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## Recreational diving services — Requirements for rebreather diver training — Decompression diving to 60 m

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 228, *Tourism and related services*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Rebreathers (i.e. breathing devices that recirculate some or all of the diver's exhaled breath and replenish any consumed oxygen to maintain a breathable mixture) are becoming much more widely available and popular among divers. The market for rebreather diving has been constantly growing in recent years and is now considered to be large enough that the need for standards for training organizations on minimum training requirements is evident. Rebreathers allow divers to dive longer and to greater depths. Such depths can go beyond 30 m and may therefore require mandatory decompression stops. If rebreathers are used improperly they can be hazardous; divers have had fatal accidents due to incorrect use of these devices. It is therefore important to specify training for diving with such devices.

Training organizations offering training that conforms with this document may exceed any of the requirements in terms of the volume or complexity of training but should at least ensure the students master all the skills and knowledge defined in this document.

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# Recreational diving services — Requirements for rebreather diver training — Decompression diving to 60 m

## 1 Scope

This document specifies requirements for rebreather diver training programmes which provide the competencies required to perform dives to 60 m with a rebreather using a breathing mixture containing helium requiring mandatory decompression stops.

This document specifies evaluation criteria for these competencies.

This document specifies the requirements under which training is provided, in addition to the general requirements for recreational diving service provision in accordance with ISO 24803.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24802-2, *Recreational diving services — Requirements for the training of scuba instructors — Part 2: Level 2*

ISO 24803, *Recreational diving services — Requirements for recreational diving providers*

ISO/FDIS 24805, *Recreational diving services — Requirements for rebreather diver training — Decompression diving to 45 m*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1

#### **rebreather**

apparatus that has a supply of gas carried by the diver, allowing the diver to breathe under water which enables the diver to inspire gas from a facepiece connected to a counterlung and to pass exhaled gas through a carbon dioxide absorption material before it is re-breathed from the counterlung and inspired partial pressure of the gases within the apparatus remain within acceptable physiological limits so that gas is thus recirculated within the apparatus

Note 1 to entry: A rebreather can also be called a self-contained rebreathing apparatus.

Note 2 to entry: A facepiece can be a mouthpiece assembly, a half mask, a full-face mask or a helmet.

[SOURCE: EN 14143:2013, 3.1, modified — Note 1 to entry modified and Note 2 to entry added. This content has been reproduced with the permission of CEN. Copyright remains with CEN.]

### 3.2

#### **rebreather type**

primary rebreather design

EXAMPLE Closed-circuit rebreather (CCR), manually controlled closed-circuit rebreather (mCCR), electronically controlled closed-circuit rebreather (eCCR), semiclosed-circuit rebreather (SCR), manually controlled SCR (mSCR), electronically controlled SCR (eSCR), hybrid closed-circuit rebreather (hCCR)

### 3.3

#### **rebreather unit**

type of *rebreather* (3.1) having consistent controls, displays and configuration over several *rebreather models* (3.4) where the operation is essentially the same from rebreather model to rebreather model

### 3.4

#### **rebreather model**

specific individual design of *rebreather* (3.1) made by a manufacturer

### 3.5

#### **breathing gas**

gas present in the *breathing loop* (3.14) inspired by the diver

### 3.6

#### **supply gas**

gas present in a cylinder which may be added to the *breathing loop* (3.14)

### 3.7

#### **bailout gas**

gas present in a cylinder that may be breathed directly by the diver

### 3.8

#### **nitrox**

breathable mixture of nitrogen and oxygen with more than 21 % oxygen content, which may contain trace gases at levels no higher than those found in normal air

[SOURCE: ISO 11107:2009, 3.5]

### 3.9

#### **trimix**

gas comprising a specified mixture of oxygen, helium and nitrogen, capable of supporting human life under appropriate diving or hyperbaric conditions

Note 1 to entry: This includes manufactured gas mixtures made up from combinations of pure oxygen, pure helium and pure nitrogen, with or without compressed air.

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### 3.10

#### **heliox**

gas comprising a specified mixture of oxygen and helium, capable of supporting human life under appropriate diving or hyperbaric conditions

### 3.11

#### **PO<sub>2</sub>**

partial pressure of oxygen in a gas mixture

Note 1 to entry: This usually refers specifically to the breathing-gas mixture inhaled by a diver.



**3.12****set-point**

PO<sub>2</sub> setpoint

PO<sub>2</sub> value that is used by a control system to determine when a solenoid valve injects oxygen into the *breathing loop* (3.14)

**3.13****respiratory minute volume****RMV**

product of the tidal volume and breathing frequency measured in litres per minute

[SOURCE: EN 14143:2013, 3.10 — This content has been reproduced with the permission of CEN. Copyright remains with CEN.]

