Deep Diver

Specialty Course Instructor Guide
Product No. 70224 (Rev. 10/10) Version 2.02

PADI Deep Diver
Specialty Course Instructor Guide

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Introduction

This section includes suggestions on how to use this guide, an overview of course philosophy and goals, a flow chart to show you how course components and materials work together for success, and ways you can organize and integrate student diver learning.

How to Use this Guide

This guide speaks to *you,* the PADI Deep Diver Specialty Instructor. The guide contains three sections – the first contains standards specific to this course, the second contains knowledge development presentations, the third considers optional confined water and/or surface training and details the open water dives. All required standards, learning objectives, activities, and performance requirements specific to the PADI Deep Diver course appear in **boldface** print. **The boldface assists you in easily identifying those requirements that you *must* adhere to when you conduct the course.** Items not in boldface print are recommendations for your information and consideration. General course standards applicable to *all* PADI courses are located in the General Standards and Procedures section of your PADI *Instructor Manual.*

Course Philosophy and Goals

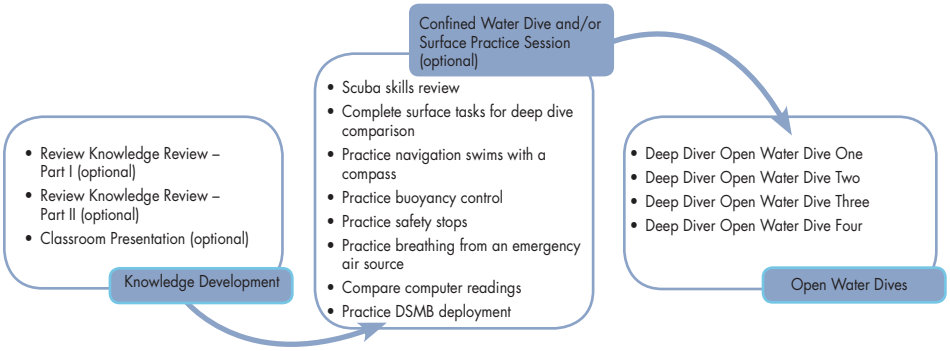
It's a rare diver who hasn't felt the urge to dive deep. Deep diving opens the door to many new exciting dive sites like deeper wrecks, reefs and walls. As a rule, divers tend to be adventurous people, and deep diving – whether to visit a wreck or take photos – can certainly be called adventurous. It's only natural that like most divers, you have some interest in deep diving.

Deep diving is a means to an end. You make a deep dive to see, to do or to experience something that you can't on a shallower dive. There's no reason to make a deep dive if you can make essentially the same dive at a shallower depth. Unlike shallower dives, deep dives tend to be short since time and air supply is limited. Therefore, you don't have a great deal of time to do much so you'll need to make smart decisions about a dive objective and dive accomplishments. Keep

that thought, the *philosophy* of this course is to focus on *making smart decisions for a stress free, deep diving experience with an emphasis on safety.* Thus, the *goal* of this course is to bring to light the necessary equipment needed to support deep diving activities, to discourage thrill seeker attitudes and encourage the proper deep diver behavior of following appropriate limits, and to teach student divers a systematic, methodical approach to enjoying deep diving. Student divers will develop the techniques involved in deep diving within recreational limits (between the depths of 18 metres/60 feet and 40 metres/130 feet) while avoiding disturbing delicate marine life.

The best way to learn Deep Diving procedures and to apply them is by doing it. This *course philosophy,* therefore, expands student diver knowledge about deep dive planning and organization, the basics of deep diving, hazards to avoid, deep diving support equipment, and how to interact responsibly with the aquatic life they'll see while deep diving. Student divers will apply the knowledge they gain by reading the PADI *Deep Diver Manual* and watching the companion video on at least four open water dives practicing and demonstrating the practical aspects of deep diving.

Course Flow Options



Course Flow Options provides a visual representation of how knowledge development and confined water and/or surface practice sessions support open water dives. When possible, it's preferable to have student divers complete and review Knowledge Reviews from the PADI *Deep Diver Manual* before participating in the open water dives. Knowledge Review – Part I is the same Knowledge Review that appears in the Deep Diver section of *Adventures in Diving.* If you have the first part of the Knowledge Review on file, you may at your discretion, have student divers complete only Knowledge Review – Part II.

Confined water and/or surface practice sessions are not required for the PADI Deep Diver course; however, you may choose to have practical sessions that allow student divers to practice skills such as navigating with a compass, buoyancy control, safety stops, Delayed Surface Marker Buoy (DSMB) deployment, breath-

ing from an emergency air source, reading (comparing with other divers) information from their depth gauges or dive computers.

There are four dives to complete. **You may rearrange skill sequences within each dive; however, the dive sequence must stay intact.** You may add more dives as necessary to meet student divers' needs. Organize your course to incorporate environment friendly techniques throughout each dive, to accommodate student diver learning style, logistical needs, and your sequencing preferences. You may choose from one of the approaches from Program Options, or develop your own.

Program Options

Step	Independent Study	Adventure Dive Integration	Instructor-Led
1	Independent study with manual and video (optional)	Independent study with manual and video (optional)	Knowledge Development Classroom Presentation (optional)
2	Review Knowledge Review – Part I and Part II (optional)	Give credit for Deep Adventure Dive and collect Knowledge Review – Part I (optional)	Review Knowledge Review – Part I and Part II (optional)
3	Confined Water Dive and/or Surface Practice Session (optional)	Confined Water Dive and/or Surface Practice Session (optional)	Confined Water Dive and/or Surface Practice Session (optional)
4	Open Water Dive One	Review Knowledge Review – Part II (optional)	Open Water Dive One
5	Open Water Dive Two	Open Water Dive Two	Open Water Dive Two
6	Open Water Dive Three	Open Water Dive Three	Open Water Dive Three
7	Open Water Dive Four	Open Water Dive Four	Open Water Dive Four

Section One:
Course Standards

This section includes the course standards, recommendations, and suggestions for conducting the PADI Deep Diver course.

Standards at a Glance

Topic	Course Standard
Minimum Instructor Rating	**PADI Deep Diver Specialty Instructor**
Prerequisites **Minimum Age**	**PADI Adventure Diver or Advanced Open Water Diver** **15 years**
Ratios	**Open Water 8:1 Instructor; 4:1 Certified Assistant.**
Site, Depths, and Hours	**Depth: 18-40 metres/60-130 feet** Hours Recommended: 24 **Minimum Open Water Dives: 4 dives over 2 days**
Materials and Equipment	Instructor: • **PADI Deep Diver Specialty Course Instructor Guide** • **Emergency backup air supply**

Instructor Prerequisites

To qualify to teach the PADI Deep Diver course, an individual must be a Teaching status PADI Open Water Scuba Instructor or higher. **PADI Instructors**

may apply for the Deep Diver Specialty Instructor rating after completing a Specialty Instructor Training course with a PADI Course Director, or by providing proof of experience and applying directly to PADI. For further detail, reference Membership Standards in the General Standards and Procedures section of your PADI *Instructor Manual.*

Student Diver Prerequisites

By the start of the course, a diver must be:

1. **Certified as a PADI Adventure Diver or Advanced Open Water Diver or have a qualifying certification from another training organization.** In this case, a qualifying certification is defined as proof of certification beyond entry level (at least two certifications total) with proof of 20 or more logged dives documenting experience in deep diving and underwater navigation. Verify student diver prerequisite skills and provide remediation as necessary.
2. **At least 15 years.**

Supervision and Ratios

Open Water Dives

A Teaching status PADI Deep Diver Specialty Instructor must be present and in control of all activities. During deep dives, students must be accompanied by the course instructor or certified assistant (PADI Instructor, Assistant Instructor or PADI Divemaster). During Open Water Dive One, the instructor must be in the water *directly* supervising student divers at a maximum ratio of 8:1. This ratio cannot be increased with the use of certified assistants.

The ratio for Dives Two, Three, and Four is 8 student divers per instructor (8:1), with 4 additional student divers allowed per certified assistant (4:1). The maximum student diver to certified assistant is 4:1. The Specialty Instructor must ensure that all performance requirements are met.

Site, Depths, and Hours

Site

Choose sites with conditions and environments suitable for completing requirements. Ideally, select sites familiar to student divers. Use different open water dive sites, if possible, to give student divers experience in dealing with a variety of environmental conditions (incorporate environment friendly techniques throughout each dive) and logistical challenges. Practice skills in confined water sessions first to better prepare divers to apply skills in open water later.

Depths

Conduct Dive One between 18 metres/60 feet and 30 metres/100 feet. Dives Two, Three and Four may not exceed 40 metres/130 feet.

Hours

The PADI Deep Diver course includes four open water dives, conducted over two days. No more than three dives per day. The minimum number of recommended hours is 24.

Materials and Equipment

Instructor Materials and Equipment

Use the PADI Deep Diver course materials prescriptively to accommodate various sequencing preferences and teaching and learning styles.

Required

- **PADI *Deep Diver Specialty Course Instructor Guide***
- **Specialty equipment needed for student divers to perform deep dives.**
  - **Underwater light**
  - **Demonstration items** (e.g., puzzles, problems, colored objects or colors painted on a slate)
  - **Pressure affected items** (e.g., ping-pong ball, tennis ball, wet suit materials, etc.)
  - **Safety equipment** (e.g., emergency oxygen; flag and surface float with 6 metre/20 foot weighted line for safety stops with backup air supply attached).
  - **Emergency backup air supply**

Recommended

- PADI *Deep Diver Manual.* Use the student diver manual for detailed content explanation.
- PADI *Deep Diving* video
- As needed: Extra backup lights, slates with pencils, compasses, and dive computers for student divers.

Student Diver Materials and Equipment

Recommended

- PADI *Deep Diver Manual*
- PADI *Deep Diving* video
- Underwater light
- Slate with pencil
- Dive computer
- Access to support equipment as necessary, including but not limited to: backup lights, slate and pencils, and compasses.

Assessment Standards

To assess knowledge you may review the Knowledge Reviews from the student diver's manual with the diver. **The student diver must demonstrate accurate and adequate knowledge during the open water dives and must perform all skills (procedures and motor skills) fluidly, with little difficulty, in a manner that demonstrates minimal or no stress.**

Certification Requirements and Procedures

Document student diver training by completing the PADI *Specialty Training Record* for Deep Diver (see Appendix). **To qualify for certification, by completion of the course, student divers must complete *all* performance requirements for Deep Diver Open Water Dives One, Two, Three and Four.**

The instructor certifying the student diver must ensure that all certification requirements have been met. Reference Administrative Procedures of the General Standards and Procedures section of your PADI *Instructor Manual* for detailed information on Referral.

Links to Other Courses

The Deep Diver Adventure Dive conducted during the PADI Adventures in Diving program may count as the *first dive* toward this specialty at your discretion.

Similarly, divers who successfully complete Deep Diver Open Water Dive One and Knowledge Review Part 1 may receive credit as an Adventure Dive toward the PADI Adventure Diver and the PADI Advanced Open Water Diver certifications. They may also credit the specialty certification toward the PADI Master Scuba Diver rating.

Section Two:
Knowledge Development
Conduct

Unlike shallower dives, deep dives tend to be short since time and air supply is limited. Consequently, you don't have a great deal of time to do much so you'll need to make smart decisions about a dive objective and dive accomplishments. Therefore, the philosophy of this course is to focus on *making smart decisions for a stress free, deep diving experience with an emphasis on safety.* This means to expand student divers' knowledge about deep dive planning and organization, the basics of deep diving, hazards to avoid, deep diving support equipment, and how to interact responsibly with the aquatic life they'll see while deep diving.

Student divers complete independent study of the course by reading the PADI *Deep Diver Manual* and by watching the PADI *Deep Diving* video. Work hand-in-hand with the student diver manual to address prescriptively student diver misconceptions or for clarification on certain points of interest. If there is a need for instructor-led presentations, use the following teaching outline, which appears in point form, as a road map of the conduct, content, sequence and structure for the PADI Deep Diver course.

The result should be student divers with theoretical knowledge and pragmatic experience who can adapt what they've learned to future deep dive opportunities. **Regardless of how you conduct knowledge development (independent study, instructor-led or a combination of these instructional approaches), student divers will be able to explain the following learning objectives.**

Knowledge Development

Learning Objectives

By the end of knowledge development, student divers will be able to explain:

Reasons why people deep dive, deep diving objectives, the definition of recreational deep diving, optimal depth limits for recreational divers, important information and decisions about deep diving personal depth limits.

- **What are five reasons to deep dive?**
- **What is the difference between a proper and an improper deep diving objective?**
- **What's the definition of a recreational deep dive?**
- **What are four reasons that 30 metres/100 feet is recommended as the optimal depth limit for recreational diving?**
- **What five factors should you consider when setting your personal depth limit?**

Proper equipment for the demands of deep diving, essential specialized deep diving equipment, surface support stations, and important guidelines for using dive computers.

- **How do you determine if your personal equipment is suitable for deep diving?**
- **What five specialized pieces of equipment are recommended for deep diving?**
- **What makes up a surface support station?**
- **What five guidelines should you follow when using a dive computer?**

Buddy contact and neutral buoyancy deep diving techniques, proper deep diving descents and ascents, deep diving breathing techniques, deep diving low or out-of-air situations, maintaining stop depth with and without a reference, required safety stops and emergency decompression, and deep drift and wall dives.

- **What are two techniques for maintaining buddy contact during deep dives?**
- **How should you maintain neutral buoyancy on a deep dive?**
- **How do you make a head-up descent, and why is this important in deep diving?**
- **What are two techniques for slowing or stopping descents/ascents along a reference line with your hands occupied?**
- **What are four steps to follow while descending/ascending without a reference?**
- **What are two techniques for estimating an 18 metre/60 foot per minute or slower ascent rate?**
- **How should you breathe while deep diving?**
- **How do you avoid low air or out-of-air situations on a deep dive?**
- **What is the best way to swim without stirring up the bottom, and why is it important?**
- **How do you make a safety or emergency decompression stop at 5 metres/15 feet, with and without a reference line?**

- **What should you do if you accidentally omit an emergency decompression stop?**
- **What are five recommended guidelines to follow when making a deep drift dive?**
- **What's a wall dive and what three recommended guidelines should you follow when making a deep wall dive?**

Deep diving narcosis, symptoms and signs of narcosis, factors affecting the onset and intensity of narcosis, the prevention of and dealing with narcosis at depth. The definition of decompression sickness; symptoms, signs and predisposing factors toward decompression sickness, avoiding decompression sickness, and emergency care for a diver suspected of having decompression sickness.

- **At approximately what depth does narcosis typically begin to affect divers?**
- **What are seven symptoms and four signs of narcosis?**
- **What five factors may speed the onset of, or intensify the effects of narcosis?**
- **In recreational diving, how do you prevent narcosis, and what do you do if it occurs?**
- **What is the primary reason recreational divers experience decompression sickness?**
- **What are five symptoms and seven signs of decompression sickness?**
- **What ten factors may predispose a diver toward decompression sickness?**
- **What can you do to avoid decompression sickness?**
- **What is the recommended emergency care for a diver suspected of having decompression sickness?**
- **What are seven reasons why a diver suspected of having decompression sickness should not be recompressed underwater?**

Knowledge Development Teaching Outline

Suggestions to *you,* the PADI Deep Diver Specialty Course Instructor, *appear in note boxes.*

A. Course Introduction

1. Staff and student diver introductions

Note:
Introduce yourself and assistants. Explain your background with deep diving if your student divers are not familiar with you.

Have divers introduce themselves and explain why they are interested in deep diving. Break the ice and encourage a relaxed atmosphere.

Give times, dates and locations as appropriate for classroom presentations, confined water and/or surface practice sessions, and open water dives.

Review with student divers other skills they'll want as a PADI Deep Diver. These opportunities, through additional specialty course training, may include, but are not limited to: PADI Enriched Air Diver, *PADI* Wreck Diver, *PADI* Digital Underwater Photographer, *PADI* Dry Suit Diver, *PADI* Peak Performance Buoyancy Diver *and PADI* TecRec.

2. Course goals – this course will help:
    a. Develop your practical knowledge of deep diving.
    b. Increase your diving skills.
    c. You plan, organize, and make deep dives.
    d. Improve your diving ability and provide you with additional supervised experience.
    e. Encourage you to participate in other specialty training.
3. Course overview
    a. Classroom presentations and confined water and/or surface practice sessions.
    b. Open water dives. There will be four open water dives.
4. Certification

a. Upon successfully completing the course, you will receive the PADI Deep Diver Specialty certification.

b. Certification means that you will be qualified to:

1. Plan, organize, make, and log open water deep dives in conditions generally comparable to or better than, those in which you are trained.

2. Apply for the Master Scuba Diver rating if you are a PADI Advanced Open Water Diver and a PADI Rescue Diver (or qualifying certification from another training organization) with certification in four other PADI Specialty ratings, and you have 50-logged dives.

Note:
Use the PADI Student Record File. *Explain all course costs and materials, and what the costs do and do not include, including equipment use, dive site fees, etc. Explain what equipment student divers must have for the course, and what you will provide. Cover and review points about scheduling and attendance.*

5. Class requirements

a. Complete paperwork.

b. Course costs.

c. Equipment needs.

d. Schedule and attendance.

B. Why Dive Deep?

- ***What are five reasons to deep dive?***

1. Deep diving activities

a. Deep diving is a means to an end. It is a passport to a greater number of dive sites where you can sightsee and engage in new activities.

b. Deep diving may allow you to:

1. Observe different types of aquatic life and bottom topography unique to deeper environments such as walls. Despite their awe-some appearance, these structures are very fragile. Good buoyancy control skills help minimize your contact with the wall.

2. Explore wrecks that lie untouched by waves, surge and ice. Deep wrecks tend to be better preserved by the cool, lower-oxygen water common to deep wrecks; however, they are still fragile. Remember to explore them carefully and never take anything but photos.

