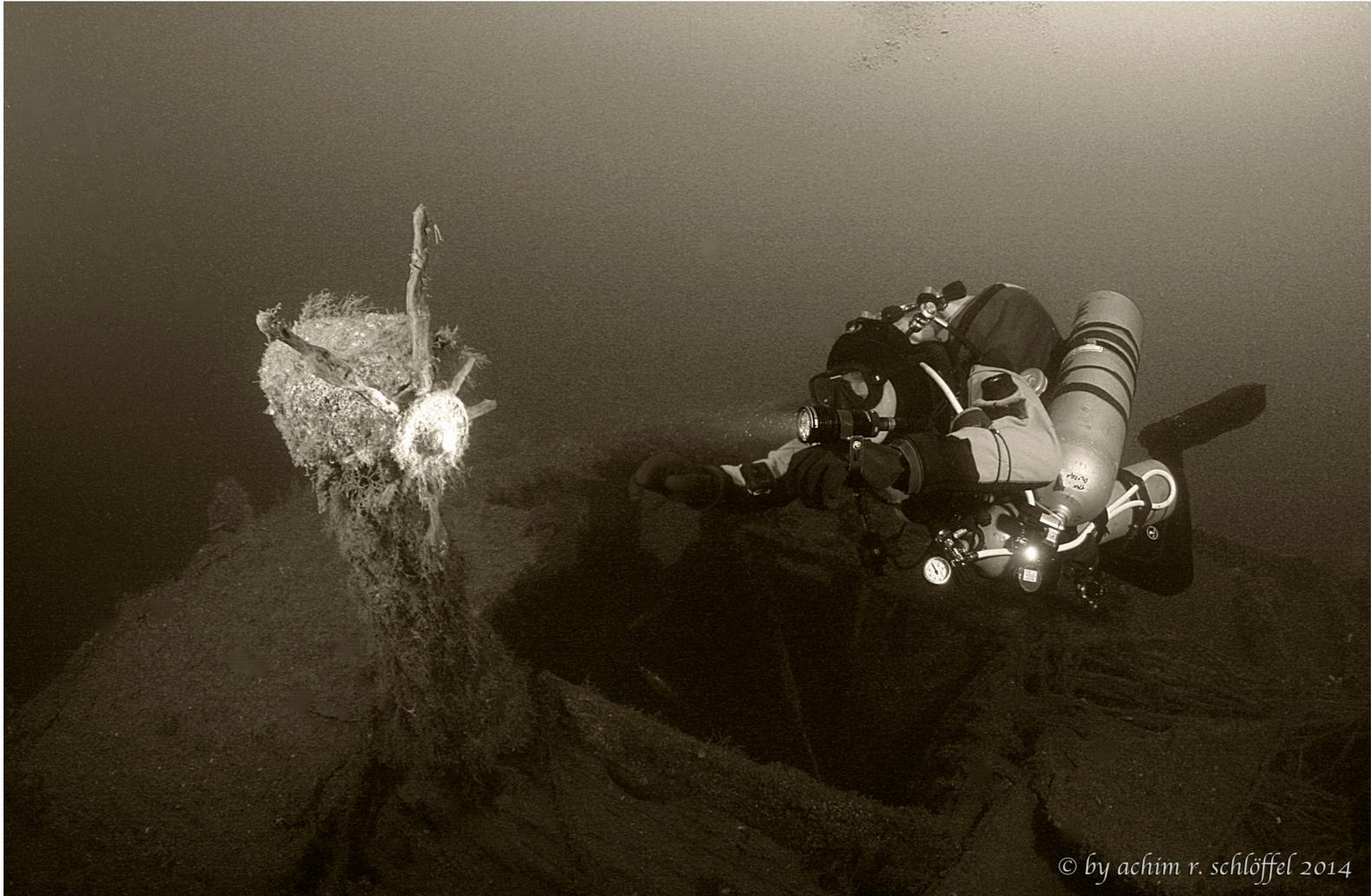




ISE Exploration Diver Level II



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ISE Exploration Diver Level II

Disclaimer

This Manual is NOT meant for self-study but as an addition to the class held by a certified instructor from InnerSpace Explorers.

Reading this manual does NOT substitute this class or any part of it.

This manual can only be downloaded from www.is-expl.com from a registered student booked for this specific class only.

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ISE Exploration Diver Level II

- **Introduction to InnerSpace Explorers**



ISE Exploration Diver Level II

Mission Statement

Inner Space Explorers was founded to provide the highest quality training available, for all individuals sharing the common goal of underwater exploration and conservation.

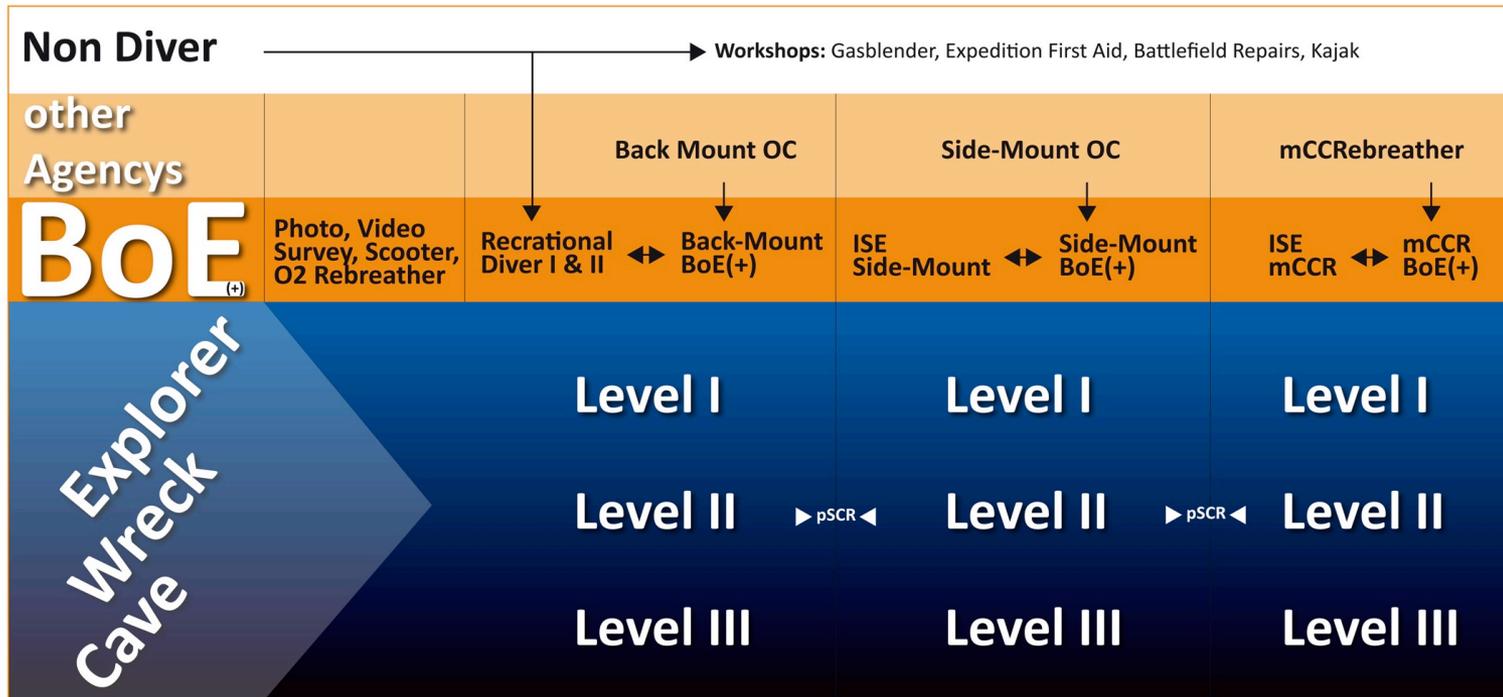
The four main pillars of education, training, research and exploration builds the base line of all ISE training that greatly enhances the thrill, safety and ultimately the fun of 'Your Passion'.





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InnerSpace Explorers ClassFlowchart



Note: • Additional prerequisite for Cave / Wreck Level II is Explorer Level I • and additional prerequisite for Cave / Wreck Level III is Explorer Level II
 Instructor Levels needs User certification from next Level



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Why ISE?

- **Strict global standard and procedures of the organization**

All instructors are to follow it so as to have standardized training and procedures, as this greatly removes inconsistency in within the organization.

- **Re-qualification**

This is to ensure divers and instructors do not jump back into the sport after long period of absenteeism hurting themselves, or greatly reducing the quality of diver training provided by ISE. Divers have to do an evaluation dive with the ISE instructor of that level of training.

- **No 'back to back' or 'bundled' courses for divers.**

Experiences have to be gained through personal dives before progression. Such divers enjoy advance training much more and have much better chances of excelling in the advance subject.

- **Non smoking organization.**

As the founders are active explorers, they know a healthy and fit diver will get the best out of the sport. We allow smokers to enter the foundation class, and give them the mindset that exploration brings more fun then smoking and help them quit.

- **Critical skills practice.**

Due to strong demands around the world, we apply relevant underwater simulation drills as they are critical to a diver survival and allowing divers to understand their true limits. A 'train the way we race' approach.



