>2</sub> levels (SETPOINT) and setpoint switching using manual and pre-programmed methods when available.
12. Manual PO<sub>2</sub> control
13. Use and adjustment of Head Up Display(s) – position/brightness/color
14. Use and adjustment of PO<sub>2</sub>/depth/time display(s) – position/brightness/color
15. Use of lift bag / DSMB and reel (where relevant and applicable)
16. Mask removal and replacement
17. Proper execution of the dive within all pre-determined dive limits
18. Demonstration of safety stops at pre-determined depths

19. Constant loop volume management
20. Cell validation checks with appropriate use of diluent and oxygen
21. Post dive clean of unit
  - Mouth piece and hoses
  - Clean and disinfect unit
  - Inspect components of unit
22. Diver maintenance of unit
  - Cell removal and replacement
  - Mouthpiece care
  - Replacing or re-charging of batteries

**Decompression related in water skills:**

1. Demonstrate the ability to drop and retrieve one (1) bailout cylinder while maintaining position in the water column
2. Demonstrate appropriate reaction to gas hemorrhage from bailout valve, first stage, second stage or SPG
3. Demonstrate appropriate reaction to simulated free-flowing deco regulator
4. Demonstrate the ability to Buddy breathe from a decompression gas
5. Oxygen rebreather mode at less than six (6) meters stop
6. Complete one (1) bailout scenario at depth to include decompression obligation on open circuit

## EXTRA REQUIREMENTS FOR COMPLETION

Notes

- Demonstrate an adequate level of fitness by completing a minimum of a 50m surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete a minimum of seven (7) training dives, including confined water skill development of at least one (1) hour, and six (6) core open water training dives with a minimum run time of 30 minutes each.
- Complete at least a minimum of 420 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of five years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of five years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

*Dive logs and student-signed course completion forms are to be submitted to the manufacturer of the specific unit on request*

## DEPTH LIMITATIONS

### **Air as diluent:**

- Open Water Training Dives shall be initially shallow , progressively increasing in depth.
- Two (2) dives must be deeper than 30 meters for certification
- All dives must be conducted at a depth shallower than 40 meters.

### **Trimix as diluent:**

- Open Water Training Dives shall be initially shallow , progressively increasing in depth.
- Two (2) dives must be deeper than 35 meters for certification
- All dives must be conducted at a depth shallower than 45 meters.

## CREDIT

- Students upgrading from CCR Diver to CCR Decompression Air Diluent Diver need to perform an evaluation dive, plus a minimum of four (4) open water divers with two (2) dives greater than 30m
- Students upgrading from CCR Diver to CCR Decompression Diver with Trimix need to perform an evaluation dive, plus a minimum of four (4) open water divers with two (2) dives greater than 35m
- Students upgrading from CCR Decompression Air diluent diver to CCR Decompression diver with Trimix need to complete a minimum of two (2) dives deeper than 35m

## NOTES

- Bailout cylinder gas is to be based on a maximum PPO<sub>2</sub> of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a ppO<sub>2</sub> higher than 1.1 bar at the bottom.
- The maximum loop set point is 1.3 bar.

### **Diving in an overhead environment**

- All skills must be demonstrated in an open water environment prior to entering the overhead environment
- The Instructor must be an active status overhead instructor for the particular environment
- The Diver must hold the user level overhead certification for the particular environment
- The course cannot be conducted in an overhead environment if it is the divers' first CCR course

### SEQUENCE

Open Water Training Dives 1 and 2 may only be conducted after completing the equipment configuration section, the Surface Diver tow and all confined water sessions.

### CERTIFICATION

The unit-specific Decompression CCR Diver (with or without Trimix) certification entitles the holder to dive with a buddy, diving on a rebreather or diving open circuit, on dives utilizing CCR diving procedures to depths of up to 40m with air diluent and 45m with Trimix and requiring staged decompression stops providing that dives are conducted in environments similar to those of the diver's training and experience.



# TRIMIX CCR DIVER 60m

## INTENT

The intent of the CCR Trimix 60m Diving program is to provide divers with the training necessary to independently plan and conduct unit specific multiple-stop decompression dives to depths of up to 60m using trimix with a minimum of 16% oxygen and utilizing CCR diving procedures with a buddy diving on a rebreather or diving open circuit.

## REQUIRED INSTRUCTOR RATING

An active status unit specific CCR Trimix 60m Diving Instructor or higher may conduct the unit specific CCR Trimix 60m Diving program.