Note:
Inform student divers to consult the Project AWARE Foundation's "Responsible Wreck Diving Considerations" *before diving on deep-water wrecks. Remind divers that they can visit www.projectaware.org to learn more.*

Responsible Wreck Diving Considerations

1. Respect the Heritage and Loss

Wrecks of military vessels or aircraft are often the last resting place of men and women who gave their lives while serving their nation. Treat these war graves with respect and honor to commemorate the lives sacrificed for their country. Protect underwater graves as you would any burial ground or memorial.

2. Respect the Environment

Low impact dive techniques are essential in preserving fragile wreck sites. It's important to fine-tune your buoyancy and streamline your equipment to avoid disturbing or damaging the artificial reef habitat during your dive. Use care to avoid touching the wreck with your hands, knees or fins. Whenever possible, use a mooring line instead of tying or anchoring on sites in a manner that may cause disturbance. Remember, many wrecks are habitats for entire ecosystems.

3. Respect Others

Resist the temptation to remove anything from wreck sites. Taking souvenirs for yourself often limits interest and enjoyment for future divers. Wrecks are not renewable resources; important archeological evidence can be lost if an object is removed. As divers, we are merely visitors to these sites. As such, we are responsible for leaving the wrecks as we found them. Take photos rather than souvenirs, so that wrecks remain intact for future generations.

4. Respect Your Limitations

Wrecks have claimed the lives of inadequately prepared divers. Exploring wrecks requires experience and supplemental skill training such as the PADI Wreck Diver Specialty course. This is especially true with regard to entering intact shipwrecks. Training for other overhead environments, such as caverns or caves, does not qualify you to enter wrecks. Know your personal limitations and dive ability. If necessary, seek additional training with a qualified instructor

5. Respect the Law
Know and obey all local laws and regulations when wreck diving, such as diver access, restricted areas, fish and game laws and collecting and reporting underwater finds. In many instances, these laws exist for your safety and protection.

6. Respect Safety
Many military vessels laid to rest at sea still contain hazardous materials such as oil, firearms, heavy containers and munitions. In most cases, transporting these materials or bringing them ashore is far more dangerous than leaving them alone. For your safety and the safety of others, do not recover or interfere with dangerous materials.

7. Respect the History and Archeology
Shipwrecks hold clues to our maritime past. Therefore, it's important not to disturb these submerged historical sites. As a diver, if you find an object or wreck that may be of historical importance, leave it where it lies, mark its position and seek advice from the local government authority who looks after historical and archeological finds.

3. Take unique photographs, but you'll want to be completely familiar with taking photos so you can use time effectively while following deep diving procedures. You can learn more about underwater photography techniques and camera equipment in the PADI Digital Underwater Photographer course.

Note:
Inform student divers to consult the Project AWARE Foundation brochure "10 Tips for Underwater Photographers" before taking underwater photos. Remind divers that they can download a pdf of this information from www.projectaware.org.

10 Tips for Underwater Photographers

1. Photograph with Care

Dive carefully as many aquatic creatures are fragile regardless of size. Improper techniques while taking or editing photos underwater can damage sensitive aquatic life and harm fragile organisms with the bump of a camera or cylinder, swipe of a fin or even the touch of a hand.

2. Dive Neutral

Camera systems may add weight or be buoyant. Make sure to secure photo and dive equipment and be properly weighted to avoid contact with reefs or other vital habitat. Practice buoyancy control and photography skills in a pool before swimming near sensitive and fragile environments.

3. Resist Temptation

Avoid touching, handling, feeding, chasing or riding aquatic life. Avoid altering an organism's location to get the perfect shot. Many aquatic creatures are shy and easily stressed. These actions may interrupt feeding, disturb mating or provoke aggression in a normally nonaggressive species.

4. Easy Does It

While diving, move slowly and deliberately through the water. Be patient and still while photographing – allow organisms to show their natural behavior for a more significant and meaningful shot.

5. Sharpen Your Skills

Make sure the difficulty of the dive and the environmental conditions are appropriate for your current skills and comfort level. Avoid stabilizing underwater by grabbing onto the reef for a better photo. Enroll in PADI's Underwater Photographer, Digital Underwater Photography and Peak Performance Buoyancy Specialty courses to become a more skilled and successful photographer.

6. Be Informed

Be aware of local regulations and protocols regarding behavior around marine mammals and other species before entering the water. These regulations protect creatures and aim to assure their preservation for future generations.

7. Be an AWARE Diver
Consider enrolling in an AWARE - Coral Reef Conservation, Project AWARE Specialty or Underwater Naturalist course to learn sustainable dive techniques and increase knowledge about the environment you're photographing.

8. Take Only Pictures, Leave Only Bubbles
Avoid souvenir collection. Nearly everything found in the aquatic realm is alive or will be used by a living creature. Removing specimens such as corals and shells can disturb the delicate balance and quickly deplete dive sites of both their resources and their beauty.

9. Share Your Images
Use images for conservation by reporting environmental disturbances or destruction using your photographs as evidence. Assist scientific research and improve resource management by contributing your photos to The Whale Shark Project and other monitoring programs. You may also submit your photos to Project AWARE. Your images have the power to change perspectives and influence conservation.

10. Conserve the Adventure
Join Project AWARE Foundation, the dive industry's leading nonprofit environmental organization. Your support helps conserve underwater environments through education, advocacy and action.

4. Drift dive in prevailing ocean currents, which slow or stop in shallow water.
5. Recover objects that have been lost in deep water. Since deep-water search and recovery techniques fall beyond the scope of this course, it's recommended that you become a certified PADI Search and Recovery Diver, as well as a Deep Diver, before attempting them.

- ***What is the difference between a proper and an improper deep diving objective?***

2. Proper deep diving objectives
   a. The objectives for each deep dive must be carefully determined.
   b. You need to isolate a sensible, nearly singular objective. You only have a short period to get things done while deep diving, so avoid trying to do too much.
   c. Do not dive deep to set records.

d. Proper deep diving objectives may include: exploring part of a deep wreck, drift diving with a current along a vertical reef wall, photographing a deeper-water organism and sightseeing.

C. What is a Deep Dive?

- ***What's the definition of a recreational deep dive?***

1. Standard definition of a deep dive

   a. A recreational deep dive is generally defined as a dive deeper than 18 metres/60 feet to an absolute maximum depth limit of 40 metres/130 feet.

   b. Most references, in this course, to breathing underwater, refer to air. Air is a generic term used for breathing gases, including any blend of enriched air, or air.

      1. Enriched air – sometimes called "nitrox" – is an oxygen-nitrogen gas mix like air is and is a good choice for making deep dives. While air consists of 21 percent oxygen, enriched air has more oxygen – typically 32 to 36 percent. Increasing the oxygen lowers your exposure to nitrogen, which increases the time before you reach a no stop limit. Using high oxygen percentages creates a few easily managed concerns, which you can learn to handle in the PADI Enriched Air Diver course.

- ***What are four reasons that 30 metres/100 feet is recommended as the optimal depth limit for recreational diving?***

2. Depth limits

   a. Although your maximum depth limit is 40 metres/130 feet, you'll probably find 30 metres/100 feet your *optimum* limit for most deep dives.

      1. You have little time below 30 metres/100 feet, even though you'll probably use a dive computer and enriched air nitrox to allow more no stop time. Your time gets significantly shorter below 30 metres/100 feet because you're consuming air/EANx faster, shortening your overall dive.

      2. Divers are more susceptible to narcosis at depths below 30 metres/100 feet – staying shallower helps avoid the problem.

      3. There is an increased possibility of decompression sickness at depths below 30 metres/100 feet; it is easier to overstay the no decompression limits with a single cylinder.

4. In most environments (especially in some freshwater bodies), light intensity falls off dramatically with depth. Below 30 metres/100 feet, low light levels complicate deep diving and dramatically reduce the diversity of aquatic life.

Note:
*Refer student divers to read the side bar in the manual "*Beyond the PADI Deep Diver Course.*" This side bar informs divers that diving deeper than 40 metres/130 feet calls for requirements beyond recreational deep diving. Specifically, the side bar explains to student divers what they'll learn in a PADI Tec Deep Diver Course and a PADI Tec Trimix Diver Course. In addition, student divers are informed of the typical Tec Diver equipment list required for deeper dives.*

- ***What five factors should you consider when setting your personal depth limit?***

3. Developing a personal deep-diving depth limit
   a. It's impossible to accurately define deep diving by simply saying it is any diving taking place between 18 metres/60 feet and 40 metres/130 feet. Depth limits must be personalized – in some situations, even 18 metres/60 feet may be too deep.

Note:
Provide student divers with an example of where the definition of deep diving may be too deep. The objective is to get students to think more in terms of day-to-day personalized depth limits rather than the established 18 metres/60 feet to 40 metres/130 feet maximum.

For example, you haven't been diving for seven months and you are about to make a dive with a new dry suit. Is the maximum depth definition in this situation still valid? Perhaps not.

   b. A personalized maximum depth limit can be formulated by taking into consideration:
      1. Environmental conditions at a deep dive site (40 metres/130 feet in a cold, low-visibility lake vs. 40 metres/130 feet in warm, clear tropical waters).

2. Your psychological and physiological well-being. If you feel unduly anxious, perhaps a less stressful dive is in order. It's okay for a dive to feel challenging, however, if you start wishing the dive was over before you've even started, listen to your feelings and skip it.
3. Is this a repetitive dive? If so, consult your computer (or RDP) to be sure you have a reasonable allowable bottom time. The general recommendations are to avoid repetitive diving deeper than the previous dive and to avoid repetitive dives deeper than 30 metres/100 feet. In the case of using enriched air, you need to respect the maximum depths for the particular blend you are using.
4. Remoteness of dive location, distance to emergency assistance and availability of proper first aid equipment. The longer it would take to reach these, the shallower and more conservative you'll want to plan your dive.
5. Training and experience of diving partner; if less than you, plan the dive based on your buddy's training and experience.

D. Equipment for Deep Diving

- ***How do you determine if your personal equipment is suitable for deep diving?***

1. It's your responsibility to be properly equipped for the demands of the deep diving environment. In addition, you'll want to become familiar with any new equipment before making a deep dive with it.
   a. Regulator
      1. Probably the most important feature to look for in a deep diving regulator is a balanced first stage. You may want to consider a high-performance second stage design. These include balanced adjustable second stages, pilot valve second stages and Venturi assisted second stages.
      2. If you're considering continuing into the Tec Deep Diver course, you may want to invest in a high end, top of the line model suited to tec diving now.
      3. Rinse your regulator thoroughly after each dive and have it serviced annually.

Note:
For a more detailed discussion on the differences between balanced and unbalanced first stages, suggest to student divers to read the side bar "The Differences between Balanced and Unbalanced First Stages" *in their student manual. In addition, refer student divers to* The Encyclopedia of Recreational Diving *for detailed illustrations of regulators.*

b. Submersible pressure gauge
    1. Whether you use a conventional SPG or an air-integrated dive computer, be sure the gauge, its swivels, and connections obtain annual service with your regulator.
    2. If you notice that your conventional mechanical SPG always seems high compared to the fill station and/or that the gauge doesn't read zero without pressure, have the gauge checked or replace it.

c. Buoyancy Compensating Device (BCD)
    1. Virtually any state-of-the-art BCD should be suitable for recreational deep diving.
    2. Inspect your BCD periodically for possible leaks, and be sure the low pressure inflator operates properly.

d. Cylinders
    1. Since you use air or enriched air faster as you dive deeper, it's better to have more than less. Deep dive with a 12 litre/71.2 cubic foot or larger cylinder.
    2. Some high capacity cylinders hold about half again to twice as much as a 12 litre/71.2 cubic foot cylinder.

e. Exposure suits
    1. The suit that keeps you comfortable at 12 metres/40 feet may not be adequate for a dive to 36 metres/120 feet. Wear exposure protection based on the planned depth temperature, not the surface temperature.
    2. You may want to use a thicker wet suit, or a dry suit with undergarments based on the temperature at depth.

f. Alternate air source
    1. An alternate air source (a system that is capable of delivering sufficient air to two divers in distress and allow them to comfortably return to the surface) is a must have for deep diving.

2. The alternate air source second stage should be visually identifiable and attached within the triangle area between the mouth and lower corners of the rib cage.
3. You may want to consider a pony bottle – an independent air source that provides additional air; it helps assure that you have ample gas to reach the surface safely in an emergency. It is important that the regulator used for the pony cylinder is easily identified, and that it cannot be mistaken for the diver's primary regulator. This can be achieved in many ways including:
   a. Color of the second stage
   b. Color of the mouthpiece
   c. Shape and style of the second stage
   d. Shape and style of the mouthpiece
   e. Coloration of the pony cylinder hose
   f. Use of a physical item, which covers the mouthpiece and must be physically removed before the regulator can be used.

   Buddy teams should confirm the procedures that will be used, should a diver need to switch to a pony cylinder and end the dive.
4. Another option that is a spin off from tec diving, cavern diving and recreational penetration diving are H- and Y-valves. These valves allow you to attach two separate regulators to a single cylinder. If one were to fail (and freeflow), you or your buddy would close the portion of the valve supplying that regulator, and you would end the dive using the other.

g. Gauges and computers
   1. Most divers use a dive computer, which tracks depth, time and no stop time remaining and (in some models) air supply and estimated air supply time remaining.
   2. Modern dive computers work for years with little care beyond rinsing, drying and replacing the batteries as specified by the manufacturer, though it's a good idea to have their accuracy checked periodically.
   3. It's a good idea to wear two dive computers so you have one for backup. Alternatively, you can wear one dive computer and then have a depth gauge and timing device as backup.

h. Surface signaling devices
   1. Audible devices such as a whistle or air horn and a signal mirror are standard pieces of equipment for every diver.

Note:
Inform student divers that devices used to gain attention at the surface should be a standard piece of equipment for every diver, regardless of certification level. Audible devices like whistles or air horns (devices that attach to the low-pressure inflator of the BCD) can be easily heard at night or in limited visibility conditions. For daytime use, suggest to divers to include a visual signaling device like a signal mirror or surface marker buoy (safety sausage) in their equipment. If time allows, show your student divers the latest devices on the market and have student divers show each other their devices they'll be using to gain attention at the surface.

- ***What five specialized pieces of equipment are recommended for deep diving?***

Note:
Remind student divers to avoid using new or unfamiliar equipment when deep diving. Suggest they first learn to use new or unfamiliar equipment at depths above 18 metres/60 feet.

2. Special equipment needed for deep diving
    a. Reference line
        1. Allows you to make comfortable, slow descents/ascents, to control yourself in currents above the bottom, to make comfortable safety stops, to offset positive buoyancy by slowing ascents, to comfortably equalize and to maintain buddy contact.
            a. Can be a boat's mooring or anchor line, but often best to have a separate weighted reference line attached to a float or the boat's stern.
            b. Rope materials have differing properties, and the same diameter in different materials will have different strength. It is recommended to use no smaller than 1.25 centimetres/1/2-inch rope, nylon or polypropylene.

Note:
Remind student divers to exercise caution when using a boat's anchor line as a descent/ascent reference line. Holding onto the line as the boat pitches or rolls may result in injury if the anchor line is jerked up suddenly. Additionally, loss of the line may occur if it becomes necessary for the boat to re-anchor while divers are underwater. In areas where waves are common, some divers carry a jon line – a strong, short cord with a loop at each end that they can snug around the anchor line and hang on to. The cord helps dampen the anchor line's motion.

Ask student divers to read the side bar "Line for Divers" *in their manual. This side bar discusses the advantages and disadvantages of using synthetic or natural rope.*

b. Emergency breathing equipment
    1. Given the short no stop limits and rapid air consumption of deep dives, it's reassuring to have extra air waiting for a safety or emergency decompression stop. The simplest emergency breathing equipment is a cylinder and regulator suspended at 5 metres/15 feet, next to the reference line.
    2. Some charter dive boats have second stages on long hoses that reach down to 5 metres/15 feet, eliminating the need for a cylinder. Dive boats often suspend a weighted horizontal bar at 5 metres/15 feet, so divers can spread out and hang on for their safety stop instead of crowding a single spot on the reference line.
    3. Whatever type emergency breathing equipment is used, it's a good idea to have enough second stages for all divers to breathe from it at once.

c. Extra weight
    1. Extra weight is used to offset positive buoyancy at the end of the dive (due to an empty cylinder, etc.), allowing you to comfortably maintain a 5 metre/15 foot depth level for safety stops. Extra weight is typically placed with emergency breathing equipment on a 5-metre/15-foot stop line.
    2. These may be loose weights that you drop in your BCD pocket, or weights with snap hooks to clip to a D ring on your weight belt or BCD.

d. Dive light
    1. Dive lights come in handy for bringing out vivid colors or carefully peering into cracks and holes at depth.

2. In lower visibility environments it may be significantly darker at depth, so a light helps with reading gauges and keeping track of your buddy.
3. A small compact light is excellent for daytime deep diving.

e. First aid kit and emergency oxygen

1. It's recommended that you have first aid and emergency oxygen at hand whenever you're diving, not just deep diving.
2. Especially important when deep diving at remote locations, some distance from professional medical assistance.

Note:
Review DCS and oxygen first aid as part of your PADI Deep Diver *course. Remind student divers that they can learn more about handling emergencies in the PADI* Rescue Diver *course, and the* Emergency First Response *program.*

- ***What makes up a surface support station?***

3. Configurations of surface support stations

a. When boat diving, your surface support station is the boat. You'll need to provide an independent surface support station when diving from shore. For convenience, you can suspend your reference line, emergency breathing equipment and extra weights from a float or even a small boat, forming an independent surface support station.

b. Besides carrying deep diving equipment, you can equip a surface support station with a dive flag to warn off boaters.

- ***What five guidelines should you follow when using a dive computer?***

4. The modern dive computer has become standard among most recreational divers, and is the mainstay in most (but not all) tec diving.

a. Most provide all or some of the following features and information:

1. A continuing readout of depth and time
2. A continuing readout of no decompression limits or time needed at a certain depth for emergency decompression stops
3. Signal when ascent is too fast
4. Water temperature
5. Depth at which you must decompress in an emergency

6. Surface interval time

b. The following guidelines apply specifically to dive computers (always read and follow the manufacturer's instructions):

1. Always use your dive computer as a no stop (no decompression) device.
2. Don't share computers. Every diver needs a personal one.
3. Follow the more conservative computer, yours, your buddy's or your back up if you use one.
4. If your computer malfunctions during a dive, make a normal ascent and a safety stop (air permitting). Follow the manufacturer's instructions regarding resuming diving, which may require you to wait 12 or more hours.
5. Don't follow your computer blindly. Compare yours with your buddy's – if you've been on the same dive profiles, there shouldn't be huge discrepancies.