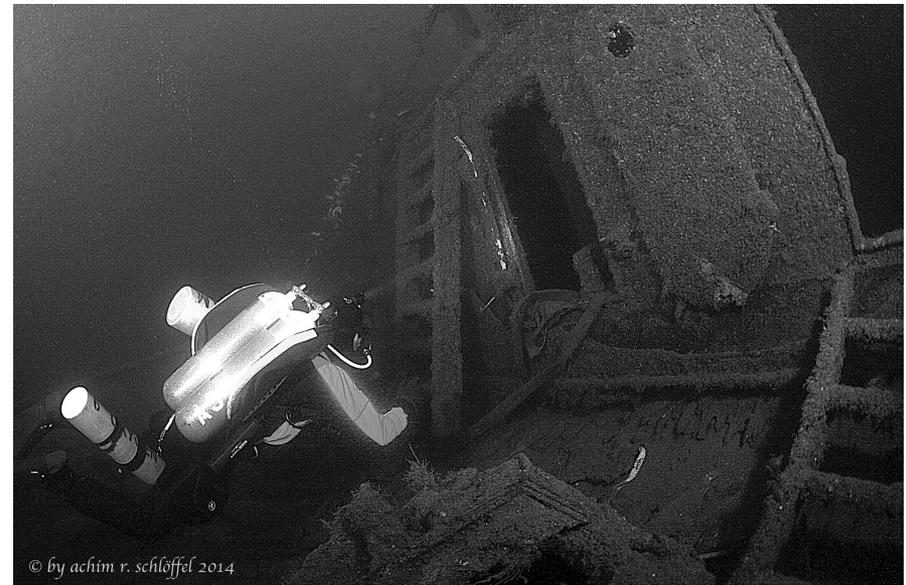
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Past, Present...

- ISE was founded by active explorers and educators
- ISE have increased the quality of diver training and education
- ISE is ready to set new standards to the topics of:

Education
Training
Research
Exploration

Diver training have often been focused on getting somebody to breathe underwater fast. By doing so, diver accidents occur at a significant rate. By redefining the four pillars of ISE, we provide a solution to these and significantly turned diving into a sport much enjoyed by all divers alike.





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Future

- Develop programs that serve certified divers in their desire to get more out of the sport.
- Develop the highest set of standards in the industry.
- Develop an international base of dedicated instructors to serve divers around the world.
- Develop dive centers around the world to support explorers in their logistics and ability to explore the aquatic realm.





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Introduction

- Why this course?
- Back to the basics?
- How is it going to benefit us?
- What to expect from the course?
- What are the minimum standards?
- How does ISE brings us to that level?



You are already a good diver, ISE wants to bring you up to the next level.



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Overview

- Introduction
- Paper Works
- Fees Collection
- General Overview

Land Theories

Land Drills

In-water Demonstrations

Training Dives

Surface Debriefs

Diver Assessment

- Diver Grading





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Index & Class Structure (sample)

09:00 Equipment & Dive 1	09:00 Theory & Dive 3	09:00 Theory	09:00 Dive 6	09:00 He Theory
12:00 Lunch	12:00 Lunch	12:00 Lunch	11:00 Debriefing	
12:30 Gear Mods	13:00 Dryruns	13:00 Dryruns	12:00 Lunch	12:00 Lunch
15:00 Dive 2	15:00 Dive 4	14:00 Dive 5	12:00 Dive 7	13:00 Dive 8
17:00 Debriefing	17:00 Debriefing	17:00 Debriefing	15:00 Debreifing	16:00 Debriefing



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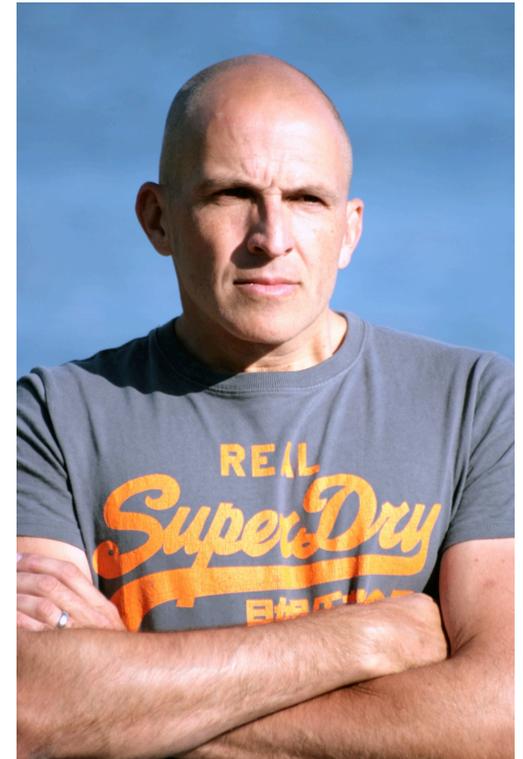
Message from the founder:

“You may ask: “what the heck?” Why should I take this class and what is it all about? This class will show you some facts, skills and items that in the end make your diving safer, more efficient and ultimately more fun.

The term “Exploration” is what you may have found a bit strange in the name of the class.

Well, what is Exploration? When a kid strolls through a ruin somewhere, the kid is exploring. If a Geologist wanders through a cave never seen before by human eyes, he is exploring it. If you swim through a popular reef you have never before been to, you explore it. Diving in general has a lot of potential for exploration.

Now we believe that there is a difference in how you do that. You may be able to breathe underwater and see because you have a mask, but that does not make you an explorer. An explorer is not only defined by the desire to cover new ground, but by the heart to preserve this ground, and make the knowledge gained accessible for others, at least through a clear documentation.





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Continued:

If you have poor trim, buoyancy and fin techniques for example, you stir up silt that covers anemones or corals that might damage it. Even in clear water, you may ruin your visibility at best. In a cave, a careless fin stroke will damage the pristine limestone formation, in which a geologist may be able to understand the history of millions of years of which nature developed.

Good skills are essential to exploration, the well prepared diver keen on diving new sites will also need some additional equipment to be prepared for the demands of the dive. Although this class can be done on a single tank, we will introduce you to the idea of doubles or at least two regulators on an H valve.

Murphy's law of what might happen, will happen gives an understanding that trouble is always around. The right equipment and skills needed to handle the situation can make a difference between a good dive, or the last dive. You will also be taught the spool – a simple tool that hold lines can be the most valuable piece of equipment ever, from sending up a surface marker, to measuring and surveying a site to doing search patterns – the possibilities are endless..”

A handwritten signature in blue ink, appearing to read 'A. Schlöffel', is written over a light blue rectangular background.

Achim R. Schlöffel
President InnerSpace Explorers



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Certification Policy

- Every level of ISE training has specific requirements that the student must meet before being awarded certification.
- These requirements include both academic knowledge as well as robust diving skills and techniques.
- The student must fulfill every skill and technique required for each step in the training before progression to the next step is possible.
- It is expected that the ISE student understands and accept the ISE Instructor obligation to deny certification if the training requirements have not been fulfilled.

Students pay for training but earns the certification.



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Types of grading

- **Pass**
- **Fail**

Pass: Student have performed well in the required skills and shown positive attitude in training.

Fail: Student is required to consult the instructor again and remedy shortcomings.

There can only be a successful or a failed exploration



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“I heard there is a resident Napoleon Wrasse somewhere at the first rock off the shore, I want to see it.”

“The government wants to know where does water from the caves flow to in case of pollution. Shall our team volunteer to check it out?”

“Have you been to the deep wrecks of the HMS Repulse or the HMS Prince of Wales?”

What does exploration mean to you?

- Curiosity
- Purpose
- Excitement
- Research
- Share





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***HOW DO WE ACHIEVE
THE QUALITIES OF AN EXPLORATION
GRADE DIVER?***



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By primarily receiving the right education!

By selecting the specific equipment to support our dives!

We have to dive to gain experiences, and once we have a concrete foundational support...

We inherit the qualities through constant practice!



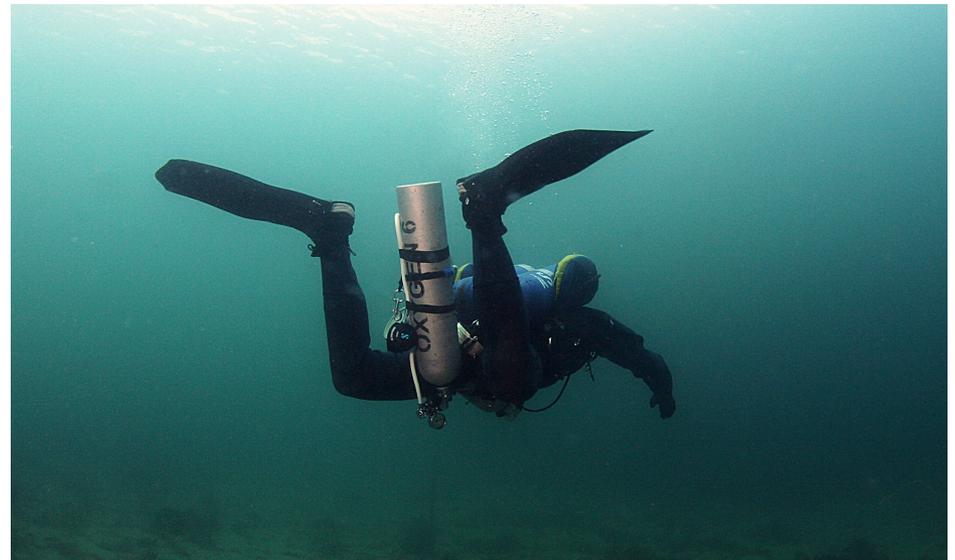
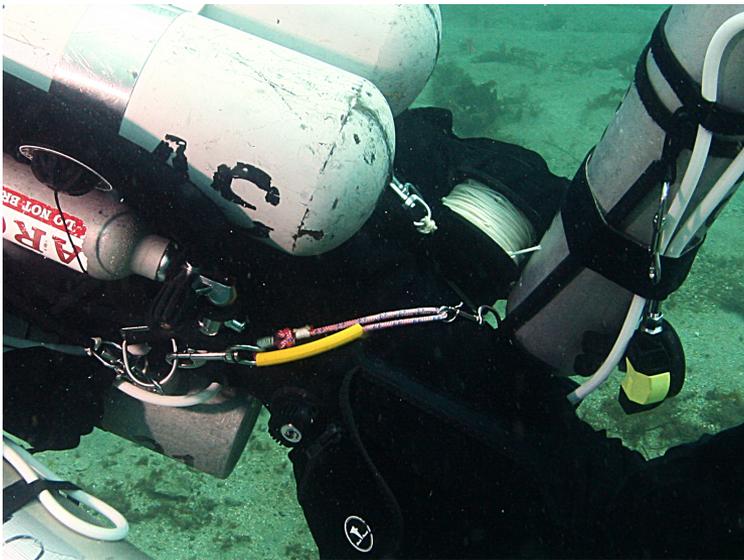
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Additional Equipment

ISE Exploration Diver Level II

Additional Equipment for Exploration Diver Level II

There is not much more to come in the Level II class except more Stages and therefore the so-called „Leash“ to carry them.