## TEACHING RATIOS

- The maximum number of students for CCR training is 3:1

## STUDENT PREREQUISITES

- Decompression CCR Diver
- Have logged a minimum of 50 CCR dives over a minimum of 50 hours, including at least 20 dives deeper than 30m and at least ten (10) dives requiring staged decompression.
- At least 25 dives / 25 hours are required on the specific unit.
- Minimum Age: 18

## DURATION

- Minimum hours for course completion: 40
- Minimum number of days: 4

## MATERIALS AND EQUIPMENT

**The minimum required student and Instructor equipment for this program includes:**

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency, is properly functioning and is appropriate for bailout and accelerated decompression diving
- Has no non-manufacturer approved modifications
- Two off-board stage cylinders, one for bottom bailout, one for decompression suitable for a safe return to the surface including all safety and decompression stops in the event of an emergency
- Backup OC/CCR computer for bailout in the event of a system failure
- For Open water and lake environments with the exception of cave, a Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A back up Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- Backup mask
- Cutting device
- Access to appropriate gas analyzers

**All skills must be demonstrated by the instructor on the specific unit being trained.**

**The minimum required student and instructor materials for this program includes:**

- Manufacturer's unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)
- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)
- Manufacturer's sign off sheet/course completion document

## REQUIREMENTS FOR COMPLETION

**Academics**

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Gas Physiology
  - Oxygen (O<sub>2</sub>) toxicity, Hypoxia, Hyperoxia
  - Central nervous system (CNS) tracking
  - Oxygen tracking units (OTU)
  - Oxygen (O<sub>2</sub>) metabolizing calculations
  - Carbon dioxide (CO<sub>2</sub>) Toxicity, Hypercapnia
  - Nitrogen absorption
  - Equivalent narcosis depth theory
  - Helium absorption
  - HPNS
2. Gas mixing
3. Formula Work
4. Manually controlled closed circuit rebreathers
5. Dive Tables.
  - Creation of custom dive tables appropriate to dive depths
  - Creation of lower percentage of oxygen (PO<sub>2</sub>) diluent to support loop flushing and bailout at depth
6. Dive Computers.
  - Mix adjustable
  - Constant PO<sub>2</sub>
  - Decompression Conservatism / Gradient Factor selection
  - Oxygen (O<sub>2</sub>) integrated
7. Dive Planning
  - Operational planning
  - Scrubber Duration
  - Gas requirements including bailout scenarios
  - Gas consumption
  - Gas management

8. Decompression on a CCR
  - Oxygen limitations
  - Nitrogen limitations
  - Helium limitations
9. Unit Assembly
  - Loop configurations
10. Unit Specific Check list
11. Equipment Maintenance
  - Fuel cell management
  - Date stamps
  - Replacement
12. Additional fitted equipment and modifications
  - Auto diluent addition
  - Dual mode mouthpieces
  - Heads up display
  - Additional manual injectors
  - Integrating oxygen monitors for dive computers

**Skills**

1. Pre-dive checks
  - Specific Unit Checklist
  - Unit build-up
  - Scrubber canister filling
  - Breathing loop check including mouthpiece one way valves and positive and negative check
2. Verify diluent and oxygen (O<sub>2</sub>) cylinder contents using appropriate gas analyzers
3. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
4. Stop at 3-6 meters on descent for leak bubble check
5. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
6. Mask removal and replacement

7. Emergency procedures
  - Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
  - Properly execute a recovery from system failure and conclude the dive and decompression with the unit in manual mode
  - Gas shutdowns and loss of gas, correct choice and switching to off board gases
  - Broken hoses, catastrophic failure scenarios
  - Flooded absorbent canister
  - Cell errors
8. Oxygen rebreather mode in depths less than six (6) meters
9. Demonstrate competence managing two (2) bailout cylinders, including drop and recovery while maintaining position in the water column
10. Deployment of a lift bag / delayed surface marker buoy (DSMB) at depth and mid water
11. Simulate failed lift bag / DSMB deployment
12. On two (2) of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
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. Rescue skill session as outlined by the training agency
17. Cell validation checks with appropriate use of diluent and oxygen
18. Demonstrate proper understanding and implementation of team diving procedures to conduct bailout from a depth greater than 30 meters
19. Demonstrate ability to plug in and share off-board gas, including sharing/swapping of off-board bailouts

## EXTRA REQUIREMENTS FOR COMPLETION

Notes

- Demonstrate an adequate level of fitness by completing a minimum of a 50m surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete at least six (6) training dives, including one open water skill development session of at least one (1) hour, and a minimum of five (5) open water training dives, with a minimum runtime of at least 30 minutes each.
- Complete a minimum of 360 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of five years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of five years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

*Dive logs and student signed course completion forms are to be submitted to the manufacturer of the specific unit on request*

## DEPTH LIMITATIONS

- Open Water Training Dives shall be initially shallow, progressively increasing in depth.
- Two (2) dives should be deeper than 30 meters
- And an additional two (2) dives should be deeper than 50 meters for certification
- All dives must be conducted at a depth shallower than 60 meters.