**3.14****breathing loop**

portion of a *rebreather* (3.1) through which gas circulates, usually consisting of a mouthpiece, breathing hose(s), counterlung(s), non-return valves and a CO<sub>2</sub> absorbent canister

**3.15****scrubber**

canister in the *breathing loop* (3.14) containing CO<sub>2</sub> absorbent

**3.16****confined water**

swimming pool with a depth appropriate to the activity or body of water, offering similar conditions with regard to visibility, depth, water movement and access

[SOURCE: ISO 24801-2:2014, 3.5]

**3.17****open water**

body of water significantly larger than a swimming pool, offering conditions typical of a natural body of water

[SOURCE: ISO 24801-2:2014, 3.6]

**3.18****limited open water**

*open water* (3.17) no deeper than 20 metres with no appreciable water movement, and visibility that is sufficient to allow effective student supervision and skill development

**3.19****service provider**

entity (individual or organization), including any individual acting on behalf such an entity, which offers one or more of the following services:

- introductory diving activities;
- snorkelling excursions;
- provision of training and education;
- organized and guided diving for qualified divers;
- rental of diving equipment.

[SOURCE: ISO 24803:2017-03, 3.1]

**3.20****safety stop**

non-mandatory *decompression stop* (3.21) near the surface prior to surfacing

**3.21**

**decompression stop**

mandatory stop during ascent from depth prior to surfacing

**3.22**

**no-decompression diving**

diving without requiring mandatory *decompression stops* (3.21)

**3.23**

**decompression diving**

diving with mandatory *decompression stops* (3.21)

**3.24**

**delayed surface marker buoy**

**DSMB**

surface marker buoy that can be deployed by a diver from underwater

## 4 Competencies

The training programme shall ensure that students are qualified to independently plan and conduct dives requiring mandatory decompression stops using the specific rebreather unit for which the diver has received training.

Divers qualified in accordance with this document are competent to dive with a suitably qualified buddy to 60 m using a rebreather with a supply gas containing

- a minimum of 15 % oxygen; and
- sufficient helium to control narcosis and to ensure a breathing gas density of less than 6,3 g/l.

In order to be deemed qualified to dive with a specific rebreather unit other than the one that the diver has received initial training for, a diver will need further unit specific training.

The training program shall ensure that the student has a full understanding of any theoretical concepts or skills applicable to the rebreather type, rebreather unit and rebreather model they will use. Students shall be provided with an overview of any information that is not specific to their rebreather, but this only needs to be informative in nature so that they are aware of the general possible configurations that other divers may use.

## 5 Prerequisites for training

### 5.1 General

The service provider shall ensure that the student fulfils the following prerequisites to take part in the training course envisaged.

In order to participate in a training programme in accordance with this document, students shall be qualified in accordance with ISO 24805.

### 5.2 Minimum age

The minimum age to participate in a training programme in accordance with this document shall be 18 years.

### 5.3 Diving experience

Students shall have logged at least 50 dives with a minimum of 50 h using a rebreather. At least 25 logged dives and 25 h shall have been made with the same specific rebreather unit to be used in the

course. A minimum of ten rebreather dives shall have been made to a depth of at least 30 m requiring staged decompression.

## 5.4 Health requirements

Documented evidence shall be obtained that the student has been medically screened as suitable for recreational diving by means of an appropriate questionnaire or medical examination.

NOTE See Reference [2] for an example of a medical questionnaire and accompanying guidance to physicians.

In case of doubt, the training service provider shall refer students to proper medical resources. If the student is not examined by a physician, the student shall be obliged to confirm by signature that he or she has understood written information given by the instructor on diseases and physical conditions which can pose diving-related risks.

Students shall be advised of the importance of appropriate regular medical examinations.

## 6 Introductory information

Information in accordance with ISO 24803 shall be made available to the students prior to, or during the first class or meeting.

In particular the students shall be informed of the limits of their training and qualification as specified in accordance with [Clause 4](#).

## 7 Theoretical knowledge

### 7.1 Knowledge review

The training programme shall ensure that knowledge in accordance with ISO 24805 is reviewed by assessing the students (e.g. by means of an exam or quiz) before teaching new knowledge. Where knowledge gaps are identified remedial training shall be carried out.

### 7.2 Rebreather basics

The training programme shall ensure that students have knowledge concerning the following, specifically relating to decompression dives to 60 m:

- advantages and limitations of different rebreather types;
- the concept of rebreather unit-specific requirements;
- maintaining PO<sub>2</sub> within physiological limits.

### 7.3 Function of rebreather components

The training programme shall ensure that students have knowledge concerning the function of the following components of a rebreather, with emphasis on the specific features of the rebreather unit they will use during their training, specifically relating to decompression dives to 60 m:

- scrubber (CO<sub>2</sub> absorbent);
- gas supplies (this shall include where applicable: oxygen, diluent or other supply gases);
- gas addition valves (this shall include where applicable: manual, automatic diluent valve (ADV) or other automatic gas addition);
- mouthpiece, dive surface valve (DSV);