Additional Equipment for Exploration Diver Level II

The Leash

is basically a loop of rope (about 6mm) with a piece of regulator hose as a handle and a looped in boltsnap. You will see various designs and length in the web and on the beach – Your instructor will show You the right size and explain to You why it should be the way it is.



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Additional Equipment for Exploration Diver Level II

Stages & Regulators

This is more to be seen as a shopping guide to avoid people buying the wrong gear prior to the class. In fact you need 3 stages:

#1: Bottomstage should be 80 cft Luxfer

#2: 50% Stage can be an „80“ as well but a 7 Liter is much nicer if available

#3: Oxygen Stage is a 40 cft Luxfer.

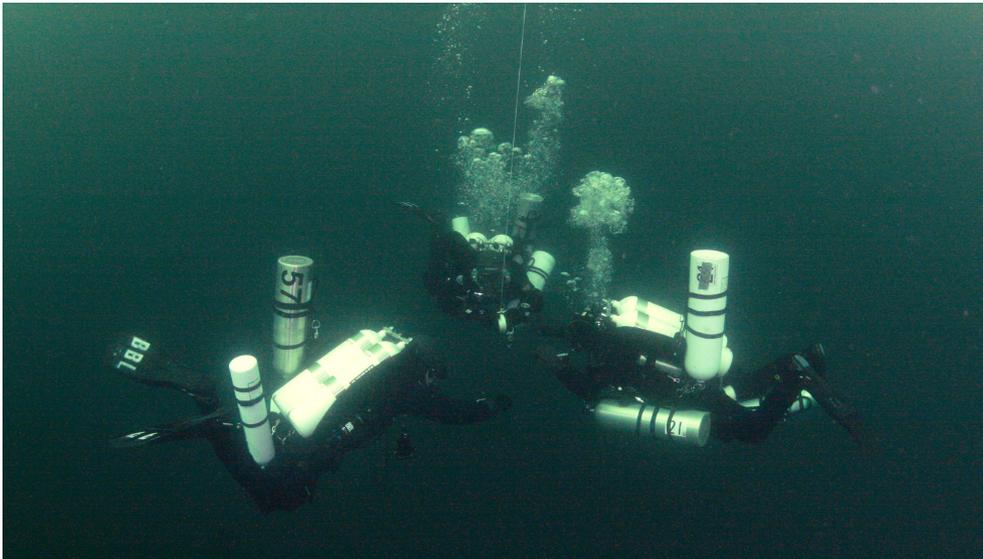


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Additional Equipment for Exploration Diver Level II

Liftbag & Reel

To set a more stable deco platform and be visible if drifting





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Gasproperties



ISE Exploration Diver Level II

Gas Properties

The ISE Standard Gases

Standard Gas	Operational Depth	Max depth
Nitrox 32%	0-30 Meter	33 Meter (1.4)
Triox 30/30	0-36 Meter	36 Meter (1.4)
Triox 21/35	30-45 Meter	56 Meter (1.4)
Trimix 18/45	45-60 Meter	67 Meter (1.4)
Trimix 15/60	60-75 Meter	83 Meter (1.4)
Trimix 10/80	75-90 Meter	130 Meter (1.4)
Trimix 21/35	Deco 57 Meter up	57 Meter (1.4)
Triox 35/25	Deco 36 Meter up	36 Meter (1.6)
Nitrox 50%	Deco 21 Meter up	21 Meter (1.6)
Oxygen	Deco 6 Meter up	6 Meter (1.6)



ISE Exploration Diver Level II

Gas Properties

Oxygen- Extended

There was a lengthy discussion on Oxygen in the Level I class so You might wonder why we have the topic on the table again.

Diving to greater depths and staying down for extended bottomtimes calls for longer deco. In the end we have a lot more time to collect CNS and OTUs and get ourself into trouble.

For this reason we will have a closer look to the oxygen exposure that we face during Level II diving.



PO2	Effect
1.6 bar	max PO2 in rest (deco)
1.4 bar	Max PO2 in rec diving
0.8-1.2 Bar	Bottom PO2 in technical diving
0.5 bar	Oxygen Tracking begins
0.21 Bar	NORMOX
0.18 Bar	1st Hypoxia Symptoms
0.16 Bar	Hypoxia starts
0.10 Bar	Deadly Zone



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Physiology



ISE Exploration Diver Level II

Physiology

Hypoxia

and the symptoms are already discussed. Diving with mixtures with less than 21% Oxygen in this class exclusively makes Hypoxia a No 1 topic.

Descending with a hypoxic mix is something that has to be well planned and that has to be planned taking in account several factors.

NEVER breath gas with less then 16% O₂ on the surface (swimming to the downline or to the boat, etc.

The practice of „going down fast“ while breathing the bottommix (to come to a certain depth where the mix is breathable is a NOGO as it may force the diver to switch when he cant descent (ear equalizing problems for example). If he does not switch he is in danger of getting hypoxic. Always descent on a mix that that goves you a safe O₂ level.

Physiology

Hyperoxia

CNS Symptoms:

Vision, *ANY* disturbance including *tunnel vision* etc
Ears, *ANY* changes in normal hearing function
Nausea, severity may vary and be intermittent
Twitching, classically manifested in facial muscles
Irritability, personality shifts, anxiety, confusion etc
Dizziness, vertigo, disorientation

Pulmonary Symptoms:

Dry cough
Breast pain /irritation
Shortness of breath
Reduction of the Vital capacity



> 2.0 bar Convulsions, drowning, death
2.0 bar - Elevated CNS oxygen toxicity danger
1.6 bar - Max exposure during decompression
1.4 bar - Max exposure during recreational diving
1.2 bar - Max exposure during technical diving
0.5 bar - Threshold for pulmonary oxygen toxicity (theoretical)
0.21 bar - Normoxic oxygen level



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Physiology Variation of O₂ tolerance

“ The variation of tolerance between individuals, the variation of tolerance of each individual, the impairment of tolerance with work and underwater exposure, all make diving pure oxygen below 25 feet (7.6 meters) of sea water a hazardous gamble. ” - Donald, 1944

The above statement by Henneth Mc Donald basicly says it all. In fact all the number we use to measure Oxygen exposure and as well the limits we set are theoretical and can vary not only from Individual to individual but also from day to day on the same individual.

This is affected by serveral factors, some within our influence some not. Factors are age, fitness level, hydration, enviroment, stress, mixture of gas and many more.





ISE Exploration Diver Level II

Physiology

The CNS% Clock

Dr. Bill Hamilton defined that at a PO₂ greater than 0.5 bar the oxygen tracking begins. The following table shows the maximum exposure times for the given PO₂s.

PO ₂ in Bar	Max exposure time in min.
1.6	45
1.5	120
1.4	150
1.3	180
1.2	210
1.1	240
1.0	300

Note: The accumulated CNS halves every 90min.

Tip:

For a rough guess in Level 2 Diving
You can estimate:

$$(\text{Bottomtime} + \text{Decotime}) = \text{CNS\%}$$

Example:

20 min @45 min + 20min of deco
→ 40% CNS



ISE Exploration Diver Level II

Physiology

The OTU (Oxygen Toxicity Unit) Table

Dr. Bill Hamilton defined that 1 bar of Oxygen for 1 Minute is 1OTU.
The following table indicates the maximum dose one can tolerate.

Multi day exposure	Daily dose limit	Total operational limit
1	800	850
2	700	1400
3	620	1860
4	525	2100
5	460	2300
6	380	2520
7	350	2660
8	330	2800
9	310	2970

Tip:

For a rough guess in Level 2 Diving
You can estimate:

$(Bt\text{-time} + \text{half of Decotime}) \times 3 =$
Total OTUs

Example:

20 min @45 min + 10min of deco x 3
→ 90 OTUs

Note: The accumulated OTUs reset after 24 hrs.



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Dive Planning



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Dive Planning

END

Stands for Equivalent Narcotic Depth. Although the term is frequently used in Nitrox Diving this is wrong as Nitrox has no narcotic benefit. Therefore the term makes only sense in Helium based Diving where a clear benefit compared to air can be archived.

Sample Calculation 1:

Let's consider a dive to 40 Meters using 21/35.

While in Air the Nitrogen percentage is 79, in 21/35 it is 44%.
The Oxygen can be left aside as it is 21% in both mixtures.

40 Meter → 5 Bar x .44 = 2.2 Bar of Nitrogen

As we want to compare to air → 2.2 Bar of Nitrogen : .79 = 2.78 Bar

Result: On a dive to 40 Meters with 21/35 a diver experiences the same narcosis as on an airdive to 18 Meters.

Sample Calculation 2:

Let's consider a dive to 60 Meters using 18/45.

While in Air the Nitrogen percentage is 79, in 18/45 it is 37%.
The Oxygen is 18% instead of 21%

Here the comparison is that of the sum of narcotic gases:

60 Meter → 7 Bar x .55 = 3.85 Bar

As we want to compare to air → 2.2 Bar of Nitrogen : 1

Result: On a dive to 60 Meters with 18/45 a diver experiences the same narcosis as on an air dive to 28.5 Meters.