Note:
Ask student divers to show you their dive computer they intend to use for their deep dives. If divers don't have a dive computer explain the features and benefits of several different types. Have a variety of dive computers for student divers to handle.

*Refer student divers to the side bar "*Computer Misconceptions*" in their student manual. Discuss with divers the four misconceptions about dive computers.*

1. *Computers track something in your body.*
2. *Computers are more reliable than tables.*
3. *A computer that costs more is safer than a cheaper one.*
4. *The computer says it, so I can do it.*

E. Deep Diving Techniques: Buddy Contact and Neutral Buoyancy

- ***What are two techniques for maintaining buddy contact during deep dives?***

1. Maintaining buddy contact while deep diving

a. If you and your buddy lose track of each other on a shallow dive you can usually surface, regroup and continue the dive. On a deep dive,

you seldom have sufficient air and no stop time to continue the dive.

b. How to maintain contact:

1. Maintain eye contact during feet first descents
2. Maintain eye contact during ascents
3. On the bottom, swim side-by-side
4. Try to stay within touching distance; use a short line for you and your buddy to hold on to in low-visibility conditions.

- ***How should you maintain neutral buoyancy on a deep dive?***

2. Maintaining neutral buoyancy while deep diving

a. Begin each deep dive properly weighted (perform a buoyancy check). For deep dives, it's ideal to check your weighting with a nearly empty cylinder. This is because your scuba cylinder can be two kilograms/five pounds (or more) lighter when it's nearly empty at the end of a dive. The extra buoyancy could make you struggle to stay at the safety stop.

b. During descents and ascents, adjust buoyancy often. Don't wait to neutralize buoyancy until you reach the bottom. Avoid uncontrolled descents due to excessive negative buoyancy or fast ascents due to excessive positive buoyancy.

c. As you descend add air to your BCD periodically to compensate for the loss of buoyancy. If you're diving in a dry suit, it's very important to add air to your suit frequently as you descend. You need to do this not just to maintain neutral buoyancy, but to equalize the suit and prevent a dry suit squeeze.

F. Deep Diving Techniques: Descents and Ascents

- ***How do you make a head-up descent, and why is this important in deep diving?***

1. Making a head-up descent while deep diving.

a. It's recommended that you make a head-up, feet-first vertical descent while deep diving:

1. Reduces disorientation due to vertigo
2. Makes it easier to equalize your ears; helps prevent squeeze injuries. Air spaces are easier to equalize when your head is up.
3. Allows for better buoyancy control; slower descent gives you time to fine-tune buoyancy, adjust loose equipment, check depth, etc.

b. Alternatively, keep your head slightly higher than the rest of your body, and allow your body, legs and feet to take a less upright, more

diagonal position – keep your feet at the lowest point. You may find this diagonal position to be more stable during the descent.

c. When using a reference line alternate one hand between your BCD low-pressure inflator mechanism and equalizing your ears, while your other hand holds onto the line.

- ***What are two techniques for slowing or stopping descents/ascents along a reference line with your hands occupied?***

2. Slowing or stopping descents and ascents

a. Important to make slow, controlled descents and ascents

1. A rapid descent may result in an ear, sinus, mask or dry suit squeeze if you can't equalize fast enough. Equipment may become loose due to suit compression.
2. Control your descent rate and stop your descent prior to reaching the bottom. Look at the bottom composition and determine whether to make contact. Avoid disturbing aquatic life and/or stirring up a soft bottom reducing visibility.
3. Fast ascents can cause lung overexpansion injuries, cause you to miss a safety stop and increase the likelihood of decompression sickness. Remember: Be a S. A. F. E. Diver – Slowly Ascend From Every dive

b. When both hands are occupied and a reference line is used, to slow or stop descent or ascent:

1. Descend or ascend with one hand on the line, while using the other to equalize and control your BCD. If your hands are occupied, you can still slow or stop your descent or ascent on a line by locking your elbow around the line.
2. To remain stopped for a while with both hands free, wrap your leg around the line.

- ***What are four steps to follow while descending/ascending without a reference?***

3. Deep diving descents or ascents without a reference

a. Deep diving descents and ascents without a reference are not recommended. Try to make every deep diving descent or ascent either holding on to a reference line or near a sloping bottom or wall.

b. If a descent or ascent must be made without a reference, follow these guidelines:

1. At the start, place your body in a head-up, feet-first vertical or diagonal position.
2. Face your buddy and descend or ascend close together, maintaining eye contact. Continuously adjust your buoyancy as needed to remain neutral throughout your descent or ascent.
3. While descending watch the depth on your dive computer and adjust your buoyancy so you don't exceed your maximum depth.
4. While ascending, obey the 18 metres/60 feet per minute rule or the rate specified by your computer (whichever is slower). Keep one hand overhead and rotate. Listen for boat noises overhead. Make a three minute (or longer) safety stop at 5 metres/15 feet and wait for noise to pass before continuing your ascent.

- ***What are two techniques for estimating an 18 metre/60 foot per minute or slower ascent rate?***

4. Estimating proper ascent rate
   a. Be a S. A. F. E. Diver – Slowly Ascend From Every dive.
   b. Rate of ascent is not to exceed 18 metres/60 feet per minute (.3 metres/one foot per second) – but it's fine to go slower. Think of ascent rate as a speed limit.
   c. How to estimate ascent rate:
      1. The easiest way to track your ascent rate is to use your dive computer. You measure ascent rate at .3 metres or one foot per second. It should take about 20 seconds to rise six metres, or 10 seconds to rise 10 feet. If your computer has a slow ascent warning, use it. This technique is very accurate.
      2. If you have a computer problem, the easiest way to ascend at an appropriate rate is to stay with your buddy, who likely still has a working computer. In addition, you have a backup depth gauge and watch; you can estimate your rate by comparing your depth with time.

Note:
*Ask student divers to familiarize themselves with the side bar in their student diver manual "*Ascent Rate Mythology.*" Over the years, diving folklore has drummed up some interesting "facts" about ascent rates. These range from ideas that once had some validity, but have passed their time, to others that have no basis in reality at all. These myths include:*

1. *The 18 metre/60 foot per minute ascent rate is based on hard data about human physiology.*
2. *To ascend at a proper rate, ascend no faster than your smallest bubbles.*
3. *A slow ascent rate replaces a safety stop.*
4. *You can ascend too slowly.*

G. Deep Diving Techniques: On the Bottom

- ***How should you breathe while deep diving?***

1. Deep diving breathing techniques
    a. It is possible to over-breathe your regulator during strenuous activity while deep diving. A feeling of suffocation occurs when the regulator cannot deliver a comfortable amount of air. This occurs because of the increased density of air passing through your regulator.
    b. Density is only part of the issue. A gas flows less smoothly as the flow speed rises. This happens because as air flows through dive equipment, your trachea and bronchi and into your lungs, drag from contact with the passage surfaces causes the air to become turbulent. Turbulence disrupts even airflow and increases breathing resistance, which in turn demands more effort –- more effort demands more air.
        1. Always breathe consistently deep and slow. By breathing slowly and deeply, you avoid over-breathing your regulator and feeling out of breath.
        2. Try to breathe from your stomach and diaphragm, so you fill your lungs from the bottom up. Slow, deep breathing maximizes your respiratory efficiency, so you use your air more slowly. For maximum air conservation, relax and don't overexert yourself.

- ***How do you avoid low air or out-of-air situations on a deep dive?***

2. Even though the laws of physics dictate that you use air about twice as fast at 30 metres/100 feet as at 10 metres/33 feet, during the dive it seems to go faster than that. To prevent low air or out-of-air emergencies:
   a. Check your submersible pressure gauge (and other instruments) frequently.
   b. Reach your ascent point with sufficient air to make a safe ascent, a three-minute safety stop and reach the surface with an appropriate reserve.
   c. Calculate air consumption for a given depth. Air integrated dive computers provide a technological solution to estimating air consumption. Try to avoid overexertion, exercise and strenuous activity.

Note:
Work with student divers to show them how to estimate their air consumption by using the chart in their student manual. Ensure student divers understand that by estimating the depth of their dive and by using the chart to find the column representing their cylinder size they should be able to find an approximate total time (in minutes) they'll have underwater listed on the chart. With time permitting, go through a number of examples with divers.
For example: A dive to 21 metres/70 feet, with a 12 litre/80 cubic foot cylinder will allow you approximately 34 total minutes underwater.

In addition, remind student divers that knowing an estimate of how long a cylinder may last at a certain depth is no substitute for constant monitoring of their submersible pressure gauge or dive computer. Ask student divers to read both "Air Consumption Calculation" *and* "How Much Reserve?" *side bars in their student manual to formulate a good all-round air management plan.*

- ***What is the best way to swim without stirring up the bottom, and why is it important?***

3. Anti-silting techniques on the bottom
   a. Avoid touching the bottom with your fins on deep dives. Doing so reduces visibility and destroys aquatic life.
   b. As you get near the bottom, stop all fin movement. Neutralize buoyancy.

c. When on the bottom avoid stirring up the bottom. Release the reference line and move away from the descent area as others come down. You can hover away from the line or kneel on the bottom after making sure that the area is free of sharp objects or aquatic life.

H. Deep Diving Techniques: Safety Stops and Emergency Decompression

- ***How do you make a safety or emergency decompression stop at 5 metres/15 feet, with and without a reference line?***

1. A safety stop increases your safety margin by giving your body a chance to release excess dissolved nitrogen before surfacing. It also helps you affirm proper buoyancy control and a proper ascent rate by forcing you to stop before ascending the final 5 metres/15 feet to the surface.
   a. Recommended after all dives, but especially after deep dives and repetitive dives.
   b. Must make a safety stop if:
      1. Your dive has been to 30 metres/100 feet or deeper.
      2. Your pressure group at the end of the dive is within three pressure groups of the no decompression limit.
      3. You dive up to any limit on the Recreational Dive Planner.
2. Besides creating an extra safety margin, safety stops help you avoid the serious situation of accidentally missing an emergency decompression stop. During a safety stop, double-check with your buddy your no decompression status on your computer or the RDP limits.
3. Maintaining stop depth with the aid of a reference line
   a. Using your depth gauge, find the place on the line that is 5 metres/15 feet below the surface and grab the line just above that point (this positions the mid-chest area at 5 metres/15 feet). If you're on a rising and falling anchor line, holding on to a jon line will smooth out the stop a little, but you must be sure to maintain neutral buoyancy.
   b. Your body should be vertical and parallel with the line. Most divers seem to prefer a near vertical position during a stop, though a horizontal position is theoretically optimal. However, practically speaking, any position that's comfortable is fine.
   c. In clear, currentless water, you may prefer to hover near the line, without actually hanging on to it. One advantage of this is that several divers don't end up crowding the same point on the line.
4. Maintaining stop depth without the aid of a reference line and without a sloping bottom

a. Ascend slowly to 5 metres/15 feet, adjusting your buoyancy to remain neutral at that depth.

b. Maintaining your depth by watching your computer with a hand on your buddy, who keeps an eye on the boat, navigation or double checks the RDP if making a tables-based dive. You may want to deploy a Delayed Surface Marker Buoy (DSMB), one with a line long enough for your safety stop depth, to make your location visible to others.

c. Maintain a comfortable body position and avoid overexertion.

Note:

Explain to student divers that a Delayed Surface Marker Buoy (DSMB) is a long sausage-like marker buoy, with an opening at one end. Divers carry it deflated and rolled up in a pocket, or rolled and attached to their reels. At the end of the dive, prior to ascending, a diver can use their alternate air source or exhaled bubbles to inflate the DSMB and send it to the surface, paying out line from their reel as it goes. Divers can then slowly reel the line in as they ascend.

Make clear that DSMBs provide divers with a visual reference as they ascend and during their safety stops. They are helpful when divers are in a current, or unable to return to the boat for any reason. They also allow boat traffic to identify divers as they begin their ascent.

Suggest to student divers that they will be able to practice DSMB deployment in their confined water session.

5. Making an emergency decompression stop

a. Using a computer, follow the procedures dictated by the computer. Typically, your computer will tell you how long to stop at 3 metres/10 feet before you can surface.

b. If you're using the RDP, these are the rules if you accidentally exceed the no stop limits:

1. If you exceed the no decompression limit by no more than five minutes, make an eight minute stop at 5 metres/15 feet. Do not dive again for at least six hours.

2. If you exceed the no decompression limit by more than five minutes, make a stop at 5 metres/15 feet for at least 15 minutes (air supply allowing) and do not dive for at least 24 hours.

- ***What should you do if you accidentally omit an emergency decompression stop?***

6. If you accidentally miss an emergency decompression stop
    a. Remain calm.
    b. Tell your buddies or the divemaster and monitor yourself closely for symptoms of decompression sickness.
    c. Breathe 100 percent oxygen if available.
    d. If anything unusual develops, seek medical assistance.
    e. Do not reenter the water. The old U.S. Navy procedures for omitted decompression are not recommended for recreational divers.

Note:
Inform student divers that the age-old Navy procedure for omitted decompression is no longer recommended for recreational divers. The Navy procedure was never intended for recreational divers; it was designed to be used if the diver is asymptomatic, a chamber is on site, surface-supply or ample air is available, communications are available, decompression platforms are available, and the diver is capable of realizing he made an error and can get back into the water and descend to 12 metres/40 feet, having already calculated his emergency stops, all within three to five minutes. Generally, recreational divers operate well outside these conditions.

I. Deep Diving Techniques: Drift Dives and Wall Dives

- ***What are five recommended guidelines to follow when making a deep drift dive?***

1. Making a deep drift dive
    a. Make all deep drift dives from boats.
    b. Do everything at the same time as your buddy – suiting up, entering, descending, etc.
    c. Depending on the location, you may enter the water with an inflated BCD or you may enter the water with an empty BCD and descend immediately. It's important that everyone agrees to use the same technique.

d. Where practical, use an unanchored and hand-carried buoy as a visual reference for the trailing boat and for ascents. During the dive, make sure your equipment is streamlined and secured. Dangling equipment can destroy aquatic life in an instant and can cause damage on exposed parts of shipwrecks.

e. Watch your air supply and no stop times closely and allow an extra margin with both. On drift dives, it's often impractical to have emergency breathing equipment hanging from the boat or buoy. You may therefore want to allow an extra air reserve to assure you can make your safety stop.

Note:
Review "For Want of an Attitude" side bar in the student diver manual with your class. Emphasize to your student divers that it's important that they deep dive with an appropriate attitude regarding deep diving. Remind divers that recreational deep diving remains fun and has acceptable risk only as long as they apply appropriate principles and techniques, including those they've learned in this course. If they disregard proper procedures, fun and safety go out the window. Review the example as to how quickly little things can lead to an incident or accident.

- ***What's a wall dive, and what three recommended guidelines should you follow when making a deep wall dive?***

2. Deep dives along walls are exhilarating, especially in very clear water.
   a. When making a dive along a "bottomless" wall, there are three considerations
      1. Watch depth – in clear water it is easy to exceed depth limits.
      2. Dive next to the wall to avoid vertigo. The wall is your reference.
      3. Don't harm aquatic life on the wall – avoid touching or kicking the wall with hands or fins.

Note:
Review with student divers Project AWARE Foundation's "Ten Ways a Diver Can Protect the Underwater Environment." *Remind divers that they can download a pdf of this information from www.projectaware.org.*

Ten Ways a Diver Can Protect the Underwater Environment

1. ***Dive carefully to protect fragile aquatic ecosystems***
   Many aquatic organisms are delicate and can be harmed by the bump of a camera, the swipe of a fin or even the gentle touch of a hand. Some aquatic organisms like corals grow very slowly and breaking even a small piece can destroy decades of growth. By being careful you can prevent long-term damage to magnificent dive sites.
2. ***Be aware of your body and equipment placement when diving***
   Keep your gauges and alternate air source secured so they don't drag over the reef or other vital habitat. Control your buoyancy, taking care not to touch fragile organisms with your body or equipment. You can do your part and prevent injury to aquatic life every time you dive.
3. ***Keep your dive skills sharp through continuing education***
   Before heading to open water seek bottom time with a certified professional in a pool or other environment that won't be damaged. You can also refresh your skills and knowledge with a PADI Scuba Review, PADI Advanced Open Water Diver course or Project AWARE Specialty course such as Peak Performance Buoyancy.
4. ***Consider how your interactions affect aquatic life***
   Avoid touching, handling, feeding or riding on aquatic life. These actions may stress the animal, interrupt feeding and mating behavior or provoke aggressive behavior in normally nonaggressive species.
5. ***Understand and respect underwater life***
   Playing with animals or using them as food for other species can leave a trail of destruction, disrupt local ecosystems and rob other divers of their experiences with these creatures. Consider enrolling in a PADI Underwater Naturalist, AWARE Fish Identification or Coral Reef Conservation Specialty course to better understand sustainable interactions.

6. ***Be an ecotourist***
   Make informed decisions when selecting a destination and choose Project AWARE Environmental Operators or other facilities dedicated to sustainable business practices. Obey all local laws and regulations and understand your effect on the environment. Don't collect souvenirs like corals or shells. Instead, take underwater photos and follow Project AWARE's 10 Tips for Underwater Photographers.
7. ***Respect underwater cultural heritage***
   Divers are privileged to access dive sites that are part of our cultural heritage and maritime history. Wrecks can also serve as important habitats for fish and other aquatic life. Help preserve these sites for future generations by obeying local laws, diving responsibly and treating wrecks with respect.
8. ***Report environmental disturbances or destruction***
   As a diver, you're in a unique position to monitor the health of local waters. If you notice unusual depletion of aquatic life, injury to aquatic animals or strange substances in the water, report these observations to responsible authorities in your area.
9. ***Be a role model for other divers and nondivers when interacting with the environment***
   As a diver, you see the underwater results of carelessness and neglect. Set a good example in your own interactions so that others can learn from you.
10. ***Get involved in local environmental activities and issues***
    You can greatly affect your corner of the planet. There are plenty of opportunities to support healthy aquatic environments including Project AWARE conservation and data collection activities like local beach and underwater cleanups and CoralWatch monitoring, supporting environmental legislative issues, attending public hearings on local water resources, conserving water or making responsible seafood choices.