## NOTES

- Dives 1 and 2 must be planned within the no-decompression limits of the Combined Air/EAN Tables or the student's personal dive computer or computer-generated decompression profiles.
- The planned decompression obligation (total ascent time including all decompression stops) for training dives must not exceed 30 minutes for dives 3 and 4, and must not exceed 60 minutes for dives 5 and 6.
- At least one (1) dive must have a total run time in excess of 60 minutes.
- If environmental or water conditions make it unsafe or impractical to meet the cumulative time requirement in six (6) dives, additional training dives should be scheduled.
- Bailout cylinder gas to be based on a maximum PPO<sub>2</sub> of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a PPO<sub>2</sub> higher than 1.2 bar at the bottom.
- The maximum loop set point is 1.3 bar.
- The maximum END for the Diluent for the bottom part of the dive, cannot be greater than 30m

### **Diving in an overhead environment**

- All skills must be demonstrated in an open water environment prior to entering the overhead environment
- The Instructor must be an active status overhead instructor for the particular environment
- The Diver must hold the user level overhead certification for the particular environment

SEQUENCE

Open Water Training Dive 2 may only be conducted after completing the surface diver tow and all the open water skill development session.

CERTIFICATION

The unit-specific CCR Trimix 60m Diving certification entitles the holder to dive autonomously with a buddy, diving on a rebreather or diving open circuit, on dives using Trimix with a minimum of 16% oxygen, utilizing CCR procedures to depths of 60m, and requiring unlimited staged decompression stops with a maximum of two bail out gas mixtures, providing that dives are conducted in environments similar to those of the diver's training and experience.

# TRIMIX CCR DIVER 100m

## INTENT

The intent of the CCR Trimix 100m Diving program is to provide divers with the training necessary to independently plan and conduct unit specific staged decompression dives to depths of up to 100m using hypoxic Trimix mixtures and utilizing CCR diving procedures with a buddy diving on a rebreather or diving open circuit.

## REQUIRED INSTRUCTOR RATING

An active status unit-specific CCR Trimix 100m instructor or higher may conduct the unit-specific CCR Trimix 100m program.

## STUDENT PREREQUISITES

- CCR Trimix 60m Diving certification or equivalent.
- Have logged a minimum of 100 CCR dives over a minimum of 100 hours, including at least 30 dives deeper than 30m, at least ten (10) dives deeper than 50m and at least 20 dives requiring staged decompression.
- At least 50 dives / 50 hours are required on the specific unit.
- Minimum Age: 18

## TEACHING RATIOS

- The maximum number of students for CCR training is 3:1

## DURATION

Recommended hours for course completion: 30

## MATERIALS AND EQUIPMENT

**The minimum required student and Instructor equipment for this program includes:**

A complete CCR Unit that:

- Is compliant to local laws, is approved by the training agency, is properly functioning and is appropriate for bailout and accelerated decompression diving
- Has no non-manufacturer approved modifications
- Three (3) bailout stage cylinders, one for bottom bailout, all with 1-2 meter hose second-stage and SPG, low-pressure inflator hose or quick-connect compatible with the unit if applicable, Oxygen cleaned as required
- Backup OC/CCR computer for bailout in the event of a system failure
- Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- A back up Delayed Surface Marker Buoy (DSMB) and spool / reel appropriate for the planned dive depth
- Backup mask
- Cutting devices
- Emergency spool
- Access to emergency decompression gas, by team sharing, staging, or from support divers
- Access to appropriate gas analyzers

**All skills must be demonstrated by the instructor on the specific unit being trained.**

**The minimum required student and instructor materials for this program includes:**

- Manufacturer's unit specific user manual
- Agency student training manual or online training course
- Agency instructor manual (electronic instructor manuals meet this requirement)
- Course liability release and assumption of risk (in accordance with local laws)
- Training agency approved medical document
- Unit specific checklist (units equipped with a built in electronic checklist, meet this requirement)

## REQUIREMENTS FOR COMPLETION

**Academics**

Students shall have sufficient understanding and knowledge in the following subject areas listed. They should be capable of planning dives in the typical local conditions and environment and be able to plan for typical emergency situations.