Dive Planning

EAD

Stands for Equivalent Air Depth. The term is frequently used in Nitrox Diving and describes the amount of Nitrogen Your Body takes on a dive with nitrox compared to a dive on air at a equivalent depth

Sample Calculation 1:

Let's consider a dive to 30 Meters using 32% Nitrox

While in Air the Nitrogen percentage is 79, in Nitrox 32 it is 68%.

30 Meter → 4 Bar x .68 = 2.72 Bar of Nitrogen

As we want to compare to air → 2.72 Bar of Nitrogen : .79 = 3.44 Bar

Result: On a dive to 30 Meters with Nitrox 32 a diver loads as much Nitrogen as on a air dive to 24 Meters.

Therefore his No Deco Limit is the same as for air @24 meters → 30 Minutes!!



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Dive Planning

CNS%

As we learned before we need to make sure we do not get too much Oxygen over the course of the dive to avoid symptoms of Oxygen toxicity. Carefull planning well within the limits helps to avoid problems

Sample:

40 Meters for 30 min with 21/35, +deco of 25 min on 50% Nitrox

-> 5 bar x .21 bar o2 = 1.05 Bar O2 => 1.1 Bar for 240 min = 100%
=> 1.1 Bar for 30 min = 12.5%

-> 2 bar x .5 bar O2 = 1.0 Bar O2 => 1.0 bar for 300 min = 100%
=> 1.0 bar for 25 min = 9%

Total CNS after Dive is ca 21.5%

Please note: Estimate Result: $30 (Bt)+25 (Dt) = 55:2 = 27\%$



ISE Exploration Diver Level II

Dive Planning

OTU

As we learned before we need to make sure we do not get too much Oxygen over the course of the dive to avoid symptoms of Oxygen toxicity. Carefull planning well within the limits helps to avoid problems

Sample:

40 Meters for 30 min with 21/35, +deco of 25 min on 50% Nitrox

-> $5 \text{ bar} \times .21 \text{ bar } \text{o}_2 = 1.05 \text{ Bar } \text{O}_2 \Rightarrow 1 \text{ Bar for 1 min } 1 \text{ OTU} \Rightarrow 31.5 \text{ OTUs}$

-> $2 \text{ bar} \times .5 \text{ bar } \text{O}_2 = 1.0 \text{ Bar } \text{O}_2 \Rightarrow 25 \text{ OTUs}$

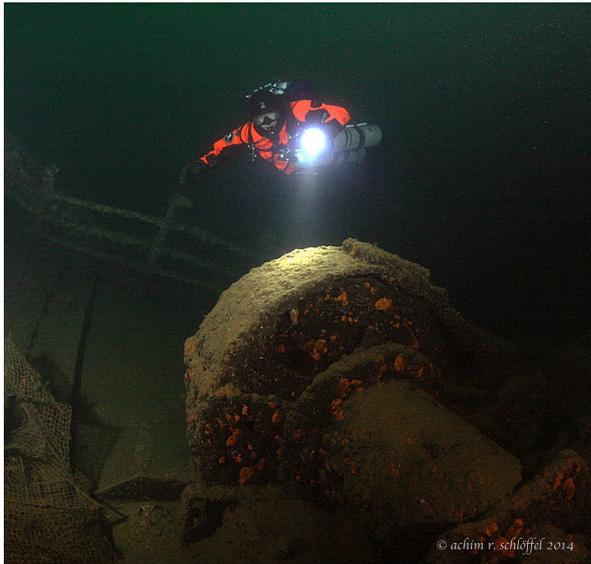
Total OTUs after Dive is ca. 57

Please note: Estimate Result: $30+13=43 \times 1.5=65 \text{ OTUs}$

Dive Planning

PO₂ & PN₂ -> MOD

The max PO₂ we do not want to exceed have been discussed previously. On top of that we do not want to expose ourselves to a higher narcosis level than we would experience at 30 meters on air.



As we use standard gases we do not need to figure out if the gas is correct for every dive again. The following table gives you an idea of why we do what we do.

Standard Gas	Depthrange	Max PO ₂ /END
Nitrox 32%	0-30 Meter	1.28 / 30
Triox 30/30	0-36 Meter	1.38/22
Triox 21/35	30-45 Meter	1.2/25
Trimix 18/35	45-60 Meter	1.26/28
Trimix 15/60	60-75 Meter	1.27/24
Trimix 10/80	75-90 Meter	1.0/10
Trimix 21/35	Deco 57 Meter up	1.4/33
Triox 35/25	Deco 36 Meter up	1.6/24
Nitrox 50%	Deco 21 Meter up	1.6/21
Oxygen	Deco 6 Meter up	1.6/6

Dive Planning

Average Depth – Profiling the dive

The classical question for any diveplanning is:

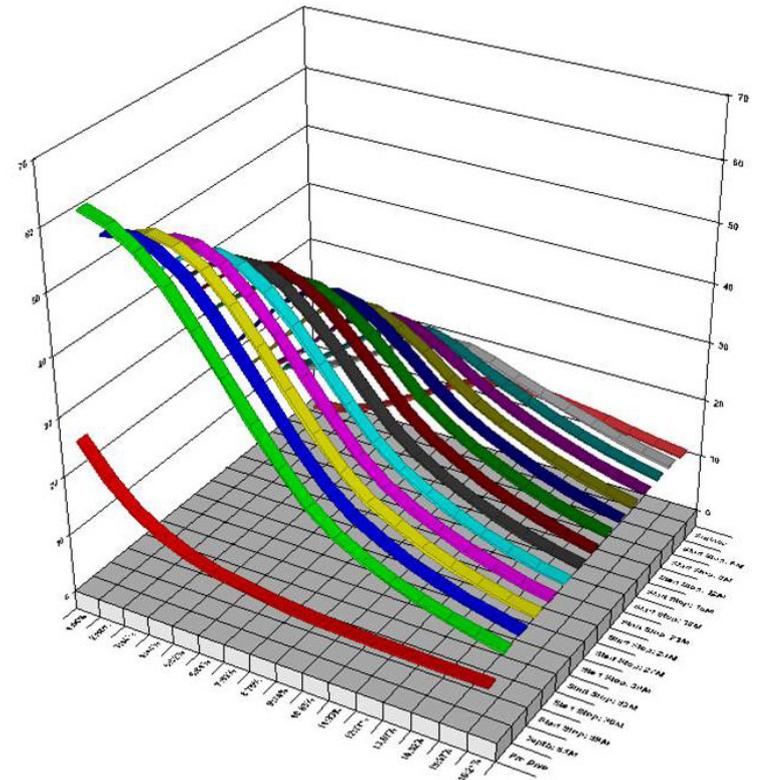
How deep do I go for how long?

Unfortunately this cannot really be answered in advance. So the question needs to be:

How long have I been on what depth?

The answer to this is somewhere between the moment You touch the water and the moment You give thumbs up and start Your ascent. What numbers You come up with is up to Your analysis of the dive, the amount of conservatism You want to add and Your ability to picture what you did.

We call this „*profiling the dive*.“

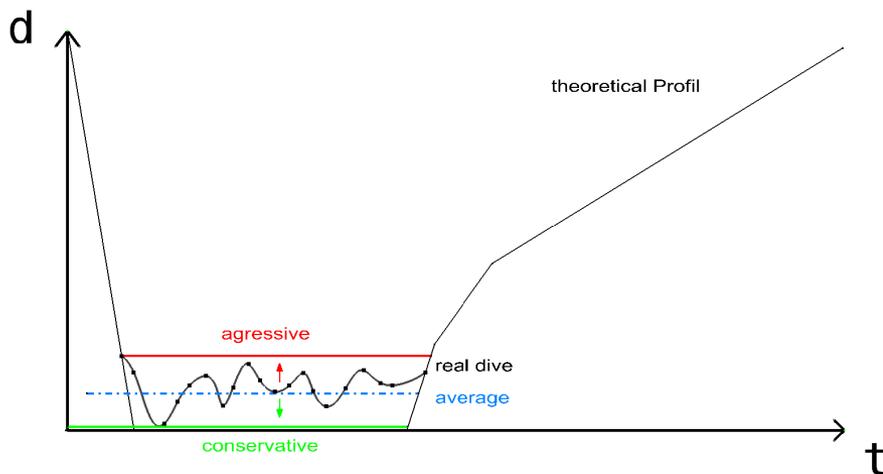


Profiling the Dive

Choose Your conservatism

As stated before, the Bottomtime can be set anywhere between the start of You descent and the start of ascent. While most tables are based on this method, some of the programs available on the market use the pure Bottomtime, beginning with the reach of target depth and the start of the ascent. The truth lies somewhere in between and can differ

The same statement can be given for the depth. While one could simply count the estimated bottomtime on the maximum depth reached, whilst someone else may choose an average between any point of the descent and the max depth.. Up the level of conservatism You want to use. Regarding to various factors such as Bodyshape, fitness, temperature, taskload, a.s.o.



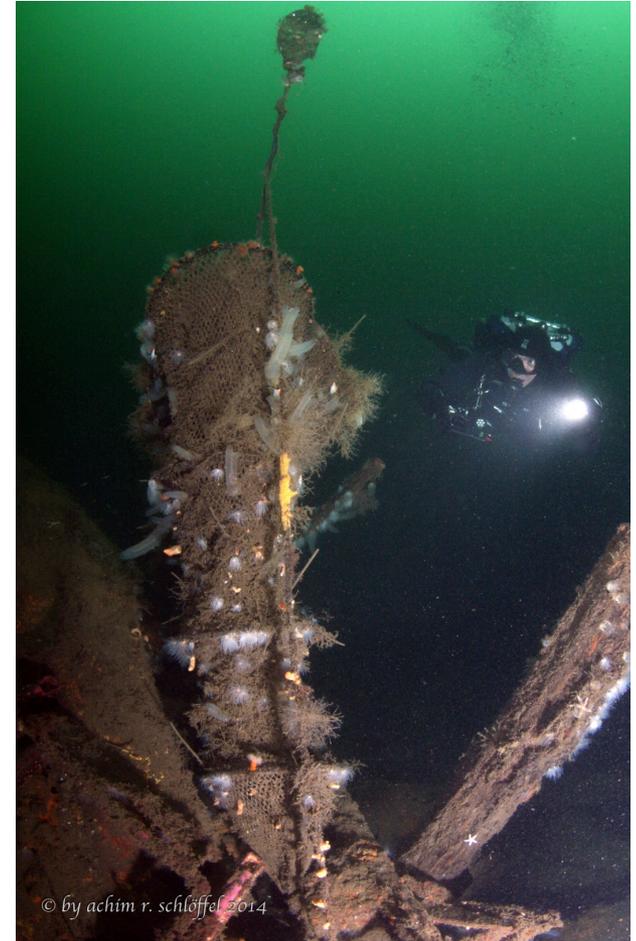
Situational Awareness

Create Awareness on the Situation

Although this may seem logic in the first place it is not something that is given to the diver naturally. In fact, the more demanding the dive becomes, may it be through more and advanced equipment or may it be through the tasks of the dive itself, the higher the chance is, that the diver is not able to focus on all matters at once.