J. Gas Narcosis

- ***At approximately what depth does narcosis typically begin to affect divers?***

1. Nitrogen narcosis (or more properly, gas narcosis), is the narcotic property of air or enriched air when breathed under pressure on deep dives.
    a. Physiologists don't understand the exact causes of nitrogen narcosis, but it has been linked to absorption of nitrogen into nerve cell structure. All gases (including oxygen – hence the preferred term gas narcosis) can induce narcosis if they penetrate the cell lipid (fat) structure in sufficient concentration.
    b. Because narcosis is a physiological phenomenon, it is variable depending upon the individual, and upon physical condition. This means it not only varies from person to person, but in the same person from day to day.
    c. At depths of approximately 30 metres/100 feet to 40 metres/130 feet you will probably be able to perform routine tasks (such as adjusting buoyancy or taking photos). This, however, leads to a false sense of security. Actual impairment from narcosis may be such that you cannot handle a stressful, new or complex situation underwater.

- ***What are seven symptoms and four signs of narcosis?***

2. Symptoms and signs of narcosis
    a. The common symptoms (what you feel yourself) include:
        1. Rigid, inflexible thinking, such as being unable to adapt to unexpected conditions on a dive.
        2. Loss of good judgment and short-term memory loss.
        3. A false sense of security.
        4. Lack of concern for a specific task or for your own safety.
        5. Unjustified elation.
        6. Drowsiness and a desire to sleep.
        7. Anxiety.
    b. The common signs (what you observe in another diver) include:
        1. Inappropriate behavior, such as poor diving habits.
        2. Short attention span and slowed thinking, such as having trouble understanding a dive computer or hand signals.
        3. Impaired vigilance and a disregard for safety.
        4. Stupor and semi consciousness.

- ***What five factors may speed the onset of, or intensify the effects of narcosis?***

3. Because narcosis is a form of intoxication, physiological conditions can intensify it. These include:
    a. Hard work underwater and/or failure to breathe deeply, which build up carbon dioxide levels.
    b. Inexperience with deep diving or no recent deep dives. Divers with deep diving experience seem to build a temporary adaptation to and compensation for narcosis.
    c. Alcohol or drugs (tranquilizers, barbiturates, sleeping pills, some decongestants, etc.) that cause drowsiness. These chemicals impair nerve impulse transmission, so that when combined with nitrogen, narcosis can occur at surprisingly shallow depths.
        1. It is understood – never dive under the influence of alcohol. Use prescription drugs only with the clearance from a doctor.
    d. Anxiety. Anxiety creates perceptual narrowing and other psychological reactions that can magnify the effects of narcosis. Low visibility, cold and dark water can all contribute to anxiety, and therefore narcosis.
    e. Fatigue. Just as alcohol and other intoxicants affect you more when you're tired, so does breathing a gas under pressure. If you're tired, you're more likely to have narcosis affect you.

- ***In recreational diving, how do you prevent narcosis, and what do you do if it occurs?***

4. Don't ignore narcosis, even if you or an apparently affected diver seems able to handle routine tasks. Such a diver may be able to dive adequately, but may not be able to respond properly to an emergency.
    a. To prevent narcosis dive at shallower depths.
    b. Most of the time you can avoid narcosis by staying above 30 metres/100 feet, keeping in mind that it can occur shallower if drugs or other factors are involved. If narcosis becomes a factor on a deep dive ascend to a shallower depth and narcosis will subside on its own with no aftereffects.

K. Decompression Sickness

- ***What is the primary reason recreational divers experience decompression sickness?***

1. Cause of decompression sickness
    a. The primary reason divers suffer DCS is from diver error. Often, DCS is a result of several errors contributing to the situation.
    b. These errors cause a diver to absorb more nitrogen than expected, or fail to release sufficient nitrogen safely before surfacing.
    c. These errors include:
        1. Misuse of, or failure to use dive computers or tables
        2. Exceeding proper ascent rates
        3. Omitting emergency decompression stops
        4. Running out of air (which can lead to exceeding proper ascent rates and omitting emergency decompression/safety stops)
        5. Ignoring factors that predispose divers to DCS
        6. Failure to follow conservative diving practices (such as staying well within your computer's limits).

Note:
Remind student divers that enriched air nitrox is the latest tool in our efforts to stay underwater. Especially in the 18 to 30 metre/60 to 100-foot range, enriched air nitrox gives you more of what you got into diving for – time underwater. Explain to student divers that enriched air does this by replacing some of the nitrogen in the air with oxygen. This means you absorb less nitrogen during a dive, which gives you longer no decompression limits. Suggest to student divers, if they haven't already done so, to take a PADI Enriched Air Diver *course. Explain to divers that they will learn the procedures for no decompression diving with enriched air nitrox, and will learn to use enriched air dive computers, as well as tables for planning dives within no stop limits and oxygen exposure limits.*

- ***What are six symptoms and six signs of decompression sickness?***

2. Symptoms and signs of decompression sickness
    a. The common symptoms (what you feel yourself) include:
        1. Pain, often in the limbs, and also often, but not necessarily in the joints. The pain can move over time.

2. Numbness, tingling or paralysis
3. Unusual fatigue or weakness
4. Skin itch
5. Shortness of breath
6. Dizziness & Vertigo

b. The common signs (what you observe in another diver) include:

1. Favoring an arm or leg, or rubbing a joint
2. Paralysis
3. Unconsciousness
4. Staggering
5. Collapse
6. Coughing spasms
7. Blotchy skin rash

- ***What ten factors may predispose a diver toward decompression sickness?***

3. Factors predisposing divers to decompression sickness

a. In the majority of instances, DCS occurs at the surface within one to two hours of the dive. However, it can occur underwater at a shallow depth, and symptoms can be delayed as long as 48 hours.

b. DCS may become more likely based on these factors:

1. Dehydration. This reduces the quantity of blood circulating to eliminate nitrogen.
2. Excess fat tissue and poor fitness. Fat tissue holds more dissolved nitrogen, and being out of shape impairs circulatory and respiratory efficiency. It also reduces tolerances to physical stressors.
3. Age. As a person ages, the circulatory system becomes less efficient, therefore in theory, nitrogen elimination slows.
4. Heavy exertion immediately before, during or immediately after a deep dive. Exertion before or after the dive can promote micro bubbles that grow as excess nitrogen dissolves into them. Exertion during the dive speeds up the circulation, accumulating more nitrogen than normal.
5. Injuries and illness. These can affect circulation and the ability to eliminate nitrogen.
6. Use of alcohol. Before the dive, this can cause dehydration, and immediately after the dive it alters circulation, possibly promoting bubble growth.
7. Cold water. To save heat, the body restricts circulation to parts of the body, thereby eliminating nitrogen less effectively.

8. Hot showers or baths immediately after a dive. These cause skin capillaries to dilate, altering circulation.
9. Carbon dioxide increase. This is usually caused by exertion or skip-breathing (breath holding) and interferes with the blood's ability to carry nitrogen.
10. Exposure to altitude. Altitude exposures lessen the surrounding pressure after a dive, allowing bubbles to form when they wouldn't be expected at sea level. Follow current recommendations when flying or driving to altitude after diving.

c. Presently, there's no way to quantify predisposing factors in such a way that they can be incorporated into a decompression model. Therefore, the more predisposing factors that apply to you, the more important it is to dive conservatively.

Note:
Explain to student divers that because people differ in their susceptibility to decompression sickness, no decompression table can guarantee that decompression sickness will never occur, even though they dive within the table limits.

- ***What can you do to avoid decompression sickness?***

4. Avoiding decompression sickness
   a. Never dive to the limits of the Recreational Dive Planner (or any other table or dive computer) and avoid factors or situations that may aggravate the situation.

- ***What is the recommended emergency care for a diver suspected of having decompression sickness?***

5. Recommended emergency care for decompression sickness
   a. Have the diver lie down and administer 100 percent oxygen if available. For most cases, have the diver lie on the back or left side, whichever is more comfortable, but not sitting up.
   b. In severe cases, in which the patient has no breath and no signs of circulation, you will need to provide CPR. In this case, the patient must be face up.
   c. Put an unresponsive breathing diver in the recovery position, left side down.
   d. After beginning first aid – or before if the diver is unresponsive and you're alone – immediately contact the local emergency medical system.

Note:

Review with your student divers the following emergency contact information:

1. Emergency contact information for medical assistance:

a. ***DAN America:*** *Divers Alert Network (DAN) America serves as the headquarters for IDAN (International DAN). Regions of coverage include the United States and Canada.*

1. Emergencies

a. United States Coast Guard VHF Channel 16

b. DAN Emergency Hotline

+1-919-684-9111

**Hotline is available 24 hours a day, seven days a week. It can be called collect for both diving and non-diving emergencies (including all TravelAssist-related needs).*

2. Non-emergencies, general inquiries and the DAN Medical Information Line +1-919-684-2948

b. ***DAN World:*** *Regions of coverage include the Caribbean, Polynesia, Micronesia and Melanesia (except Fiji), Puerto Rico, Guam, Bahamas, British and U.S. Virgin Islands, Central and South America and any other region not otherwise specifically designated.*

1. Diving Emergencies +1-919-684-9111

**DAN America provides emergency hotline services for the DAN World region.*

2. Traveler Emergency Medical Services

Skype - TravelerEMS English +1-202-470-0929 Spanish + 52-55-8421-9866 Portuguese + 55-11-3711-7063

c. ***DAN Brasil:*** *Regions of coverage include Brasil.*

1. Diving Emergencies +1-919-684-9111

**DAN America provides emergency hotline services for the DAN World region.*

2. Non-emergencies (19) 3707-1569 – general inquiries

+1-919-684-2948 – Non-emergency medical inquiries

d. ***DAN Europe:*** *Regions of coverage include geographical Europe, the countries of the Mediterranean Basin, the countries on the shores of the Red Sea, the Middle East including the Persian Gulf, the countries on the shores of the Indian Ocean north of the Equator and West of India and Sri Lanka, as well as the related overseas territories, districts, and protectorates.*

1. Diving Emergencies

a. DAN Europe +39-06-4211-8685

*e. **DAN Japan:** Regions of coverage include Japan, Japanese islands, and related territories.*

1. Diving Emergencies

a. DAN Japan + 81-3-3812-4999

*f. **DAN Asia-Pacific:** Regions of coverage include all Asian countries between India and Korea, Australia, New Zealand, and the South Pacific Islands.*

1. Diving Emergencies

a. DES Australia +1-800-088-200 (within Australia)

+61-8-8212-9242 (outside Australia)

b. DAN / DES New Zealand 0800-4DES111 (within New Zealand)

c. Singapore Naval Medicine & Hyperbaric Center 6758-1733 (within Singapore)

d. DAN Asia-Pacific (within Philippines) (02) 632-1077

e. DAN Asia-Pacific (within Malaysia) (05) 930-4114

f. DAN Asia-Pacific (within Korea) (010) 4500-9113

g. DAN Asia-Pacific (China) +852-3611-7326

2. Non-Diving Emergencies

a. Head Office – Australia +61-3 9886 9166

*g. **DAN Southern Africa:** Regions of coverage include South Africa, Swaziland, Lesotho, Namibia, Botswana, Zimbabwe, Mozambique, Angola, Zambia, Zaire, Malawi, Tanzania, Kenya, Madagascar, Comoros, Seychelles, and Mauritius.*

1. Diving Emergencies

a. DAN Southern Africa 0800-020-111 (within South Africa)

+27-11-254-1112 (outside South Africa – accepts collect calls)

e. Provide contact information for local area:

_____

_____

f. Recompression and recompression chambers

1. Secondary medical treatment for DCS usually requires recompression in a chamber.
   a. Recompression reduces the bubbles and forces them back into solution.
   b. Accompanied by oxygen, drug therapy and fluids for rehydration, the diver is brought back to surface pressure at a slow, controlled rate.
   c. Often, more than one recompression is required.

Note:
*Time allowing; take your class to a recompression chamber facility. Ask student divers to familiarize themselves with the side bars "*Recompression Chambers*" and "*Decompression Sickness, Decompression Illness*" in their student diver manuals.*

- ***What are seven reasons why a diver suspected of having decompression sickness should not be recompressed underwater?***

6. Never put a diver suspected of having decompression sickness back into the water for recompression for the following reasons:
   a. Recompression often requires extreme pressure – the equivalent of 50 metres/165 feet, which is well beyond safe diving depths.
   b. Recompression usually involves oxygen and drug therapy, both of which are at best difficult and under many circumstances impossible underwater.
   c. Recompression treatments typically take six to 10 hours - far longer than a diver can reasonably endure the heat loss even in very warm water, and that assumes having adequate air for such a dive.
   d. Attempting treatment underwater makes it impossible for medical personnel to observe the diver, and the diver's safety is jeopardized because it's hard to communicate with him.
   e. Attempting to recompress underwater will make someone worse if with an incomplete attempt, and it only delays getting the patient to a proper medical facility.

Section Three:
Open Water Dives
Conduct

There are no required confined water and/or surface practice sessions for the PADI Deep Diver Specialty Diver course, however, developing student diver abilities in conditions that doesn't add complexity to learning new skills such as reading (comparing with other divers) information from depth gauges or dive computers, deploying Delayed Surface Marker Buoys (DSMBs), and controlling buoyancy at safety stops before progressing to more challenging conditions, is sound instruction. Some of the underwater skills, such as basic buoyancy control, breathing from an emergency air source, and navigating with a compass, are much easier to learn if you have student divers practice them in a confined water session or on the surface first. You may add confined water and/or surface practice sessions at your discretion. The confined water session may also include a scuba skills review. After completing the course, suggest to divers to dry-rehearse navigation techniques, alternate air source procedures, and safety stop measures before commencing deep dives.

On the first dive, student divers use a visual reference for descents, record changes to colors at depth, read and compare their depth gauge or dive computer readouts with other students' and practice using their diving equipment to monitor ascent rates. On the second dive, student divers perform a free descent using a reference line, wall or sloping bottom, record changes that occur to three pressure-sensitive items while at depth, navigate away from and back to the reference line, monitor their ascent rates and practice a three-minute safety stop. On the third dive, student divers compare the amount of time it takes to complete a task on the surface and at depth and simulate an emergency decompression stop while breathing from an emergency air source. On the fourth dive, student divers complete an underwater tour of the area before proceeding to the surface. Divers who finish exercises in dive one, two, or three with sufficient air and no decompression time remaining may continue to dive for pleasure and experience, at your discretion. Bottom time on each dive should not exceed the no decompression limits of the Recreational Dive Planner or each diver's computer, if used. **Regardless of how you conduct the open water dives, student divers must demonstrate the following performance requirements to qualify for certification.**

Open Water Dives

Performance Requirements

By the end of the open water dives, student divers will be able to:

Deep Diver Open Water Dive One

- **Execute a descent using a reference as a tactile or visual guide (line, wall or sloping bottom).**
- **Compare changes in color at the surface and at depth.**
- **Compare your own depth gauge to your instructor's and/or other student diver's depth gauges.**
- **Use a depth gauge and timing device (or a dive computer with an ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.**
- **Perform a 3-minute safety stop at 5 metres/15 feet before surfacing.**

Deep Diver Open Water Dive Two

- **Execute a "free" descent using a reference line, wall or sloping bottom as a visual guide only.**
- **Describe and record the changes that occur to three pressure-sensitive items while at depth.**
- **Perform a navigation swim with a compass away from, and back to, the anchor of the reference line (one diver navigates away from, the other navigates back to, the reference line for a distance of between 10 and 20 kick cycles, depending on visibility).**
- **Perform an ascent using a reference line, wall or sloping bottom as a visual guide only.**
- **Use depth gauge and timing device (or a dive computer with ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.**
- **Perform a 3-minute safety stop at 5 metres/15 feet before surfacing without physically holding on to a reference line for positioning.**

Deep Diver Open Water Dive Three

- **Execute a descent using a reference as a tactile or visual guide (line, wall or sloping bottom).**
- **Compare the amount of time needed to complete a task on the surface and at depth.**
- **Perform an ascent using a reference as a tactile or visual guide (line, wall or sloping bottom).**
- **Use a depth gauge and timing device (or a dive computer with ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.**

- **Perform an 8-minute simulated emergency decompression stop at 5 metres/15 feet before surfacing, while breathing from an emergency air source for at least one minute of the total time.**

Deep Diver Open Water Dive Four

- **Execute a descent using a reference as a tactile or visual guide (line, wall or sloping bottom).**
- **Complete an underwater tour of the area.**
- **Perform an ascent using a reference as a tactile or visual guide (line, wall or sloping bottom).**
- **Use your depth gauge and timing device (or a dive computer with ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.**
- **Perform a 3-minute safety stop at 5 metres/15 feet before surfacing.**

Open Water Guidelines for Deep Dives

A. General Open Water Considerations

1. Involve student divers in dive-planning activities. Have student divers prepare a surface-float system with a reference line for ascents and descents, and emergency-decompression breathing equipment as appropriate.

2. Conduct a thorough briefing. The better the briefing, the more smoothly the deep dive will proceed. Assign buddy teams according to ability (pair weak with strong) and establish check in and check out procedures, depth limitations, environmentally aware diving techniques, bottom times, and cylinder pressures for turnaround times, safety stops and reserves. Deep dives may be psychologically stressful to some individuals. Pay close attention to stress levels and behavior. In an effort to reduce stress, you could direct student divers' attention towards observing aquatic life during the dive. Never force a student diver to make a deep dive.

3. The use of qualified assistants with inwater training is highly recommended. An assistant at the bottom of the reference line can help keep track of buddy teams and watch student divers waiting to complete an exercise with the instructor. An assistant at 5 metres/15 feet can watch for student divers who may ascend in an emergency and can help monitor student diver safety and simulated decompression stops. Assistants at the surface can help with check in and check out procedures and be prepared to help in an emergency.