1. Gas Physiology
  - Oxygen (O<sub>2</sub>) toxicity, Hypoxia, Hyperoxia
  - Oxygen (O<sub>2</sub>) metabolizing calculations
  - Central nervous system (CNS) tracking
  - Oxygen tracking units (OTU)
  - Carbon dioxide (CO<sub>2</sub>) toxicity, Hypercapnia
  - Nitrogen absorption
  - Equivalent narcosis depth theory
  - Helium absorption
  - HPNS
2. Gas mixing
3. Formula Work
4. Manually controlled closed circuit rebreathers
5. Dive Tables.
  - Creation of custom dive tables appropriate to dive depths
  - Creation of lower percentage of oxygen (PO<sub>2</sub>) diluent to support loop flushing and bailout at depth
6. Dive Computers.
  - Mix adjustable
  - Constant partial pressure of oxygen (PPO<sub>2</sub>)
  - Decompression Conservatism / Gradient Factor selection
  - Oxygen (O<sub>2</sub>) integrated
7. Dive Planning
  - Operational planning
  - Scrubber Duration
  - Gas requirements including bailout scenarios
  - Gas management
  - Gas consumption



8. Decompression on a CCR
  - Oxygen limitations
  - Nitrogen limitations
  - Helium limitations
9. Unit Assembly
  - Loop configurations
10. Unit Specific Check list
11. Equipment Maintenance
  - Oxygen Sensor management
  - Date stamps
  - Replacement
12. Additional fitted equipment and modifications
  - Auto diluent addition
  - Dual mode mouthpieces
  - Heads up display
  - Additional manual injectors
  - Integrating oxygen monitors for dive computers

**Skills**

1. Pre-dive checks
  - Specific Unit Checklist
  - Unit build-up
  - Breathing loop check including mouthpiece one way valves and positive and negative check
  - Verify diluent and oxygen (O<sub>2</sub>) cylinder contents using appropriate gas analyzers
  - Positive and negative check
2. Show good awareness of buddy and other team members through communications, proximity and team oriented dive practices
3. Stop at 3-6 meters on descent for leak bubble check
4. Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet
5. Mask removal and replacement
6. Emergency Procedures
7. Properly execute a recovery from a system failure and conclude the dive and decompression on open circuit gases carried
8. Properly execute a recovery from a system failure and conclude the dive and decompression with the unit in manual mode

9. Gas shutdowns and loss of gas, correct choice and switching to off board gases
10. Broken hoses, disaster scenarios
11. Flooded absorbent canister
12. Cell errors
13. Oxygen rebreather mode in depths less than six (6) meters
14. Manually control CCR Unit for one full dive including all decompression stops
15. Demonstrate competence managing three (3) bailout cylinders, including drop and recovery while maintaining position in the water column
16. Demonstrate proper understanding and implementation of team bailout procedures and conduct a team bailout from a depth greater than 40 meters
17. Demonstrate ability as a team to plug in and share off-board gas, including team sharing/swapping of off-board bailouts
18. On two (2) of the dives, demonstrate an ascent with ascent reel and lift bag and perform staged decompression
19. Proper execution of the dive within all pre-determined dive limits
20. Ability to manage multiple failures in adverse conditions
21. Rescue skill session as outlined by the training agency
22. Cell validation check
23. Demonstrate of surface support/support divers in dealing with bailout scenarios

## EXTRA REQUIREMENTS FOR COMPLETION

Notes

- Demonstrate an adequate level of fitness by completing a minimum of a 50m surface diver tow with both the rescuer and the victim wearing a complete CCR diving system and bailout cylinder(s) applicable to their specific program
- Complete all academic sessions and unit specific assessments as specified in the training material of the Training Agency and the Manufacturer.
- Complete at least six (6) training dives, including one open water skill development session of at least one (1) hour, and a minimum of five (5) open water training dives, with a minimum runtime of at least 30 minutes each.
- Complete a minimum of 360 minutes of total in-water time on the applicable CCR unit.
- Be able to independently complete a full dive plan
- Complete a final course exam as set out by the training agency and / or manufacturer with a required minimum pass rate of 80% with 100% remediation.
- When the feature is available on a rebreather, download the student's dive logs of all training dives and retain for a minimum of five years.
- If the feature is not available on a rebreather, download the dive logs from the students dive computer and retain for a minimum of five years
- Fill in and sign a course completion form confirming all academics and practical sessions have been completed

*Dive logs and student signed course completion forms are to be submitted to the manufacturer of the specific unit on request*

## DEPTH LIMITATIONS

- Open Water Training Dives shall be initially shallow, progressively increasing in depth.
- Two (2) dives should be deeper than 40 meters
- And an additional two (2) dives should be deeper than 70 meters for certification
- All dives must be conducted at a depth shallower than 100 meters.