A big part of situational awareness is to visualize the dive before and play mentally with the tasks and problems that may arise and have a solution and a tactic ready.

Situational awareness means to be able to adapt to the situation coming up on You – may it be environmental issues, marine life, partners or changes in the plan.





ISE Exploration Diver Level II

Gasmanagement



ISE Exploration Diver Level II

Gasmanagement

Gasmanagement is the same as for Level 1:

„You need enough gas to get Yourself and your OOG Partner up to the next breathable gas while following proper ascent procedures.“

Lets look at it on a practical example:

You and Your partner plan a dive to 70 Meters using D20 with 15/60 and 50% Nitrox + Oxygen as a Decogas in a 7L Tank and a 40 cft.

HOW LONG DOES IT TAKE YOU TO GO TO 21 METERS?
(here the OOG can go on his own stage – ONE FAILURE ONLY!!)

2 Min @ 70 to solve the issue (deploy long hose and start up)

2 Min up to 54 Meters (10m/min to 75% of max depth)

11 Min up to 21 Meters (3m/min to first deco stop / gasswitch)

17 Min total



ISE Exploration Diver Level II

Gasmanagement

HOW MUCH GAS DO YOU NEED FOR THAT?

Estimating a RMV of 20 Liters / min and the fact that both of have stress and therefore breath more we can assume a total 60 Liters / min for both of You

Att.!! This value may vary due to depth, equipment, enviroment and can be significantly more!!! – so plan accordingly!!

17 Min at an average between 70 and 21 ($70+21 / 2 = 45,5$ Meters) using 60 Liters / min =>

$17 \times 5,6 \times 60 = 5814$ Liters of Gas

As You use a D20 this has to be divided by 40 => $5814 / 40 = 145$ Bar

This means that You need to call the dive with a min of 145 Bars left in You D20 to have sufficient backup!

Estimate a round 15 Liters RMV on a relaxed dive this means that with the left 2200 (8000-5800) You can stay 18 min at 70 Meters. ($2200 / 8 / 15 = 18,33$)



ISE Exploration Diver Level II

Gasmanagement - Decogas

How much Decogas

Estimating a RMV of 15 Liters / min during deco and the concept of planning for one failure at a time in combination with the described „loss of decogas“ procedure leads to the following:

Decotime of Segment x average depth in bar x 15 = Liters of gas needed.

Expl.:

20 min on 50%

-> $20\text{min} \times 2,5 \text{ bar} \times 15 = 750 \text{ Liter}$ (divided by 7 liter in case of a 7 Liter Stage) = 107 Bar.

In case of a loss of Oxygen the time of the O2 Deco has to be done 2 times.

20 min on Oxygen x 2 = 40 min on 6 and 3 Meters.

$40 \times 1,45 \times 15 = 870 \text{ Liter}$

This results in a total of 1620 Liters = 150 bar in a 80cft Tank.



ISE Exploration Diver Level II

Stagehandling

Stagehandling – Tricks of the Trade

Diving 3 stages makes it important to follow a procedure that avoids unnecessary clippings (and therefore reduces the risk of loss) and makes it as unlikely as possible to switch to a wrong gas.

- > the first gas to use is in front – outside (bottomstage)
 - this is because it is the easiest to reach stage
 - it is visible for the partner
 - You can unclip it at the bottom and turn it to store the reg
- > the second gas to be used is on the inside (50%)
 - and therefore come next automatically after the first stages goes – no clipping needed
 - no possibility to take the wrong gas – only one choice available
- > the last gas is on the leash (Oxygen)
 - only stage that has to be moved before use.
 - O₂ is the gas that can be substituted easiest.



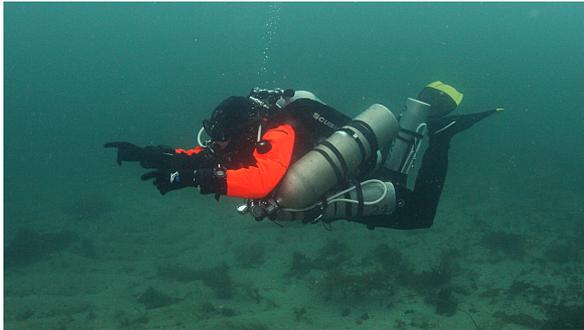
Stagehandling – The Procedure

Bottomstage

The bottomstage is breathed from the surface. When the stage is empty you unclip the tail and turn the stage forward. Store the hose and close valve.

Unclip front and:

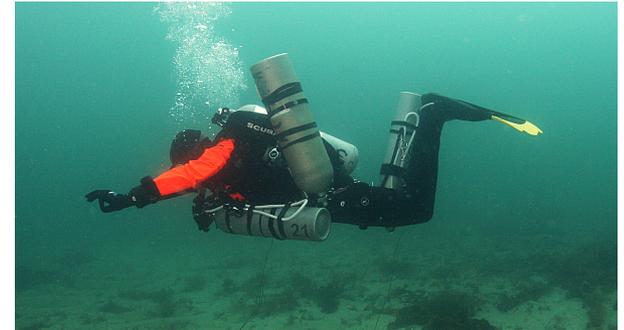
- noseclip it in hip D-Ring – or:
- shoot to surface.



Diver breathing from a Bottom Stage



Diver Storing Bottom Stage



Diver with Bottom Stage in Noseclip

Stagehandling – The Procedure

50% / 21 Meter Stage

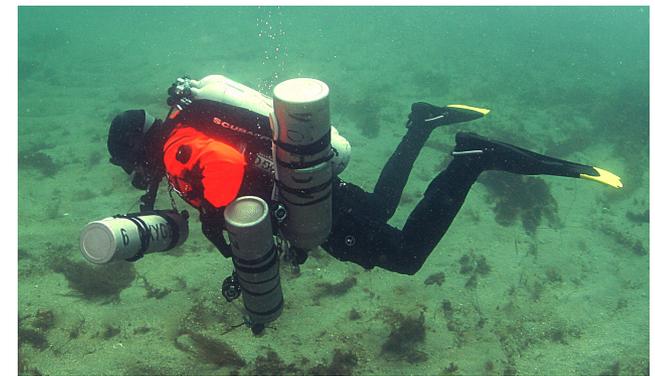
The bottomstage is gone and You have only the 50 on the front. The O2 is on the leash. This makes the dangerous mistake of accidentally switching to the O2 at depth impossible. The risk of loosing a stage is also not given as You do not have to juggle stages for this switch.

When You are at 9 Meters, You switch to backgas. Unclip the tail and bring it forward. Store hose and close valve.

Make leash hang down from hip. Unclip nose and clip in leash (one hand). Unclip O2 from leash and in shoulder D-Ring. Bring leash back and clip tail of O2 in Hip D-Ring. Ascent to 6 meters.



Switching to 21m Stage after BT Gas is noseclipped



Storing 21m Stage and bringing O2 to the front

Stagehandling – The Procedure

Oxygen / 6 Meter Stage

The 50% Stage is gone (in the leash) and the O2 is the only stage in the front. This was the only juggling of a full stage and it was done with the one that is the least dramatical to loose.

The risk of switching to the wrong stage is again not given as it is only one. Switch to Oxygen and surface with the stage in place.



Diver switching to O2 Stagewith21m stage stored on leash



ISE Exploration Diver Level II

Decompression



ISE Exploration Diver Level II

Decompression

Theorie of Decompression

This is a very complex topic and every organisation or agency developed its very own way of approaching this and communicating it to its customers and students. ISE believes that the scientific approach is not the best and that a practical approach is what serves the diver best. The diver neither needs to be a doctor nor a needs a master in physics. The diver needs to understand what happens in his body and how to handle this situations.

Why this intro?

There are manuals out there that look so professional and scientific but in the end most users do not understand what it is all about. On the other hand there are very rudimentary plans out there that bring the „aha- effect“ on the students face and get all the mystery out of the topic. In the end, if the instructor is able to bring the knowledge to the student in clear and understandable words, the diver will be able to plan his dives safe and will avoid trouble.

The ISE approach is very practical and avoids a too scientific way of explaining things. We hope You appreciate this and ask Your instructor if You want a more scientific explanation for certain things.

Decompression

Theorie of Decompression

Generally speaking one can say that decompression is the way of accomplishing two needs: Get back to the surface as fast as possible and dont get bubbles to form in Your system. The Solution for these two needs are very contrary. Whilst a fast ascent would serve the first, avoiding any ascent and therefore preassure reduction would be best for the second. The way to go lies somewhere in between...



Decompression

Theorie of Decompression

The historic approach was to go as far in the water column as possible in a defined speed. Reaching the so called Deco-Ceiling (the maximum pressure difference between his tissues and his lungs that can be tolerated before bubbles start to form) the diver has to wait for a certain amount of time to allow the pressure difference to reduce before he can go to the next stop.