4. It is recommended, but not required, that Open Water Dive Three be the deepest of all the dives in the course. Open Water Dive Three is suited for the deepest dive in the dive sequence since it includes a reference line for descents and ascents; in a two-day dive sequence, it is the first dive of the second day; and the objectives for Dive Three are such that a deeper dive would enhance student learning.

B. Deep Diver Open Water Dives

Dive One

- **Execute a descent using a reference as a tactile or visual guide (line, wall or sloping bottom).**
- **Compare changes in color at the surface and at depth.**
- **Compare your own depth gauge to your instructor's or other student diver's depth gauges.**
- **Use a depth gauge and timing device (or a dive computer with an ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.**
- **Perform a 3-minute safety stop at 5 metres/15 feet before surfacing.**

a. Briefing
   1. Dive sequence – review Dive One tasks

b. Predive procedures

c. Dive One Tasks
   1. Student divers observe and record color changes of objects while at depth. If possible, use underwater lights to view colors with natural light and then with the artificial light comparison
   2. Student divers compare depth gauge or dive computer readings with buddy's and instructor's. Write down each reading on a slate.

d. Post-dive procedures

e. Debriefing
   1. Student divers discuss the changes of color of objects at depth. In addition, discuss the comparison of personal depth gauge or computer readings with instructor's and other student divers'. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time. Specifically focus the discussion on descents using a reference, their observations of color changes at depth, the comparison of depth gauge or dive computer readings, their ascents using a reference, procedures for monitoring their ascent rate, and the 3-minute safety stop at 5 metres/15 feet before surfacing.

f. Log dive (instructor signs log)

Dive Two

- ***Execute a "free" descent using a reference line, wall or sloping bottom as a visual guide only.***
- ***Describe and record the changes that occur to three pressure-sensitive items while at depth.***
- ***Perform a navigation swim with a compass away from, and back to, the anchor of the reference line (one diver navigates away from, the other navigates back to, the reference line for a distance of between 10 and 20 kick cycles, depending on visibility).***
- ***Perform an ascent using a reference line, wall or sloping bottom as a visual guide only.***
- ***Use depth gauge and timing device (or a dive computer with ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.***
- ***Perform a 3-minute safety stop at 5 metres/15 feet before surfacing without physically holding on to a reference line for positioning.***

a. Briefing

1. Dive sequence – review Dive Two tasks

b. Predive procedures

c. Dive Two Tasks

1. Student divers handle and examine pressure-related objects while at depth.
2. Student divers navigate away from and/or back to the reference line for a distance of 10-20 kick cycles.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss the appearance of the pressure-related objects. In addition, discuss how student divers managed the navigation exercise. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time. Specifically focus the discussion on descents using a reference line, wall or sloping bottom as a visual guide, their navigation exercise, their ascents using a reference line, wall or sloping bottom as a visual guide, procedures for monitoring their ascent rate, and the 3-minute safety stop at 5 metres/15 feet before surfacing.

f. Log dive (instructor signs log)

Dive Three

- ***Execute a descent using a reference as a tactile or visual guide (line, wall or sloping bottom).***
- ***Compare the amount of time needed to complete a task on the surface and at depth.***
- ***Perform an ascent using a reference as a tactile or visual guide (line, wall or sloping bottom).***
- ***Use a depth gauge and timing device (or a dive computer with ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.***
- ***Perform an 8-minute simulated emergency decompression stop at 5 metres/15 feet before surfacing, while breathing from an emergency air source for at least one minute of the total time.***

a. Briefing

   1. Dive sequence – review Dive Three tasks

b. Predive procedures

c. Dive Three Tasks

   1. Student divers repeat timed task at depth for comparison with time taken to complete the same task on the surface.

   2. Student divers perform an 8-minute simulated emergency decompression stop while breathing from an emergency air source for at least one minute.

d. Post-dive procedures

e. Debriefing

   1. Student divers discuss the timed task performed at the surface to that performed at depth. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time. Specifically focus the discussion on descents using a reference line, wall or sloping bottom as a tactile or visual guide, their timed task, their ascents using a reference line, wall or sloping bottom as a tactile or visual guide, and procedures for monitoring their ascent rate. In addition, talk about the 8-minute simulated emergency decompression stop at 5 metres/15 feet before surfacing and how student divers handled breathing from an emergency air source for at least one minute of total time. Ask student divers to discuss what they used for an emergency air source (alternate air source second stage, pony bottle, H- and Y-valves). Again, ask divers to elaborate on what worked, what didn't, and how things may be done differently the next time.

f. Log dive (instructor signs log)

Dive Four

- ***Execute a descent using a reference as a tactile or visual guide (line, wall or sloping bottom).***
- ***Complete an underwater tour of the area.***
- ***Perform an ascent using a reference as a tactile or visual guide (line, wall or sloping bottom).***
- ***Use your depth gauge and timing device (or a dive computer with ascent-rate indicator) to measure an ascent rate not to exceed 18 metres/60 feet per minute.***
- ***Perform a 3-minute safety stop at 5 metres/15 feet before surfacing.***

a. Briefing

   1. Dive sequence – review Dive Four tasks

b. Predive procedures

c. Dive Four Tasks

   1. Student divers complete an underwater tour of the area at depth.

d. Post-dive procedures

e. Debriefing

   1. Student divers discuss their underwater tour at depth. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time. Specifically focus the discussion on descents using a reference as a tactile or visual guide (line, wall or sloping bottom), their underwater tour, their ascents using a reference as a tactile or visual guide (line, wall or sloping bottom), procedures for monitoring their ascent rate, and the 3-minute safety stop at 5 metres/15 feet before surfacing.

f. Log dive (instructor signs log)

Appendix

Table of Contents

Deep Diver
Knowledge Review Part I Answer Key

Note:
To assess knowledge you may review the Knowledge Review from the student diver's manual with the diver, ideally prior to participating in skill practice. Prescriptively teach answers to questions student divers may have missed or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

1. List five factors to consider when determining your personal deep-diving depth limit.
   1. *Environmental conditions*
   2. *Physical and psychological fitness*
   3. *Surface interval – pressure group*
   4. *Geographical location*
   5. *Buddy's ability*

2. Explain how to determine if your equipment is suitable for deep diving.
   Consider equipment's condition and appropriateness for use while deep diving. Regulator and SPG serviced annually. BCD in good working condition, exposure suit used based on deep water temperatures. Complete set of gauges – ideally on a console.

3. List five pieces of specialized equipment recommended for deep diving.
   1. *Reference line*
   2. *Emergency breathing equipment*
   3. *Extra weights*
   4. *Underwater light*
   5. *First aid and emergency oxygen*

4. Describe proper ascent and descent techniques for deep diving, including positioning, maintaining a proper ascent rate and descending/ascending without a visual reference.
   When possible, descend feet-first on deep dives. Estimate rate of ascent using depth gauge and timer together or electronic depth gauge/dive computer with ascent warning. Without a visual reference, ascend/descend in a feet-down position, face buddy, watch rate of ascent, and adjust buoyancy frequently. Make a safety stop.

5. Explain how to avoid low-on-air or out-of-air situations while deep diving.
   Monitor SPG frequently – more often than on shallower dives.

6. Describe how to make a safety stop at 5 metres/15 feet with a visual reference (line or sloping bottom).
   Grasp line (or bottom) so that depth is at mid chest level – body vertical. Maintain neutral or slight negative buoyancy – watch depth and time. Review dive time and depth limits.

7. Describe how to prevent narcosis, and how to treat it if it occurs.
   Stay in shallower water. If nitrogen narcosis occurs, ascend with buddy to shallower water until symptoms/signs subside.

8. List six symptoms and six signs of decompression illness.

Symptoms	*Signs*
1. *Pain in arms, legs or torso*	1. *Blotchy skin rash*
2. *Local numbness, tingling, paralysis*	2. *Tendency to favor an arm or leg*
3. *Dizziness and vertigo*	3. *Staggering*
4. *Unusual fatigue/weakness*	4. *Coughing spasms*
5. *Skin itch*	5. *Collapse*
6. *Shortness of breath*	6. *Unconsciousness*

9. What is the primary reason divers get decompression illness?
   Diver error

10. Explain how to minimize the risk of decompression illness.
    Use all decompression devices and tables (including the RDP) accurately, and never dive to their limits.

Adventure Dive: Deep Diver

Skills Overview

- Knowledge Review
- Briefing
- Observe Colored Objects at Depth
- Assembling and Positioning Emergency Equipment
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Timed Task on Bottom
- Depth Gauge Comparisons at Depth
- Guided Tour (time/air pressure permitting)
- Ascent and Safety Stop
- Exit
- Debrief
- Log Dive – Complete Adventure Dive

Deep Diver
Knowledge Review Part II Answer Key

Note:
To assess knowledge you may review the Knowledge Review from the student diver's manual with the diver, ideally prior to participating in skill practice. Prescriptively teach answers to questions student divers may have missed or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

11. Describe a proper deep diving objective:
    To view a wreck, reef or other special underwater feature or organism that can only be found at a deep site.

12 List five guidelines to follow when using a dive computer:
    1. *Use as a no decompression device.*
    2. *Don't share computers.*
    3. *Follow the most conservative profile.*
    4. *If your computer malfunctions, make a normal ascent and safety stop.*
    5. *Don't follow your computer blindly.*

13. Describe how to maintain neutral buoyancy while deep diving.
    Be properly weighted and adjust buoyancy frequently, especially upon ascent.

14. Describe two techniques for estimating a proper ascent rate.
    Compare change in depth with the change in time, or use a dive computer or gauge that tracks ascent rate.

15. Explain what divers should do if they discover they have accidentally omitted an emergency decompression stop:
    Remain calm. Inform divemaster or buddy and monitor yourself for symptoms of decompression illness. Breathe 100 percent oxygen, if available.

16. List five recommendations that you should follow when making a deep drift dive.
    1. *Dive from a boat, if possible.*
    2. *Closely coordinate dive with your buddy.*
    3. *Use same entry technique as your buddy/group.*
    4. *Tow a surface buoy, if possible.*
    5. *Watch air supply and no decompression limits.*

17. List four guidelines you should follow when diving near a wall:
    1. *Watch your depth.*
    2. *Dive close to the wall.*
    3. *Avoid damaging aquatic life on wall.*
    4. *Use the wall as a reference for safety stops.*

18. List ten factors that may predispose a diver to decompression sickness.
    1. *Excess fat tissue*
    2. *Age*
    3. *Heavy exertion*
    4. *Injuries and illness*
    5. *Dehydration*
    6. *Use of alcohol*
    7. *Cold water*
    8. *Hot shower/bath immediately after dive*
    9. *Carbon dioxide increase*
    10. *Exposure to altitude*

19. Describe the steps to take if a diver is suspected of having decompression sickness.
    Alert the local emergency medical system. Have the diver lie down and administer 100 percent oxygen, if available. Continuously monitor patient.

20. Explain why a diver suspected of having decompression sickness should not be put back in the water.
    Recompression usually involves oxygen and drug therapy as well as long treatments under close observation of medical personnel, which is impossible to accomplish underwater.

PADI Adventure Dive Training Record
Adventure Dive:
Deep Diver

Skills Overview

- Knowledge Review
- Briefing
- Note object color on surface
- Assembling and Positioning Emergency Equipment
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Note object color at depth
- Depth Gauge Comparisons at Depth
- Guided Tour (time/air pressure permitting)
- Ascent and Safety Stop
- Exit
- Debrief
- Log Dive – Complete Adventure Dive

Instructor Statement

"I verify that this student diver has satisfactorily completed the Knowledge Review and Performance Requirements (as described in PADI's Adventures in Diving Program Instructor Guide) for this PADI Adventure Dive. I am a renewed, Teaching status PADI Instructor for the current year."

Instructor Name: _____

Instructor Signature: _____

PADI #: _____ Completion Date: _____
Day/Month/Year

Instructor Contact Information (Please Print)

Instructor Mailing Address: _____

City: _____ State/Province: _____

Country: _____ Zip/Postal Code: _____

Phone/Fax/email: _____

Student Diver Statement

"I verify that I have completed all of the Performance Requirements for this Adventure Dive. I realize that there is more to learn about deep diving and that completion of a PADI Deep Diver course is highly recommended. I also agree to abide by PADI Standard Safe Diving Practices."

Student Diver Signature _____ Date: _____
Day/Month/Year

PADI Specialty Training Record

Deep Diver

Instructor Statement

"I verify that this student diver has satisfactorily completed all academic and/or any confined water training sessions as outlined in the PADI Specialty Course Instructor Guide for Deep Diver. I am a renewed, Teaching status PADI Instructor in this specialty."

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Open Water Dives

Dive One

I verify that this student diver has satisfactorily completed Dive One as outlined in the PADI standardized guide for Deep Diver including:
- Descent using a reference as a tactile or visual guide (line, wall or sloping bottom)
- Compare depth gauges with buddy and instructor, record data
- At depth, observe colored objects with/without lights
- Perform safety stop 3 minutes at 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Two

I verify that this student diver has satisfactorily completed Dive Two as outlined in the PADI standardized guide for Deep Diver, including:
- Descent using a line, wall or slopin bottom as a visual reference
- Observe pressure-affected objects
- Navigate away from and back to reference line
- Perform safety stop 3 minutes at 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Three

I verify that this student diver has satisfactorily completed Dive Three as outlined in the PADI standardized guide for Deep Diver, including:
- Descent using a reference as a tactile or visual guide (line, wall or sloping bottom)
- Perform timed task at depth
- Perform simulated emergency decompression stop for 8 minutes at 5 metres/15 feet. Breathe from emergency air source for at least 1 minute

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Four

I verify that this student diver has satisfactorily completed Dive Three as outlined in the PADI standardized guide for Deep Diver, including:
- Descent using a reference as a tactile or visual guide (line, wall or sloping bottom)
- Underwater tour of the area
- Ascent up a line, wall or sloping bottom

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

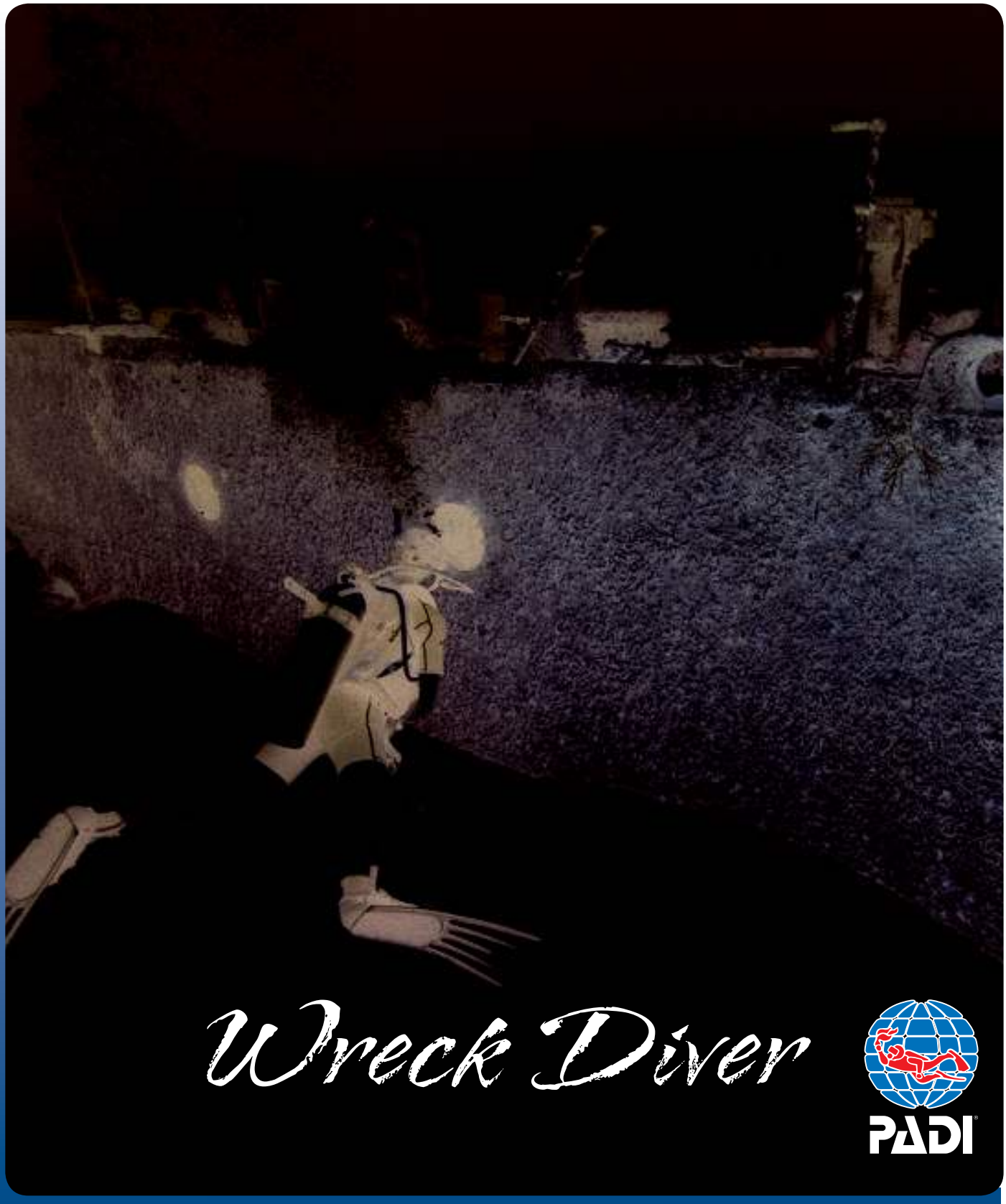
Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Student Diver Statement

"I verify that I have completed all performance requirements for this Deep Diver specialty. I am adequately prepared to dive in areas and under conditions similar to those in which I was trained. I agree to abide by PADI Standard Safe Diving Practices."