*Local rules or regulations may dictate the maximum depth permitted. If so, the local rules would supercede any other standards.*

## NOTES

- Dives 1 must be planned within the no-decompression limits of the Combined Air/EAN Tables or the student's personal dive computer or computer-generated decompression profiles.
- The primary planned decompression obligation (total time of all decompression stops including deep stops, if used) for training dives must not exceed 30 minutes for dives 2, 3 and 4, and 60 minutes for dives 5 and 6.
- At least one (1) dive must have a total run time in excess of 60 minutes.
- If environmental or water conditions make it unsafe or impractical to meet the cumulative time requirement in six (6) dives, additional training dives should be scheduled.
- Bailout cylinder gas to be based on a maximum PPO<sub>2</sub> of 1.6 at the maximum depth of the dive.
- Divers should not carry an on-board diluent gas with a PPO<sub>2</sub> higher than 1.1 bar at the bottom.
- The maximum loop set point is 1.3 bar.
- The maximum END for the Diluent for the bottom part of the dive, cannot be greater than 30m
- Preliminary dives 1 and 2 must have a minimum run time of 30 minutes.

### **Diving in an overhead environment**

- All skills must be demonstrated in an open water environment prior to entering the overhead environment
- The Instructor must be an active status overhead instructor for the particular environment
- The Diver must hold the user level overhead certification for the particular environment

SEQUENCE

Open Water Training Dives 2 may only be conducted after completing the surface diver tow and the open water skill development session.

CERTIFICATION

The unit-specific CCR Trimix 100m Diver certification entitles the holder to dive autonomously with a buddy, diving on a rebreather or diving open circuit, on dives using Hypoxic Trimix and utilizing CCR procedures to depths of 100m, providing that dives are conducted in environments similar to those of the diver's training and experience.

# CCR DIVER CROSSOVER

## INTENT

The intent of the program is to provide divers already certified on a unit with additional unit specific training to get certified on an additional unit, following RESA minimum training standards.

## REQUIRED INSTRUCTOR RATING

An active status unit specific CCR instructor at the level the candidate is crossing over for

## ADMINISTRATIVE REQUIREMENTS

- Course liability release and assumption of risk (in accordance with local laws)
- Health screening document
- Anything else as required by the Training Agency or manufacturer

## STUDENT PREREQUISITES

- Be certified as a CCR Diver or Decompression CCR Diver from a RESA recognized training agency
- Show proof of 10 logged CCR dives in the last 12 months
- Minimum age 18 years

## NOTE

- Crossover is not allowed for certifications on SCR or PSCR, or for CCR certifications that only allow a lesser dive depth: in all these cases a full course is mandatory
- Crossover applies to rebreathers of different brand/manufacturers
- Crossovers between similar units of the same brand/manufacturers may require an upgrade course as specified by the manufacturer

## MATERIALS AND EQUIPMENT

As specified in the specific diver level course standard

## DURATION

- Recommended hours for course completion: 16 to 24
- The number of classes, hours and sessions per day are set by the training agency.

## REQUIREMENTS FOR COMPLETION

### **The crossover course will include:**

- CCR assembly workshop.
- A water skills evaluation in a confined skill session. All skills from the level the candidate is crossing over at must be demonstrated successfully prior to open water dives.
- Complete a minimum of 4 open water dives and a total accumulated dive time of minimum 240 minutes, demonstrating proficiency in all skills from the level the diver is crossing over at
- Complete a final exam with a passing score as specified by the Training Agency and the Manufacturer.

**CCR Trimix 60m Diver**

- A diver certified as a CCR Trimix 60m diver may crossover that rating on the new unit after successfully meeting the crossover requirements for Decompression CCR diver on the new unit.

*All CCR Trimix 60m diver standards must be met except; Minimum of 120 minutes open water training to be completed over a minimum of 2 dives to a maximum depth of 60m/200ft*

- Must demonstrate proficiency in all required academics and skills at the CCR Trimix 60m diver level

**CCR Trimix 100m Diver**

- A diver certified as a CCR Trimix 100m diver may crossover that rating on the new unit after successfully meeting the crossover requirements for CCR Trimix 60m diver on the new unit.

*All CCR Trimix 100m diver standards must be met except: Minimum of 120 minutes open water training to be completed over a minimum of 2 dives to a maximum depth of 100m/330ft*

- Must demonstrate proficiency in all required academics and skills at the CCR Trimix 100m diver level