That way, the diver places himself on the limit with little to no space for bailout and always at the risk of bubbles forming because of diver error or any other issue that overrides the „rule“.

Almost no clearance of any tissues till the reach of the first stop. With all deco to be done in the shallow part of the ascent.

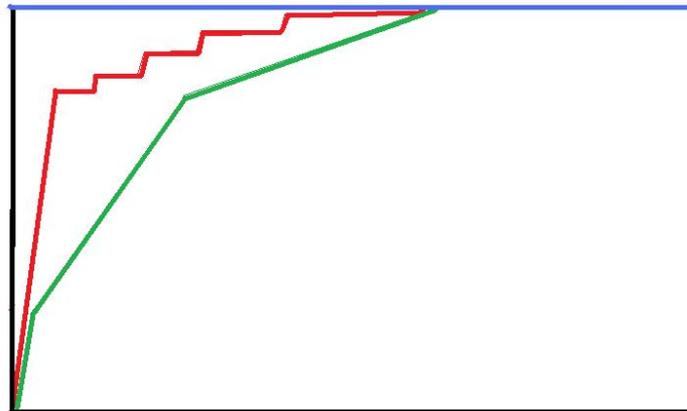


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Decompression

Theorie of Decompression

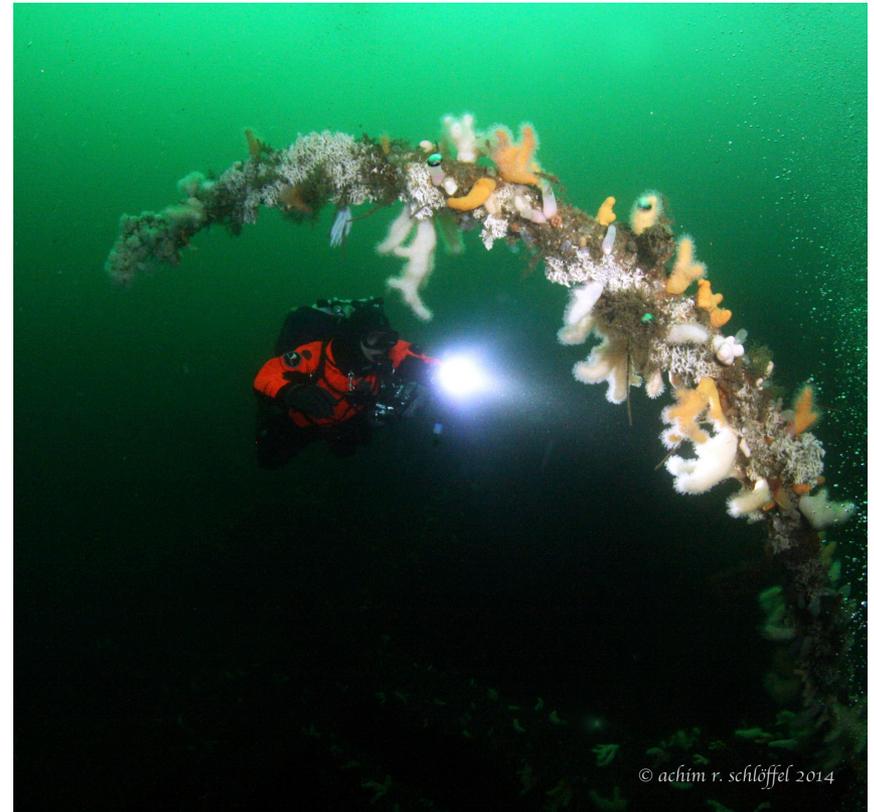
Today we accept the fact that Deco starts the moment that the pressure in our lungs gets below the the pressure in our tissues. Depending on depth and exposure time this is roughly at $\frac{3}{4}$ of our max. depth in decoding and $\frac{1}{2}$ of the max depth in recreational diving. Whilst the speed of ascent to that point is not significant we still want to keep it controlled and do not go faster than 10 meter / min. From there the diver slows down to 3 meter / min by doing 40/20 stops (40 sec stay followed by a 20 sec ascent to the next stop 3 meters shallower). That way, the pressure difference between the tissues and the lungs that is minor at that stage can equalize and be „rebuild“ during the 20 sec ascent. This goes till the first real decostop is reached. Basicly the fast tissues are very much cleared by this procedure and the diver is in a much better state than with the old procedure. The „real“ decostops follow common rules and slow the ascent further down to also clear the slow tissues and pay for the fact that the presure differrece gets bigger the closer we get to the surface.



Deco-Calculation

The question now is obviously how we figure the total deco time and how we spread it over the stops. To get the overall deco time a table can be used or a program. Both methods have the disadvantage of displaying the stops as well and usually in a way we do not want them.

Before we discuss how to spread the stops we would like to introduce you to another method to estimate your deco time that works very well in the Level 1 Range: Ratio Deco



ISE Exploration Diver Level II

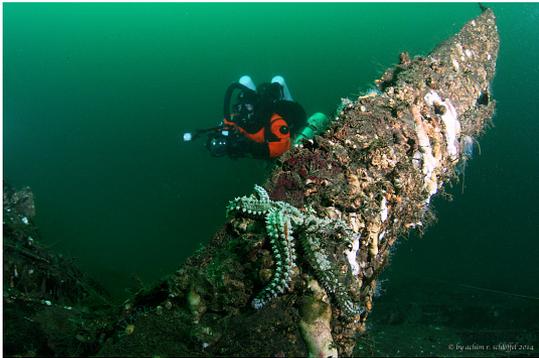
Ratio Deco Level 1

Ratio Deco is based on the fact that for every gas combination on every depth there is a fixed ratio between Bottomtime and Decotime. We use this fact.

Ready? – ok – here's the rules:

Gases: 21/35 on the Bottom and 50% Nitrox for Deco from 21 Meters up.

- Setpoint for the Ratio is 45 Meters
- The Ratio is 1:1
- For every 3 Meters plus / minus off the setpoint – the deco changes plus / minus 5 minutes
- Overall decotime is spread 50/50 between the 21-9 Meter segment and the 6/3 Meter Segment



Ratio Deco Level 2

The Rules:

Gases: 18/45 or 15/60 on the Bottom + 50% Nitrox for Deco from 21 Meters up + Oxygen at 6 Meters

- Setpoint for the Ratio is 66 Meters
- The Ratio is 1:2
- For every 3 Meters plus / minus off the setpoint – the deco changes plus / minus 5 minutes
- Overall deco time is spread 50/50 between the 21-9 Meter segment and the 6 Meter Segment





ISE Exploration Diver Level II

Ratio Deco – how to spread the stops

We do this step by step to help You understand the process.

Our example is a dive for 30 Minutes @ 70 Meters.

We are 4 meters deeper of our setpoint so we have 10 min more deco.
Our overall deco is therefore 40 minutes that we spread 20 minutes
on 21-9 and 20 minutes on 6.

We ascent with 10 meters / minute to 75% of 70 Meters = 54 Meters.

Step 1 – spread time linear:

21	4		
18	4		
15	4		
12	4		
9	4		
6	20		



ISE Exploration Diver Level II

Ratio Deco – how to spread the stops

- We do 40/20 stops from 54 to 21 Meters slowing our ascent to 3 Meters / minute.
- The rule for the Gasswitch is: Minimum 3 Minutes or the „linear“ Time. In our example 4 Minutes in fact is the linear time.
- On 18, we lose the effect of the O₂-window and speed up the gradient to go up to 15. We do a short stop of 2 minutes. (**never exceed 1:3 between stops**)
- 15 meters – we slow down and do a 3 minute stop and shift 1 minute to 12 meters
- 12 meters – we slowly get into longer stops and put the 1 minute from the 15 Stop on top to stay 5 minutes
- 9 meters. We add the 2 from 18 and do a 6 minute stop.
- 6 meters we stay 20 Minutes (12 in O₂ – 6 on Bottomgas – 2 on O₂ and then do a slow ascent 1 meter / minute

Step 2 – create curve:

21	4	4	
18	4	2	2 go to 9 meters
15	4	3	1 goes to 12 meter
12	4	5	Use the 1 from 15
9	4	6	Use the 2 from 18
6	20	20	

The result is the same amount of decotime than before but in a nice shaped curve.

Decompression

Decompression Sickness

Decompression Sickness (DCS) ist divided into 3 Categories:

I – No CNS related Sympmtoms. Sympmtoms are Jointpain, Skinrash, Weakness, etc

II – CNS related Symptoms. Paralysation, Coordination Problems, Unconcoueness, Death

(III) DCS affection the inner ear causing vertigo (vestebiular hit)





ISE Exploration Diver Level II

Decompression

I – No CNS related Symptoms

The Definition of „Type1“ is that there are no CNS effects. This is because we talk about symptoms created by the slower tissues like Bones and Fat that do not interact with nerves or bloodvessels directly and therefore cause pain or irritation but no effects on the CNS side.

It is important to understand that the slower and therefore Type-1 related Tissues usually get cleared in the later and shallower part of the deco.

Symptoms are:

- Weakness
- Jointpain
- Skinrash
- „Flu“ Symptoms
- T.b.c.



ISE Exploration Diver Level II

Decompression

II – CNS related Symptoms

The Definition of „Type2“ is that there are CNS effects. This is because we talk about symptoms created by the faster tissues like Blood, Muscles, etc that do interact with nerves or bloodvessels directly and therefore lead to issues with the CNS

It is important to understand that the faster and therefore Type-2 related Tissues usually get cleared in the early and deeper part of the deco.

Syptoms are:

- Fatigue
- loss of feeling / sense
- Paralyzation
- Death
- T.b.c.