Student Diver Name: _____

Student Diver Signature: _____ Date: _____
Day/Month/Year



Wreck Diver

PADI

Specialty Course Instructor Guide

Product No. 70232 (Rev. 4/07) Version 2.0

PADI Wreck Diver
Specialty Course Instructor Guide

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Introduction

This section includes suggestions on how to use this guide, an overview of course philosophy and goals, a flow chart to show you how course components and materials work together for success, and ways you can organize and integrate student diver learning.

How to Use this Guide

This guide speaks to *you,* the PADI Wreck Diver Specialty Instructor. The guide contains three sections – the first contains standards specific to this course, the second contains knowledge development presentations, the third considers optional confined water and/or surface training and details the open water dives. All required standards, learning objectives, activities, and performance requirements specific to the PADI Wreck Diver course appear in **boldface** print. **The boldface assists you in easily identifying those requirements that you must adhere to when you conduct the course**. Items not in boldface print are recommendations for your information and consideration. General course standards applicable to *all* PADI courses are located in the General Standards and Procedures section of your PADI *Instructor Manual.*

Course Philosophy and Goals

Diving through 9 metres/30 feet, then 12 metres/40 feet, 15 metres/50 feet, and finally 18 metres/60 feet of silty azure blue salt water, you see her lying there like a wounded bird, one of her wings fractured and one of her engines gone. Did enemy fighters blow away her engine? Was its loss plunge her from the tropical sky more than 40 years ago?

She was a B-25, an Allied workhorse of World War II in the Pacific. You don't have to stretch your imagination too far to see her in her original state, ready to fight again. Her crumpled nose houses two machine guns - still stacked with bullets - now covered with hard coral, algae, and crimson red gorgonians. The cockpit escape hatch sits open, slid back as it had been on that fateful day in 1943. It was clear to see that the pilot had cleverly ditched his bomber in a narrow

shallow strait between Wongat Island and mainland New Guinea. Did the crew swim to the island? Did Japanese forces capture them? How old were these men? Twenty? Twenty-one?

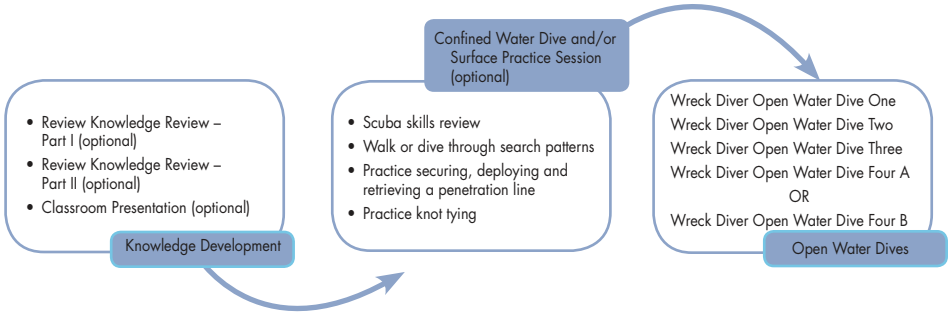
You watch as parrotfish dine on a coral incrusted machine-gun barrel. Two angelfish casually glide through the bomb bay doors while translucent shrimp dance their way over the rusty face of the altimeter gauge.

Diving on wrecks appeals to most divers, though for many different reasons. You may find yourself attracted to the challenge of exploring the wreck, or a fascination with its historical nature. Underwater photographers love wrecks for their picture potential, while those interested in nature like the fact that wrecks quickly become artificial reefs. Wrecks are typically ships, but can include railroad cars, aircraft and automobiles. In these, you'll find wreck sites range from those open to novice to those only accessible by the most experienced technical divers.

Whether your first or your hundredth dive on a wreck, few moments in diving compare with descending on the past. Keep that thought, the philosophy of this course is to focus on *fun, safe wreck diving.* Thus, the *goal* of this course is to teach student divers a systematic, methodical approach to enjoying wreck diving. Student divers will develop the techniques involved in wreck diving within recreational limits and while avoiding disturbing delicate marine life.

The best way to learn wreck diving procedures and to apply them is by doing it. This *course philosophy* therefore, expands student diver knowledge about wreck diving law, hazards to avoid, how to research wrecks, wreck diving equipment, the basics of penetrating a wreck and how to interact responsibly with the aquatic life they'll see while wreck diving. Student divers will apply the knowledge they gain by reading the PADI *Wreck Diver Manual* and watching the companion video on at least four open water dives practicing and demonstrating the practical aspects of wreck diving.

Course Flow Options



Course Flow Options provides a visual representation of how knowledge development and confined water and/or surface practice sessions support open water dives. When possible, it's preferable to have student divers complete and review Knowledge Reviews from the PADI *Wreck Diver Manual* before participating in

the open water dives. Knowledge Review – Part I is the same Knowledge Review that appears in the Wreck Diver section of *Adventures in Diving.* If you have the first part of the Knowledge Review on file, you may at your discretion, have student divers complete only Knowledge Review – Part II.

Confined water and/or surface practice sessions are not required for the PADI Wreck Diver course; however, you may choose to have practical sessions that allow student divers to practice skills such as securing, deploying and retrieving a penetration line, navigation patterns, and knot tying.

There are four dives to complete. **You may rearrange skill sequences within each dive; however, the sequence of dives must stay intact.** You may add more dives as necessary to meet student divers' needs. Organize your course to incorporate environment friendly techniques throughout each dive, to accommodate student diver learning style, logistical needs, and your sequencing preferences. You may choose from one of the approaches from Program Options, or develop your own.

Program Options

Step	Independent Study	Adventure Dive Integration	Instructor-Led
1	Independent study with manual and video (optional)	Independent study with manual and video (optional)	Knowledge Development Classroom Presentation (optional)
2	Review Knowledge Review – Part I and Part II (optional)	Give credit for Wreck Adventure Dive and collect Knowledge Review – Part I (optional)	Review Knowledge Review – Part I and Part II (optional)
3	Confined Water Dive and/or Surface Practice Session (optional)	Confined Water Dive and/or Surface Practice Session (optional)	Confined Water Dive and/or Surface Practice Session (optional)
4	Open Water Dive One	Review Knowledge Review – Part II (optional)	Open Water Dive One
5	Open Water Dive Two	Open Water Dive Two	Open Water Dive Two
6	Open Water Dive Three	Open Water Dive Three	Open Water Dive Three
7	Open Water Dive Four A *OR* Open Water Dive Four B	Open Water Dive Four A *OR* Open Water Dive Four B	Open Water Dive Four A *OR* Open Water Dive Four B

Section One
Course Standards

This section includes the course standards, recommendations, and suggestions for conducting the PADI Wreck Diver course.

Standards at a Glance

Topic	Course Standard
Minimum Instructor Rating	**PADI Wreck Diver Specialty Instructor**
Prerequisites **Minimum Age**	**PADI Adventure Diver** **15 years**
Ratios	**Open Water 8:1 Instructor; 4:1 Certified Assistant** **Wreck Penetration: 2:1 Instructor**
Site, Depths, and Hours	Depth: 18 metres/60 feet recommended Hours Recommended: 24 **Minimum Open Water Dives:** **4 dives over 2 days**
Materials and Equipment	Instructor: **PADI Wreck Diver *Specialty Course Instructor Guide*** **Penetration line and reel**

Instructor Prerequisites

To qualify to teach the PADI Wreck Diver course, an individual must be a Teaching status PADI Open Water Scuba Instructor or higher. **PADI Instructors may apply for the Wreck Diver Specialty Instructor rating after completing a Specialty Instructor Training course with a PADI Course Director, or by providing proof of experience and applying directly to PADI.** For further detail, reference Membership Standards in the General Standards and Procedures section of your PADI *Instructor Manual.*

Student Diver Prerequisites

By the start of the course, a diver must be:

1. **Certified as a PADI Adventure Diver or have a qualifying certification from another training organization similar to that of a PADI Advanced Open Water Diver.** Verify student diver prerequisite skills and provide remediation as necessary.
2. **Be at least 15 years.**

Supervision and Ratios

Open Water Dives

A Teaching status PADI Wreck Diver Specialty Instructor must be present and in control of all activities. On Dive One, student divers must be accompanied by either the Specialty Instructor or by a certified assistant. If Dive One is conducted deeper than 18 metres/60 feet, the Specialty Instructor must directly supervise at a ratio of no greater than 8 student divers per instructor (8:1). The Specialty Instructor may *indirectly supervise* Dive Two, Three and Four, though it is recommended that a certified assistant accompany each buddy team. **During wreck penetration dives, divers must be accompanied by the Specialty Instructor. The Specialty Instructor must ensure that all performance requirements are met.**

The ratio for open water dives is 8 student divers per instructor (8:1), or 4 student divers per certified assistant (4:1). The ratio for wreck penetration is 2 student divers per instructor (2:1). These ratios may not be increased by adding certified assistants.

Site, Depths, and Hours

Site

Choose sites with conditions and environments suitable for completing requirements. Special consideration should be given for wrecks that lie in deeper than 18 metres/60 feet and where there is moderate current by planning for reduced bottom time and rapid air use. It's preferable to conduct wreck penetration on a

wreck surveyed on a previous dive. When possible, use shallow wrecks to allow divers more time to complete tasks and for penetration. Plan to visit different wreck sites, if possible, to give student divers experience in dealing with a variety of environmental conditions (incorporate environment friendly techniques throughout each dive) and logistical challenges. Practice skills, especially line and reel use, in confined water sessions first to better prepare divers to apply skills in open water later.

Depths

18 metres/60 feet recommended without Deep Diver certification
30 metres/100 feet limit for Dive 1 (Wreck Adventure Dive)
40 metres/130 feet from the surface (vertical and horizontal distance included) and within the light zone for penetration dives. No out-of-air drills may be practiced in the overhead environment.

Hours

The PADI Wreck Diver course includes four open water dives conducted over at least two days. Dives that do not include wreck penetration may be conducted at night for divers who have completed the Night Adventure Dive or the first dive of the PADI Night Diver specialty course, or have qualifying night diving experience. The minimum number of recommended hours is 24.

Materials and Equipment

Instructor Materials and Equipment

Use the PADI Wreck Diver course materials prescriptively to accommodate various sequencing preferences and teaching and learning styles.

Required

- **PADI Wreck Diver *Specialty Course Instructor Guide***
- **Specialty equipment needed for student divers to perform wreck and wreck penetration dives.**
  - **Penetration line and reel** (e.g., a robust line that resists abrasion or cutting on sharp objects which is .6 centimeters/.25 inches thick for easy grasping).
  - **Safety equipment** (e.g., first aid kit, emergency oxygen, AED; flag and surface float; weighted line with contingency air supply at safety stop depth for deep dives; and descent or down line).

Recommended

- PADI *Wreck Diver Manual.* Use the student diver manual for detailed content explanation.
- PADI *Wreck Diving* video.
- Project AWARE *Responsible Wreck Diving Considerations* and Project AWARE *Ten Tips for Underwater Photographers* located at www.projectaware.org

- Project AWARE *Respect Our Wrecks* brochure
- As needed: backup wreck line and reel, extra lights, and navigational aids for divers.

Student Diver Materials and Equipment

Recommended

- PADI *Wreck Diver Manual*
- PADI *Wreck Diving* video
- Project AWARE *Responsible Wreck Diving Considerations* and Project AWARE *Ten Tips for Underwater Photographers* located at www.projectaware.org
- Project AWARE *Respect Our Wrecks* brochure
- Access to support equipment as necessary, including but not limited to: dive light, Nav-Finder™ or slate, and line and reel.

Assessment Standards

To assess knowledge you may review the Knowledge Reviews from the student diver's manual with the diver. **The student diver must demonstrate accurate and adequate knowledge during the open water dives and must perform all skills (procedures and motor skills) fluidly, with little difficulty, in a manner that demonstrates minimal or no stress.**

Certification Requirements and Procedures

Document student diver training by completing the PADI *Specialty Training Record* for Wreck Diver (see Appendix). **To qualify for certification, by completion of the course, student divers must complete all performance requirements for Wreck Diver Open Water Dives One, Two, Three and Four.**

The instructor certifying the student diver must ensure that all certification requirements have been met. Reference Administrative Procedures of the General Standards and Procedures section of your PADI *Instructor Manual* for detailed information on Referral.

Links to Other Courses

The Wreck Adventure Dive conducted during the PADI Adventures in Diving program may count as the *first dive* toward this specialty at your discretion.

Similarly, divers who successfully complete Wreck Diver Open Water Dive One and Knowledge Review Part 1 may receive credit as an Adventure Dive toward the PADI Advanced Open Water Diver certification. They may also credit the specialty certification toward the PADI Master Scuba Diver rating.

Section Two
Knowledge Development
Conduct

Diving on wrecks appeals to most divers, though for many different reasons. You may find yourself attracted to the challenge of exploring the wreck, or a fascination with its historical nature. Not all wrecks will be B-25s out of World War II, nor will they hold the same fame as the passenger liner the *Titanic,* infamous for its collision with an iceberg and dramatic sinking in 1912. However, whether your first or your hundredth dive on a wreck, few moments in diving compare with descending on the past. The philosophy of this course is to focus on *fun, safe wreck diving.* This means to introduce student divers to wreck diving law, to discuss the hazards to avoid while wreck diving, to talk about how to research wrecks, to establish the basics of wreck diving equipment, the fundamentals of penetrating a wreck, how to interact responsibly with the aquatic life they'll see while wreck diving and protect the wreck for future dives.

Student divers complete independent study of the course by reading the PADI *Wreck Diver Manual* and by watching the PADI *Wreck Diving* video. Work hand-in-hand with the student diver manual to address prescriptively student diver misconceptions or for clarification on certain points of interest. If there is a need for instructor-led presentations, use the following teaching outline, which appears in point form, as a road map of the conduct, content, sequence and structure for the PADI Wreck Diver course.

The result should be student divers with theoretical knowledge and pragmatic experience who can adapt what they've learned to future wreck diving opportunities. **Regardless of how you conduct knowledge development (independent study, instructor-led or a combination of these instructional approaches), student divers will be able to explain the following learning objectives.**

Knowledge Development

Learning Objectives

By the end of knowledge development, student divers will be able to explain:

Reasons why people wreck dive, the origin of shipwreck laws, important information about artifact removal and the implementation of laws that govern artifacts of historical interest.

- **What are four common reasons why people wreck dive?**
- **What two primary considerations have led to the development of shipwreck laws?**
- **Why should only a trained archaeologist disturb artifacts on an historical wreck?**
- **What are the two main arguments given against recreational divers removing objects and artifacts from nonhistorical wrecks?**
- **What are the two main arguments given in favor of recreational divers removing, restoring and collecting objects and artifacts from nonhistorical wrecks?**
- **Why does recovering an object require special training beyond the scope of the Wreck Diver course?**
- **What is your responsibility with regard to laws that apply to the wrecks on which you dive?**

Common problems and hazards of wreck diving and the planning, organization, procedures, and techniques for fun and safe wreck diving.

- **What are five potential hazards common to wrecks, and how do you avoid them?**
- **What are five hazards of entering (penetrating) a wreck, and what causes these hazards?**
- **What are four aspects of a wreck to evaluate when diving on it?**
- **What are three ways to navigate on a wreck?**
- **Why may a compass be inaccurate on a wreck?**
- **What five dive planning and equipment considerations should be made for wreck dives deeper than 18 metres/60 feet?**
- **What are the general techniques for wreck diving in a current?**
- **What are two reasons why you should obtain a local orientation for an unfamiliar wreck?**

Researching the ship's past and mapping shipwrecks for planning future wreck dives and wreck penetration.

- **What are three reasons for researching the history and condition of a wreck?**
- **What two sources provide quick, basic information about diving a popular wreck?**
- **What possible sources can you check when researching more in-depth, detailed wreck information?**
- **What are two benefits of mapping a wreck?**
- **What four tools can you use when mapping a wreck, and what is each used for?**

Wreck penetration equipment, limits, limited-visibility diving techniques and wreck penetration emergency procedures.

- **What four pieces of equipment should be used for a penetration dive, and what is each piece used for?**
- **What are the four penetration limits to observe when inside a wreck?**
- **What are the proper techniques for:**
  - **Entering a wreck?**
  - **Moving through a wreck?**
  - **Using a penetration line in a wreck?**
- **What are the proper responses and actions for:**
  - **Loss of visibility due to silting?**
  - **A lost or cut penetration line?**
  - **Light failure?**
  - **Air supply loss?**

Knowledge Development Teaching Outline

Suggestions to *you*, the PADI Wreck Diver Specialty Course Instructor, *appear in note boxes.*

A. Course Introduction

1. Staff and student diver introductions

Note:
Introduce yourself and assistants. Explain your background with wreck diving if your student divers are not familiar with you.

Have divers introduce themselves and explain why they are interested in wreck diving. Break the ice and encourage a relaxed atmosphere.

Give times, dates and locations as appropriate for classroom presentations, confined water and/or surface practice sessions, and open water dives.

Review with student divers other skills they'll want as a PADI Wreck Diver. *These opportunities, through additional specialty course training, may include, but are not limited to: PADI* Enriched Air Diver, *PADI* Deep Diver, *PADI* Diver Propulsion Vehicle (DPV) Diver, *PADI* Digital Underwater Photographer, *PADI* Peak Performance Buoyancy Diver, *PADI* Dry Suit Diver, *and DSAT* TecRec.

2. Course goals -this course will help:
   a. Develop your practical knowledge of wreck diving.
   b. Increase your diving skills.
   c. You plan, organize, and make wreck dives.
   d. Improve your diving ability and provide you with additional supervised experience.
   e. Encourage you to participate in other specialty training.
3. Course overview
   a. Classroom presentations and confined water and/or surface practice sessions.
   b. Open water dives. There will be four open water dives.

4. Certification
    a. Upon successfully completing the course, you will receive the PADI Wreck Diver Specialty certification.
    b. Certification means that you will be qualified to:
        1. Plan, organize, make, and log open water wreck dives in conditions generally comparable to or better than, those in which you are trained.
        2. Apply for the Master Scuba Diver rating if you are a PADI Advanced Open Water Diver and a PADI Rescue Diver (or qualifying certification from another training organization) with certification in four other PADI Specialty ratings, and you have 50-logged dives.

Note:
Use the PADI Student Record File. *Explain all course costs and materials, and what the costs do and do not include, including equipment use, dive site fees, etc. Explain what equipment student divers must have for the course, and what you will provide. Cover and review points about scheduling and attendance.*

5. Class requirements
    a. Complete paperwork.
    b. Course costs.
    c. Equipment needs.
    d. Schedule and attendance.

B. The Appeal of Wreck Diving

- ***What are four common reasons why people wreck dive?***

1. People have different reasons for being interested in wreck diving, so people you dive with may have different motivations for diving on wrecks. You and your buddy may both enjoy the dive more if you understand common reasons why people dive on wrecks.
    a. Curiosity – Divers are fascinated by wrecks and want to know what is inside them. You may find yourself curious about what you'll find on a wreck, or about what made the wreck sink in the first place. Curiosity may prompt you to research the wreck to understand what they were as you explore what they've become.

b. History – Some divers engage in research or work with archaeologists and historians. Wrecks are tangible historical resources that you have direct access to; a strong interest in history may motivate you to wreck dive.

Note:
Remind student divers that artifact removal is just not done except in very specific circumstances (such as artifact documentation and historical archiving etc.) where authorities incorporate time consuming and very expensive controlled conditions that use extensive conservation techniques. Inform divers about the Project AWARE Responsible Wreck Diving Considerations *found at www.projectaware.org. Divers are encouraged to preserve our maritime cultural heritage and protect the fragile artificial reef habitat and aquatic life around wrecks. The Considerations are part of the* Respect Our Wrecks *campaign that advocates a hands-off, take-nothing-but-photos approach to wreck diving. Local laws and regulations that govern wreck diving will be addressed in more detail later in the course.*

c. Aquatic life – Wrecks become man-made reefs that attract aquatic life. In some areas, wrecks may be the only dive sites with appreciable concentrations of life. Some divers are attracted to wrecks more by their role as a reef than as an artifact or challenge.

d. Photography – Wrecks make dramatic backgrounds for photos of divers and wildlife, and wrecks themselves are photogenic. This makes photography on wrecks interesting and rewarding. Photograph with care. Dive carefully as many aquatic creatures and wrecks are fragile. Improper techniques while taking or editing photos underwater can damage sensitive aquatic life and damage wrecks with the bump of a camera or cylinder, swipe of a fin or even the touch of a hand.

Note:
Describe popular local wrecks, best access and pertinent information about their background. If possible, give divers references to local wreck dives. For example, organizations such as the Artificial Reef Society of British Columbia, Canada (ARSBC) deliberately create artificial reefs to provide features for divers to explore, as well as substrates for marine life to thrive upon. Reference www.artificialreef.bc.ca for more information.

Since the student divers have not yet learned about assessing a wreck and potential hazards, your descriptions should raise interest by emphasizing what a diver can expect to see and do, and by giving vivid historical backgrounds.

Refer student divers to Project AWARE's Ten Tips for Underwater Photographers *located at www.projectaware.org for further tips on taking photos in marine environments.*

C. Wreck Diving and the Law

- ***What two primary considerations have led to the development of shipwreck laws?***

1. Origin of shipwreck laws: two main sources
    a. Salvage laws – These laws determine who owns something lost in the sea. These items include wrecks and other craft such as sailboats, houseboats, railroad cars, automobiles, aircraft and military rafts. Salvage laws, developed before scuba diving, define when a lost object is still the original owner's, and when anyone can salvage it. In most countries, salvage law says its finders-keepers once owners have abandoned lost property, however:
        1. Different areas have different salvage laws.
        2. Many owners and insurance companies do not regard their ships as abandoned and still claim title.
        3. Laws, other than salvage laws, protect virtually all historical wrecks, and many other lost items.

Note:
Site to student divers local salvage laws. Where possible, site references (library and internet) for local salvage laws. For example, around the coast of the United Kingdom (UK) there are currently approximately 93 wreck sites designated as protected wrecks of one level or another. Reference www.mcga.gov.uk and www.english-heritage.org.uk for more information. There are three main pieces of legislation under which wreck sites have been protected in the UK.

1. *Protection of Wrecks Act 1973: certain designated, charted, historic or dangerous sites may not be dived without a license.*
2. *Protection of Military Remains Act 1986: military aircraft and designated ship (controlled sites), are considered war graves that can only be dived with a license. Other designated ships (protected sites), may be dived providing the divers do not enter, disturb or remove artifacts.*
3. *Merchant Shipping Act 1995: all wrecks and cargoes are owned – each artifact removed must be reported to the Receiver of the Wreck.*

Another example is the US where the Sunken Military Craft Act protects vessels, aircraft and space vessels, including foreign vessels in US waters from unauthorized disturbance while allowing divers to have non-intrusive access. Reference http://www.history.navy.mil/branches/org12-12.htm and http://www.projectaware.org/americas/english/smca.asp for more information.

For information on wrecks in Australia, reference the National Shipwreck Database for Australia at http://eied.deh.gov.au/nsd/public/welcome.cfm. For information on laws and heritage for wrecks in Australia, reference the Department of Environmental and Heritage Shipwreck at www.environment.gov.au/heritage/shipwrecks/index.htm.

b. Antiquity protection laws – These laws protect historical resources. After recreational diving began to grow in the 1950s and 1960s, divers discovered many wrecks. Often divers ignorantly or uncaringly destroyed wreck sites before study by archaeologists. Most countries have laws now to prevent divers from removing or even moving objects when visiting historical wrecks. Some of the rationales for these laws are:

1. The definition of historical varies regionally. As a rule of thumb, consider a wreck historical if it has been declared historical by law (the *Dartmouth*, for example), if it has known historical significance (the *Titanic,* for example), or if it is over approximately 100 years old (such as the remains of a Roman cargo ship), or if it is designated as a war grave.

- ***Why should only a trained archaeologist disturb artifacts on an historical wreck?***

2. A disturbed wreck site has less value to an archaeologist. Archaeologists learn a great deal from how objects lie in relation to each other on a wreck. Important information about the past is lost when an artifact and its resting place are disturbed improperly. The physical relationship between artifacts in a site reveals patterns of human use and behavior that no single artifact can. Removing artifacts and disturbing wrecks from their original context loses valuable information, information that is lost forever. Therefore, only a trained archaeologist should disturb a historically important wreck.

   a. Many wrecks are not historically significant, especially recent ones. However, you should be sure you're not violating any laws or regulations before disturbing anything. If in doubt, leave everything as you find it.

Note:

Inform student divers that while it is not common to come across human bones while wreck diving, it does happen, particularly when making penetration dives on war wrecks. If you ever discover human bones on a wreck:

1. *Don't disturb them. In effect, you are visiting someone's final resting place, whether you intended to or not. Show the same respect you would when visiting a cemetery or any other final resting place.*
2. *If you think you're the first to discover remains on a particular wreck, report your find to the proper authorities. If it is an older historical wreck, the remains may have archaeological significance. If it is a more recent wreck, authorities may want to recover the bones for reburial elsewhere.*

b. Even when divers don't disturb wrecks, storms, fishing nets, line and other destructive fishing practices slowly deteriorates wrecks. Divers aren't the only source of wreck damage.

c. Dumping and litter may put nonhistorical objects amid historical objects. For example, a soda can lying on a Roman wreck isn't an historical artifact.

3. Historical objects and wrecks are cultural resources that should benefit the public. Most governments believe historical objects from a wreck belong in public museums rather than private collections.

4. Undisturbed wrecks will remain attractive to future generations of divers.

2. Controversy over removing artifacts and objects from nonhistorical wrecks

a. Two schools of thought challenge recreational divers collecting objects from wrecks that are not historically significant. This controversy also involves legal decisions as to what wrecks are not historically significant.

- ***What are the two main arguments given against recreational divers removing objects and artifacts from nonhistorical wrecks?***

b. Those against removing objects from wrecks argue:

1. An artifact removed from the water deteriorates rapidly if not given proper treatment. Artifact removal can therefore lead to total loss of the artifact.

2. A wreck stripped bare is less interesting, therefore, artifact removal eventually reduces the number of interesting wrecks to dive.

- ***What are the two main arguments given in favor of recreational divers removing, restoring and collecting objects and artifacts from nonhistorical wrecks?***

c. Those who believe removing objects from nonhistorical wrecks is acceptable, if done responsibly, argue:

1. Many underwater environments rapidly destroy objects anyway; therefore, if an object removed and responsibly treated, will be saved from eventual loss, and if displayed properly, these artifacts will be seen by many nondivers who could never otherwise see them.

2. The desire to collect artifacts is a primary motivation for private individuals to look for and research wrecks. Without this motivation, many wrecks would remain undiscovered because neither the government nor museums have sufficient money to locate and research them.

- ***Why does recovering an object require special training beyond the scope of the Wreck Diver course?***

d. Regardless, recovering objects often requires special training in rigging and lift bag use, and in artifact preservation and documentation. Those interested in artifact removal should work with trained underwater archaeologists or other sources to learn and apply the techniques for artifact recovery and proper artifact treatment. To learn proper rigging and lift bag use, enroll in a PADI Search and Recovery course. You may have already learned basic lift bag use if you completed the elective Search and Recovery Dive in the PADI Adventures in Diving program.

Note:
Once again, remind student divers that artifact removal is just not done except in very specific circumstances (such as artifact documentation and historical archiving etc.) where authorities incorporate time consuming and very expensive controlled conditions that use extensive conservation techniques.

- ***What is your responsibility with regard to laws that apply to the wrecks on which you dive?***

3. Local laws and wreck diving – your responsibility as a wreck diver includes finding out what laws apply before you go diving, and obeying those laws while you dive.

Note:
Shipwrecks offer adventure and are often included among the best dive sites in the world. Divers must be responsible when exploring these submerged sites, looking after themselves, the environment and the cultural heritage. Describe and explain laws and regulations affecting diving on local wrecks. Refer student divers to references (library or the internet) for more detailed information. Some excellent references include www.projectaware.org, www.visit-fsm.org, www.scapaflow.co.uk, www.mcga.gov.uk, www.artificialreef.bc.ca, www.nationalgeographic.com, www.english-heritage.org/maritime and www.discoverychannel.co.uk.

D. Wreck Diving Hazards

- ***What are five potential hazards common to wrecks, and how do you avoid them?***

1. Potential wreck hazards. Some wrecks may have hazards unique to that wreck, but there are five potential hazards that are common to most.
    a. Sharp objects – Rusted metal objects, jagged steel plates, broken glass, splintering wood and rough or sharp coral encrustations pose potential injury sources. You avoid these by wearing exposure suits and protective gloves. It is also wise to keep tetanus immunizations current in the event of an accidental cut.
    b. Entanglement – Wrecks may have old line present on them. Because wrecks attract fish they are popular fishing sites, and you may find monofilament fishing line or nets on them. You avoid these by watching where you go. Look up as well as around as you progress to prevent swimming under entangling objects. Carry a sharp knife with a smooth and a serrated edge to handle entanglement too difficult to untangle by hand.

Note:
Inform student divers that many experienced wreck divers wear two or more cutting devices – a large, general-purpose knife or tool, and a smaller, very sharp backup, emergencies-only tool such as a z-knife or dive shears. For additional security, suggest to divers to wear cutting tools widely separated, such as one inside the calf and the other on the BCD, to help ensure reaching at least one if entangled.

c. Aquatic life – A wreck quickly becomes an artificial reef that attracts aquatic life. Watch for the same creatures you would on a natural reef, such as those that can defensively sting or bite or are fragile and can be easily disturbed. Avoid these as you would on a natural reef: fine-tune your buoyancy and streamline your equipment to avoid disturbing or damaging fragile habitant, watch where you put your hands, feet and knees; wear protective clothing; and do not touch the aquatic life.

Note:

As time allows, detail aquatic life on wrecks. Explain to the student divers that wrecks can serve as important habitats for fish and other aquatic life because their substrate acts as an artificial reef for entire ecosystems. Invertebrates, such as mussels, sponges, scallops and sea fans, attach themselves to the hard surface of the wreck. Since these organisms often support higher levels of the food web, fish populations often congregate and propagate in the safe haven of the structure. The abundance of life and biodiversity found on wrecks can be similar to that of the world's most pristine coral reefs. To learn more about aquatic life, do not touch -take a photograph, and research the animal as part of your PADI Underwater Naturalist *specialty course. The PADI* Peak Performance Buoyancy *specialty course helps divers fine-tune their buoyancy skills, helping to prevent disturbing underwater environments and silt-outs when penetrating wrecks.*

d. Unstable structure – Many wrecks have unstable frames, ceilings, hatches and other structures. Avoid diving around wrecks with unstable structures. War wrecks may have munitions lying in unstable areas, or the munitions themselves may be unstable. Divers have lost their lives moving and disturbing unstable munitions - do not touch, move or disturb munitions found underwater. Avoid structures that move in the current or surge, give easily when touched, or simply appear unstable.

e. Surge pockets and suction – The movement of surge through a wreck may cause periodic suction at restricted entranceways (hatches and holes in hulls, etc.). Watch for this type of water movement, even when diving on a wreck's exterior.

- ***What are five hazards of entering (penetrating) a wreck, and what causes these hazards?***

2. Cavern diving, cave diving and ice diving necessarily involve entering an overhead environment, whereas in wreck diving, penetrating the wreck is optional. You'll decide whether to explore the inside or to swim on the outside of a wreck for your final course dive. It may be a challenge you enjoy, but for some it may be something you do not particularly enjoy. In that case, don't do it. You can enjoy a lifetime of wreck diving without ever venturing inside – there's plenty to see outside. In the future, if you decide to give wreck penetration diving a go, it's a good idea to seek further experience and an orientation with a PADI Instructor before entering the wreck for the first time. There are five hazards specific to wreck penetration.

Note:
Remind student divers that entering a wreck or any overhead environment presents significant hazards not found in open water. By discussing the following information, it will be clear that penetrating a wreck safely (or any overhead environment) requires special equipment, training and procedures. Without these, divers should never enter an overhead environment. Even with the proper equipment, training and procedures, divers should realize that wreck penetrations raises stress and potential risk, which can reduce fun and enjoyment.

a. Loss of direction –- Merely entering a wreck can cause disorientation. A wreck leaning on its side magnifies loss of direction. Collapsed passages and debris block logical avenues of travel and open others. It's very easy to lose your sense of direction inside a wreck.

b. No direct access to surface – Loss of air (or other problems) requires exiting before beginning ascent. An emergency swimming ascent or a buoyant emergency ascent are no longer options.

c. Restricted passages – Movement may be limited in restricted passages, making turning difficult. There is greater possibility of hitting sharp or abrasive objects. Avoid these types of passages completely.

d. Falling objects – Your movement can knock loose objects that can fall on you or in your way. If there is even a remote possibility of something falling from overhead, stay out of that area.

e. Silt – Most wrecks have a layer of silt or particulate matter spread over them – on the bottom, sides and ceilings. Disturbing this material with fins, hands, or equipment can cause dangerously reduced visibility in moments. Exhaled bubbles often cause silt and particulate matter to dislodge from wreck walls and ceilings.

Note:
Give Student divers a final reminder that proper equipment and procedures, and staying within appropriate limits, make it possible to enter wrecks without significant risk. However, never enter a wreck or other overhead environment without the proper training and equipment, and without following the proper procedures.

E. Wreck Diving Techniques

- ***What are four aspects of a wreck to evaluate when diving on it?***

1. When you dive on a wreck for the first time, it is a good idea to look the wreck over and get to know it. Four main aspects of a wreck's condition should be evaluated each time you visit.
   a. Possible hazards – Look for the hazards described previously, and any that may be unique to the wreck.
   b. Points of interest – Look for those parts of the wreck that stand out as the most interesting and unique. A ship's wheel, telegraph, anchor or bell may tell you something about the wreck. This is what gives the wreck its personality.
   c. General condition – The wreck's condition affects the way you explore it, areas to avoid and your safety - particularly if you plan a penetration dive. Is the wreck strong and intact or is it weak and likely to have walls or objects break and fall? Has it generally held its structure, or is it scattered over a wide area? What is it made of - wood or steel?
   d. Entryways – For reasons previously discussed, you may find it more enjoyable to remain outside a wreck. However, if you will be planning to enter on a future dive, look for large, unobstructed openings that let in a lot of light. You should never have to squeeze through an opening or tie back a hatch or door. The entry way should be large enough to swim through comfortably with all equipment in place. Avoid any openings with sharp edges; be sure there is no immediate blockage or hazard.

- ***What are three ways to navigate on a wreck?***

2. You'll find wreck navigation influenced by how familiar you are with the wreck, your dive objective and how much of the wreck you plan to explore. Depending on what you find when you evaluate the wreck there are three basic ways to navigate. Sometimes you may find it advantageous to use different techniques on different parts of the wreck, or to combine the techniques of all three at once.
    a. Following the wreck's layout – On a fairly intact wreck in clear water, you can often navigate by following the ship's hull or rail. This is one of the easiest ways to navigate on a wreck. Apply the natural navigational techniques learned in your Advanced Open Water Diver program.
    b. Feature reference – On a more broken-up wreck, and sometimes on intact wrecks in limited visibility, it is important to note unique features and their relative positions to help you know where you are. If necessary, note these on a slate as you start the dive, then refer to the notes for your return.
    c. Base line – A base line is used on a very scattered, broken-up wreck. It is a straight line through the wreckage used as a base for navigation, commonly through the wreck center.
        1. In clear, currentless water, the base line may be as informal as the general direction the wreckage lies. In less clear water, you may use a compass heading. In poor visibility or with a current, you may lay out a rope as a base line.
        2. You use a base line by swimming along it, leaving it only short distances to explore the wreck. The base line forms a known general heading back to the boat anchor or exit that you constantly keep track of.

- ***Why may a compass be inaccurate on a wreck?***

3. Keep in mind that iron and steel objects may affect compass readings by attracting the magnetic needle away from north. Don't expect your compass to read as accurately as usual.