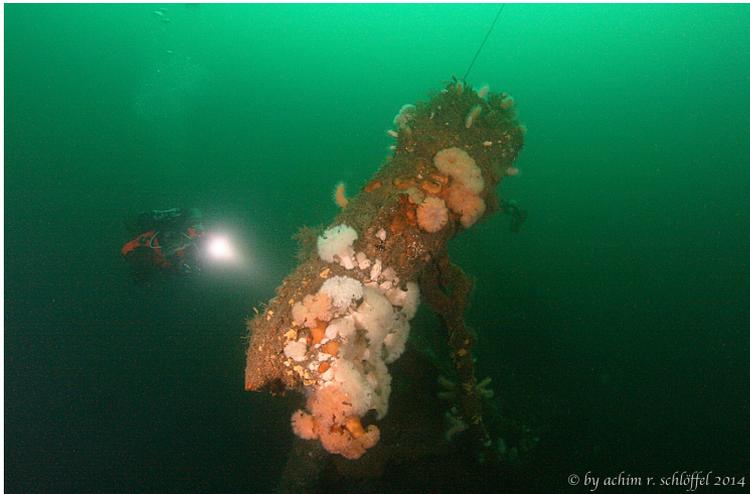
Decompression

III) DCS affection the inner ear causing vertigo (vestibular hit)

The Definition of „Type3“ is sometimes used for this special case. There is no „rule“ when and how this occurs. Although it seems that it is more likely to happen with a high He-content it was also confirmed on recreational divers on no deco dives with air.

The diver usually experiences a heavy vertigo and throws up within 45 min after the dive. This is caused by a small bubble in the inner ear that affects the balance.

Danger is given through dehydration and the victim should get O₂ and chamber treatment as soon as possible.



Decompression

Factors for DCS

DCS is caused and affected by the following factors:

- Age
- Fat
- Fitness
- Dehydration
- workload
- PFO
- Profile
- wrong gas





ISE Exploration Diver Level II

Decompression

Loss of Decogas

Loss of Decogas will result in extended Decompression. The question is always what rule to apply and what to do in practical diving,

The Rule is simple and safe.

Double the stops that You have not the right gas for and use the deeper gas.

In the real world You will have – hopefully – a buddy next to You who has decogas. What You can do now, instead of staying alone and let the partner deco away with his gas, is to share the gas (no buddybreathing!! But share 50/50) and extend the stops by 50% (deco time times 1.5)



ISE Exploration Diver Level II

Training Dives Review



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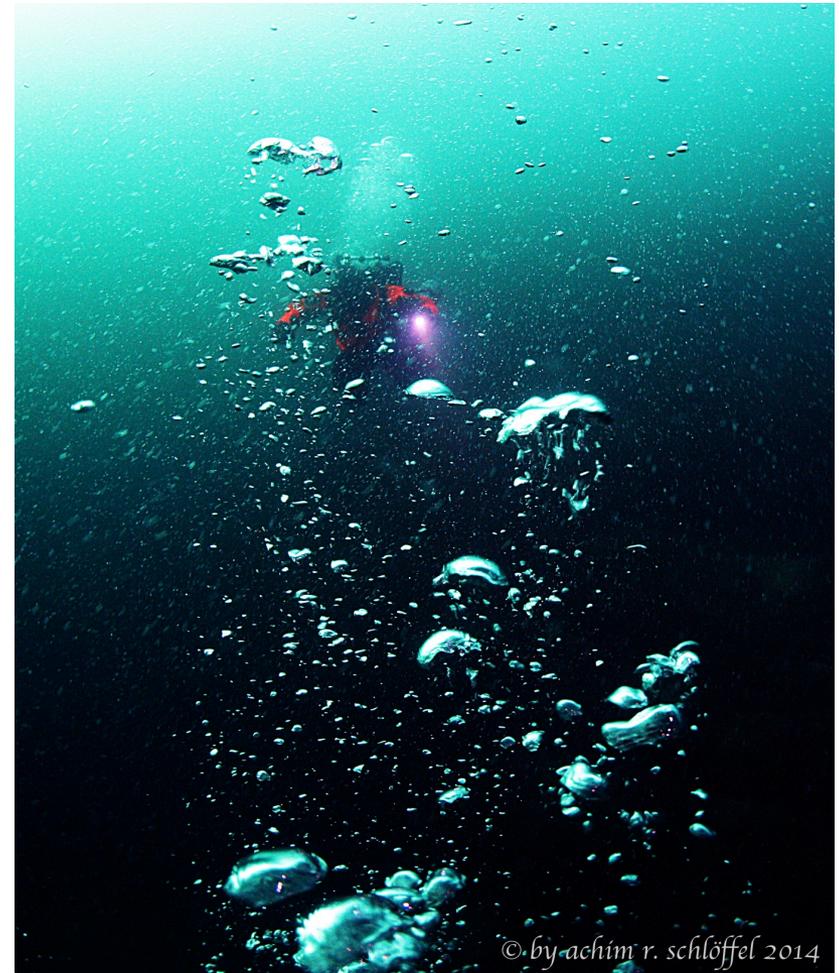
Training Dives Review

ISE Exploration Diver Level II Training has a **minimum** of 5 – 8 Dives, depending of the group, it's skills, the environment, weather and a variety of other factors.

All dives are conducted with 3 stages!

In the following a quick overview of the dives are given which should only serve as a guideline

and can be rearranged by the instructor depending on the situation.



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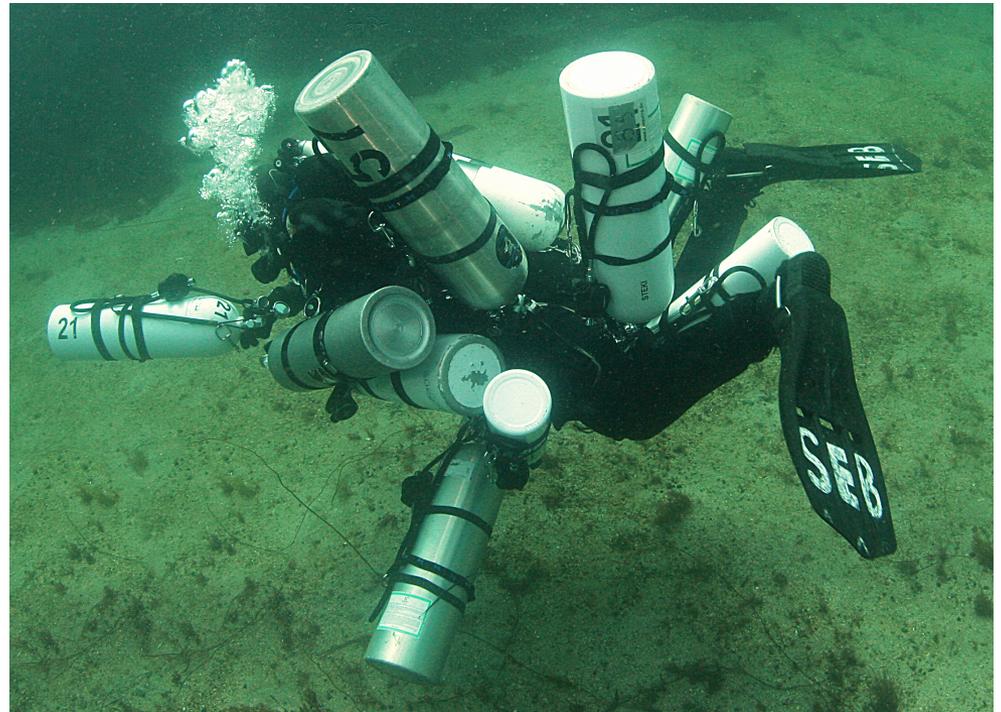
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Dive 1: (shallow water)

- Lead by instructor
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Multiple Stage handling techniques
- Stage rotation
- Clipping techniques
- Gas switching procedures

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion





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Dive 2: (Shallow water)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Critical Skills Review
- Gas sharing
- Stage handling – Taskloading

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion





ISE Exploration Diver Level II

Dive 3: (Nitrox 32 max. 30 meter)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Simulated deco dive
- Ascents with gas switches
- Bluewater vs line / liftbag
- Liftbag failures

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion





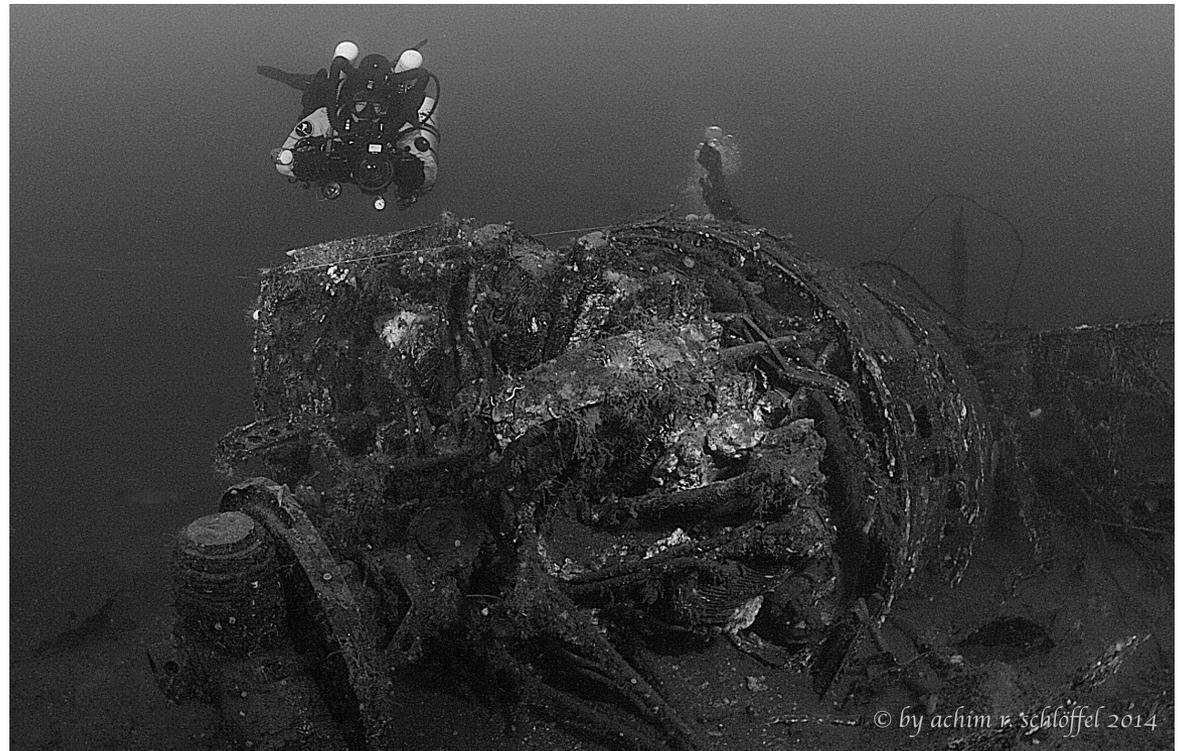
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Dive 4: (21/35 – max. 50 meters)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Experience Dive
- One task (survey)

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion





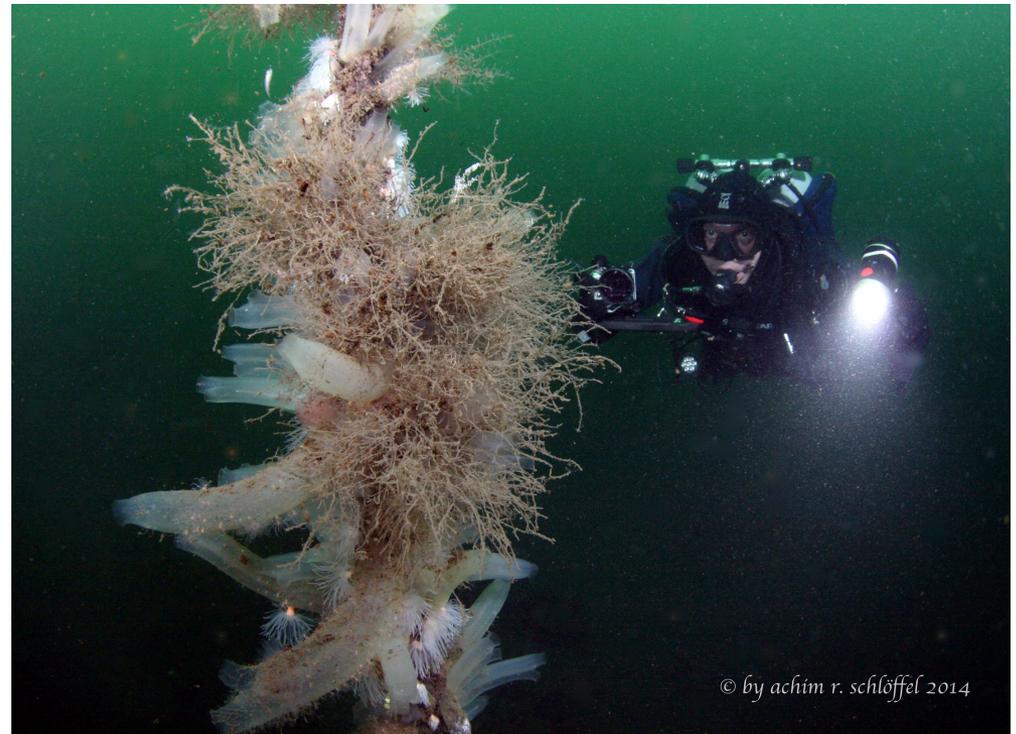
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Dive 5: (18/45) 60 Meters max)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Experience Dive
- One Task

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion



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Dive 6: (18/45) 65 Meters max)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Experience Dive
- One Task

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion





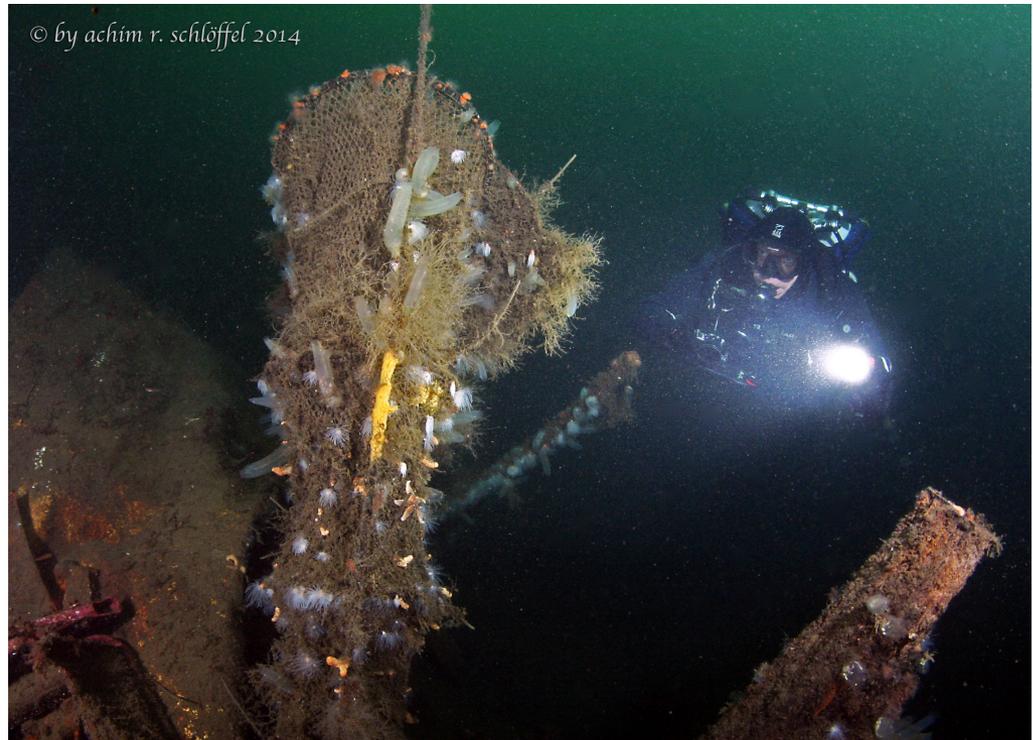
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Dive 7: (15/60) 70 Meters max)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Experience Dive
- One Task

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion





ISE Exploration Diver Level II

Dive 8: (15/60) 75 Meters max)

- Lead by team captain
- ISE RULE
- Flow check
- Hose Deployment
- Bubble check
- Sequence

- Experience Dive
- Fun Dive

- Quick debrief by team leader
- Quick debrief by instructor
- Video review and discussion



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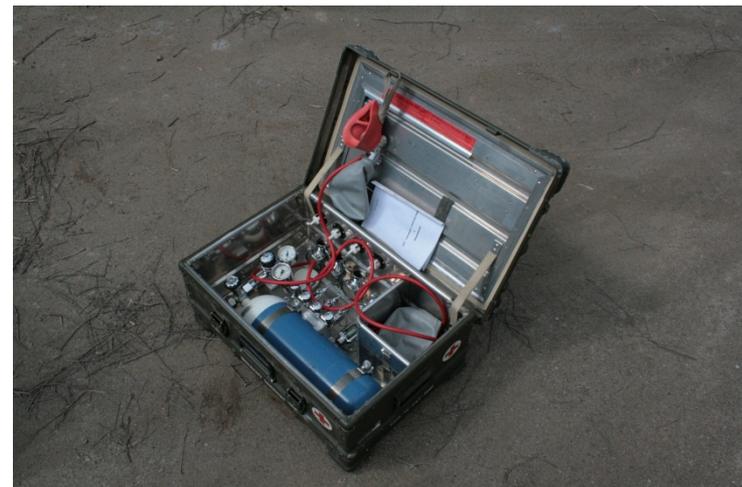
Final Words

Emergency Oxygen – A MUST

It is barely understandable how divers can spend thousands for training and gear but fail to understand that the - compared to the rest of their gear – cheap Oxygen Set may save their life or the life of fellow divers.

Divers Emergency Oxygen can be the classical set up like from Wenol or a budget solution using ex commercial stuff like seen on the pictures.

No matter what, the importance is to create the awareness amongst divers that having their own Emergency Oxygen Kit on the dive site without having to rely on others in case of ..





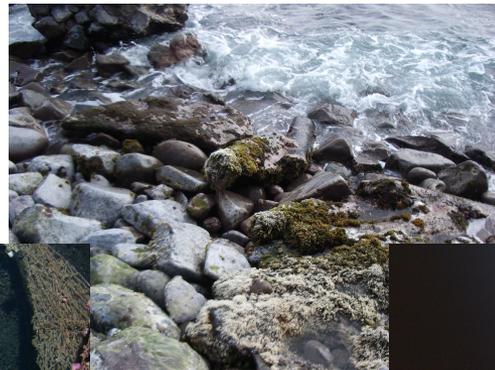
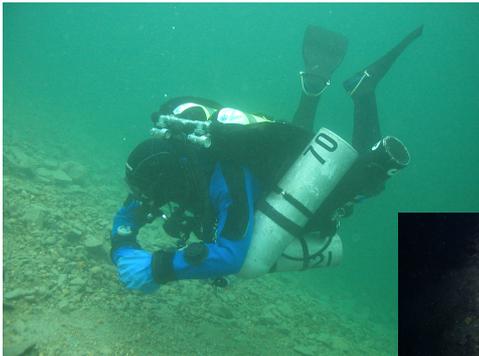
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Thank You!

We would like to thank you greatly for all your time and commitment to enroll in this course, and are sure this course have greatly benefited your diving career by enhancing you aquatic fun.

Please remember to fill up the ISE instructor QA forms.

ISE is dedicated to promote intense and solid dive training around the world. Help us spread the system and please show your support for our projects and development. Thank You!





ISE Exploration Diver Level II

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