- ***What five dive planning and equipment considerations should be made for wreck dives deeper than 18 metres/ 60 feet?***

3. Many wrecks lie in water deeper than 18 metres/60 feet primarily because large ships cruise oceans and major lakes well away from shore to avoid striking reefs. If diving on a wreck dive deeper than 18 metres/60 feet:

a. It's recommended that you be trained as a PADI Deep Diver. The PADI *Deep Diver* course provides hands-on experience with the techniques and equipment of deeper diving. It's also very useful to be certified as a PADI *Enriched Air Diver* to maximize your no stop dive time.

b. Leave a high capacity cylinder or hang an extra cylinder at 5 metres/15 feet to ensure sufficient air for a safety stop or emergency decompression stop. Some recreational wreck divers choose high capacity cylinders (2.8 litre/100 cubic foot at 240 bar/3400 psi or larger) and reserve one-third of their air for emergency use only. Be sure to have any other equipment necessary for a deep dive in the local environment, and that you can return to the line for your ascent and safety stop.

c. Take the effect of narcosis into account when planning the dive; keep your objectives simple, avoid task loading and give yourself ample time.

d. Plan for reduced bottom time caused by short no decompression limits and rapid air use. Plan a computer-assisted multilevel dive that begins by descending to the deepest point followed by gradually working your way upward in levels as you explore.

e. Become trained as a PADI Enriched Air Diver. Using EANx with an EANx computer can further increase how much time you get to explore by crediting you both for a multilevel profile and enriched air use.

- ***What are the general techniques for wreck diving in a current?***

4. Just as you commonly come across wrecks in deeper depths, you also commonly find them in areas with current. Moderate currents are common around many wrecks, calling for special techniques.

   a. The dive begins when the dive boat anchors on the wreck or attaches to a permanent mooring; divers use lines to keep from being carried away (trailing float line and swim line) and descend the anchor or mooring line. At the end of the dive, return to the anchor line and ascend along it. Constant contact with the anchor line when not on the wreck keeps divers from being carried away from the dive boat, so be sure you know where the line is at all times. Remember: a wreck often provides a haven or shelter from currents.

Note:
Caution student divers to watch where they put their hands as permanent mooring lines are generally encrusted with aquatic growth. Suggest wearing gloves for protection.

b. Continue to explore the wreck on the lee side, where the wreck shelters you from the current. You may find it easier to pull yourself along by hand rather than swim. Wear gloves and be cautious where you grab things.

Note:
Explain to student divers the techniques used in the local area for wreck diving in a current. Remind divers that devices used to gain attention at the surface should be a standard piece of equipment for every diver, regardless of certification level. Audible devices like whistles or air horns (devices that attach to the low-pressure inflator of the BCD) can be easily heard at night or in limited visibility conditions. For daytime use, include a visual signaling device like a signal mirror or surface marker buoy (safety sausage) in your equipment.

- ***What are two reasons why you should obtain a local orientation for an unfamiliar wreck?***

5. Wreck diving varies from region to region and from wreck to wreck. Whenever possible, get a local orientation when visiting an unfamiliar wreck.
   a. Optimum techniques may differ locally from the ones you've used. A local orientation provides a good way to learn the appropriate techniques.
   b. All wrecks have their unique points of interest, potential hazards, and regulations or community practices that apply. A local orientation helps you know about these in advance.

F. Researching Underwater Wrecks

- ***What are three reasons for researching the history and condition of a wreck?***

1. For many divers, wreck diving encompasses much more than visiting the remains of a ship. It includes visiting the ship's past through research.

Researching a wreck's history benefits you in three basic ways.

a. Researching the wreck's history may explain the wreck's location and condition.

b. Research reveals or confirms a wreck's identity, which plays an important role in determining whether the wreck has historical/archaeological significance, and whether it may have some unusual hazard to avoid, such as munitions.

c. Research helps you uncover unique points of interest, the suitability of the wreck as a dive site, and potential hazards.

- ***What two sources provide quick, basic information about diving a popular wreck?***

2. Sources for basic, easy-to-get information about a popular wreck in a local area include:

   a. Dive stores and dive boats can usually give a few facts about popular wrecks in their area, as well as general conditions and what to watch for while diving on a specific wreck.

   b. Dive magazines, guidebooks and the internet can be excellent sources for articles and web pages about popular wrecks. These tend to be more detailed and have more background information than what a dive store or dive boat can tell you.

- ***What possible sources can you check when researching more in-depth, detailed wreck information?***

3. Some divers want to know more than a local dive store or boat can tell them, that a newer wreck may have little known about it, or that local lore may be inaccurate. In this case, a longer time and effort commitment will be required. Although the internet can get you started, for in-depth wreck information you are likely to end up at sources of records that may not be online.

   These include:

   a. Libraries – Look up local papers from the time the wreck sank.

   b. Museums – Write or visit war museums or maritime museums for specific information.

   c. Archives – Write or visit archives of insurance, lighthouses, harbors or national history for specific information.

   d. Historical/archaeological groups – Often know the history of regional events and wrecks in surprising detail.

   e. Maritime societies – Usually maintain records of members and their ships.

f. Maritime insurance companies – Keep records on every ship, past or present, floating or sunk, that they insure.

g. Universities – Archeology or history departments have information and can offer research advice.

Note:
Inform student divers of any other local resources for researching wrecks. Mention to divers that most institutions, as the ones mentioned, operate on tight budgets and that they may be required to cover the cost of photocopying, duplicating microfilm, etc. Be prepared to do the research; most organizations, although very interested in working with you, do not have financial resources to do this work for you.

G. Mapping Shipwrecks

- ***What are two benefits of mapping a wreck?***

1. There are two primary reasons to map a wreck:

   a. To record the general layout of potential hazards and points of interest for future dive planning.

   b. To assist in planning penetration dives. A wreck map points out possible entry areas and helps you judge possible routes within the wreck.

- ***What four tools can you use when mapping a wreck, and what is each used for?***

2. Divers have come up with dozens of methods for mapping wrecks - from archaeological methods to sketching from memory. Something in between suffices. Four tools used for mapping wrecks include:

   a. Large slate – used for drawing a map. As you sketch, try to draw everything to scale.

   b. Compass – used to determine the relative angle between different wreck features. Beware of possible compass deviation around steel or iron.

   c. Marked rope or measuring tape – used when distance accuracy (more precise than kick cycles or body measurement techniques) is desired.

   d. Navigational aids (Nav-Finder, slates with grids, etc.) – used to assess bearing and distances more accurately. These aids are also used for general navigation on the wreck.

Note:
Recommend to student divers that they complete the PADI Underwater Navigator *course and consult the PADI* Underwater Navigator Manual *and* Underwater Navigation video *for more information about navigation, mapping and the use of navigational aids such as the Nav-Finder.*

H. Wreck Penetration

Note:
Remind student divers that there are many hazards related to penetrating a wreck. Because of those hazards, divers are generally encouraged to remain on the outside of wrecks. If, however, you desire to enter a wreck, you must do it properly or you face unacceptable risk. One of the most common causes of fatal dive accidents is entering overhead environments without the proper equipment and without applying the proper techniques. Wreck penetration should: 1) only be done in a wreck that is stable and secure, 2) be restricted to the light zone, 3) be done only when environmental conditions are excellent, and 4) be done only when all the appropriate equipment and procedures the particular environment calls for can be applied. The following discussion covers wreck penetration equipment, techniques and limits suitable for recreational divers. More involved wreck penetration diving requires training in technical, research or commercial diving and is beyond the scope of this course. Do not exceed the limits of your training.

- ***What four pieces of equipment should be used for a penetration dive, and what is each piece used for?***

1. Specific equipment is required for all penetration dives. This equipment, as well as special training, is necessary to offset the potential hazards of being inside a wreck safely. Under no circumstances should you try to perform a penetration dive without the necessary equipment.
    a. Dive lights – Even though you will remain in the light zone of the wreck, the ambient light dims as you move away from the entry. Therefore, a light source is necessary during penetration. You should have at least two dive lights, a primary and a backup.

1. Carry your backup dive lights so that they are out of the way and don't dangle, yet remain accessible with one hand. This makes it possible to switch lights while using the other hand for maintaining buddy contact or penetration line contact.

Note:
Ensure student divers understand light zone- the area from which you can still see the natural light at the entrance. Discuss and show divers appropriate lights available in the local market. Reinforce the fact that many wreck divers carry no fewer than three dive lights during penetration dives. If you have three lights, the chances are one in 320, and with four, chances are only one in about 6,450 that you'll have all four lights fail on the same dive within 25 dives.

b. Penetration line and reel – The penetration line and the visual reference that the light zone provides help you avoid being lost or disoriented inside the wreck. Do not make a penetration dive without a line. The line must be stored on a reel that can be used to easily deploy and retrieve the line while moving through the wreck. Inspect the line for wear before every use.
    1. Line – Wrecks frequently have sharp or abrasive surfaces than can sever your line, so use a strong, durable line made from a nonbiodegradable material.
        a. Standard line – A braided nylon line (generally #36 line) is more like a string than rope, so it tangles and jams reels if not handled with care. Place it properly so it doesn't cause entanglement or is cut by abrasion.
        b. Beginner's line – Line .6 centimetres/.25 inches thick or thicker, made of a nonbiodegradable material such as nylon, stored on a large reel. The beginner's line is very durable and less prone to tangling due to its thickness. However, the reel is bulky and awkward and requires two-handed use most of the time. Good choice for training and inexperienced wreck divers making very limited penetrations.
    2. Reel – A standard reel with standard line is preferred because it only requires one hand (except when reeling the line back up). Most reels clip to your BCD, and lock so they don't unreel when you're not using them.

Note:
Show student divers different line and reel types available in the local market. Also, have a look at accessory clips for attaching to BCDs and accessory equipment directly. Make available for student divers various brands of clips (brass, plastic and stainless steel) and have divers try sliding gate clips. Discuss pros and cons of clipping accessory equipment to BCD D rings versus placing the clip directly onto accessories.

c. Slate – Sketch a wreck map on your slate for reference during the penetration. You can make an interior map with notes to aid planning future penetration dives, and as a secondary reference to help find your way out if necessary. Slates are also handy for communicating with your buddy.

d. H-valve, Y-valve or pony bottle – Although they're not considered mandatory within recreational wreck penetration limits, you'll find that local divers consider redundant valves or air supplies standard equipment. Both H- and Y-valves and pony bottles add a safety margin for the overhead environment because, in the event of an air supply problem, it's easier to exit a wreck using your own regulator than sharing air with your buddy's alternate.

   1. H- and Y-valves are special cylinder valves that allow you to attach two separate regulators. If one were to fail (and freeflow), you or your buddy would close the portion of the valve supplying that regulator, and you would end the dive using the other.
   2. A pony bottle is a totally independent air source The primary drawback (compared to the H- or Y-valve) is that it's bulkier and not as streamlined.

Note:
Ask student divers to refer to the side bar "Optional Penetration Equipment Configurations" in their PADI Wreck Diver Manual *for ideas to set up their equipment for penetration dives. As time allows, have student divers review each other's equipment set up and if practical, provide time in confined water for divers to practice accessing and using their equipment (line, reel, dive lights, two buckle weight belts, head lights, canister HID lights, foldable snorkels and snorkel quick release clips, H- and Y-valves, pony bottles, and single cylinder TecRec configurations.*

- ***What are the four penetration limits to observe when inside a wreck?***

2. The overhead environment poses four limits beyond the normal open water constraints of depth, air supply and no decompression limits.

Note:
Remind student divers that limits coupled with equipment and training keep them within reasonably manageable risk limits. Acknowledge that tec divers and other divers with considerably more equipment and training have more liberal limits in penetrating a wreck, but these don't apply until their level of equipment and training is reached.

a. Edge of light zone – You should never penetrate a wreck past the point where you can see the natural light of the entrance. For this reason, you do not make penetration dives at night or in water so deep and murky that there is little or no natural light visible from inside the wreck.

b. Linear distance of 40 metres/130 feet –- The maximum total distance you enter a wreck should not exceed 40 metres/130 feet from the surface, even if you're still in the light zone. Example: If the wreck is 30 metres/100 feet deep, the absolute maximum penetration is 10 metres/30 feet. At 40 metres/130 feet, you should not enter a wreck at all. By marking your penetration line in 1.5-metre/5-foot or 3-metre/10-foot intervals, you can track the distance of your penetration to keep from exceeding 40 metres/130 feet linear to the surface.

c. One-third of air supply – Wreck penetration uses the rule of thirds for air planning. Use one-third of your air to penetrate (which starts when you descend), one-third to exit and keep one-third in reserve. Saving two-thirds of your air for exiting gives you more of the most important factor you need to handle a problem inside a wreck - time. The Rule of Thirds gives you about twice as much time to get out of a wreck as it took to get in.

Note:
Explain to student divers that on many wrecks, if other limits permit, the one-third reserve may be used on the outside of the wreck, and the dive ended with the usual 34 bar/500 psi or other appropriate reserve.

d. Space too narrow for two divers to pass together - Don't go past any area that is so narrow that you and your buddy couldn't move through it together while sharing air with a conventional alternate air source.

3. You shouldn't find basic wreck penetration techniques difficult, but they do take some practice. This is why you learn them initially outside the wreck.

   a. Tying off the penetration line

      1. Penetration begins by tying a line to a sturdy piece of wreckage outside the entry point.
      2. The tie-off point must not be movable, weak or have sharp edges. It must provide a firm attachment that will not cut the line. Where possible, thread the line through a hole and then tie the end to the line itself.

         a. In general, use a knot that will release quickly, even after being pulled hard, such as a figure eight knot.

         b. Divers using standard reels usually tie a permanent loop in the line end big enough to pass the reel through. The line is passed around an object, and then the reel is pulled through the loop, securing the line without tying any knots.

      3. Immediately inside the wreck, wrap the line around an object to create a secondary anchor point. This is in case the outside tie off is accidentally cut or comes free. You want to make this secondary tie and all subsequent ties in a way that's quick and secure, yet comes loose easily when you exit. With practice, you'll be able to do this quickly with using one hand.
      4. While moving inside the wreck, the line should occasionally be looped around some elevated, nonsharp object (like a round pipe) as necessary, to prevent it from being tangled.

- ***What are the proper techniques for entering a wreck?***

   b. Entering the wreck

      1. An opening through a door or hatch that can close is not a suitable entry location. Enter a wreck only where the opening is large, void of closing covers or doors and sharp edges.
      2. The diver with the reel goes first.
      3. Sweep your light in a circle as you enter. Check all areas in front, above, below and to the side of you.
      4. Check where your bubbles hit the ceiling. If they cause a severe rain of silt that could limit visibility, it may be appropriate to abort the penetration.

5. Wrap the line around nonsharp objects from time to time as necessary to route the line where your buddies can follow it, to avoid slack, and to keep the line from blocking passage.

- ***What are the proper techniques for moving through a wreck?***

c. Moving through the wreck requires the use of proper technique to prevent stirring up silt, accidental cuts or stings, and damage to the penetration line.

1. Maintain neutral buoyancy to keep off the bottom inside the wreck.
2. When swimming, stay level or with your legs slightly above your head. Use shorter, gentler sculling kicks that don't kick up much silt. Never allow your kicks to stir up silt from the bottom.
3. When practical, gently pull yourself by hand through the wreck. However, to prevent cuts or contact with aquatic life, look closely before you grab anything.
4. Do not use the penetration line to pull yourself along. This can cut or fray the line, or may pull the reel out the hands of the reel diver.
5. All activity should be slow, smooth and deliberate.

- ***What are the proper techniques for using a penetration line in a wreck?***

d. Using the penetration line – Proper techniques with the penetration line ensure that you will maintain contact with the line and that neither you nor your buddies will become entangled.

1. The maximum is three divers penetrating the same area and/or on the same line.
2. The reel diver goes first with his buddy(ies) following single file.
3. Swim near the line in a position where you can easily reach it with one hand, but do not actually hold it (except for turns or during emergencies – discussed in a moment). Know where the line is at all times. You should be able to reach out and grasp it at any time. Preferably, swim with the line just below chest level and to one side, wreck configuration allowing.
4. To turn around on the line, grasp with hand closest to line. Turn toward line, holding it away to prevent entanglement. Grasp with other hand to complete turn.

5. Upon reaching penetration, air supply, light zone or another limit, divers turn around. The last diver becomes the leader, following the penetration line to exit. The reel diver is last, taking up the line. Note: You will have somewhat reduced visibility during exit because kicking up some silt on the way in is inevitable.

- ***What are the proper responses and actions for loss of visibility due to silting?***

4. As long as you observe the penetration limits you've learned, you should have adequate time and resources to handle wreck penetration emergencies. During the wreck penetration you may need to handle problems associated with silt-out, a lost or cut penetration line, light failure, or loss of air supply. It's always important to stop, breathe, think and then act, just as you would handling any problem.

   a. Silt-out is caused by kicking up the bottom, or by your bubbles dislodging particles of sediment on the sides and ceiling of the wreck. Because a silt-out makes seeing (with or without a light) impossible, you need to use the penetration line to avoid disorientation. In case silt begins to destroy visibility:

      1. Immediately stop, reach out and loosely grasp the penetration line. Give the silt a moment to settle.
      2. If visibility does not improve quickly (depends on coarseness of sediment), you will have to abort the dive. Make a normal turn, but do not release the line. In silt-out conditions, never release the penetration line. Instead, make a loose "O" around the line with your hand.
      3. Exit the wreck, using the line as a guide. Do not pull on the line.
      4. If you're the reel diver and you can't see whether all divers make line contact and exit, lock the reel, leave it, and follow the line out.

- ***What are the proper responses and actions for a lost or cut penetration line?***

   b. Lost or cut line – If you lose contact with it, or your line is accidently cut:

      1. Stop and allow any silt to settle.
      2. Find the natural light at the entrance. If you must turn to do this, use great care not to stir up silt. You may need to cover your light and let your eyes adjust to the dark.
      3. Swim to the exit. If you have been keeping track of your progress on a slate, use it to help you retrace your path.

4. If you're the reel diver and you can't see whether all divers make line contact and exit, lock the reel, leave it, and follow the line out.

Note:
Caution student divers about trapped air left by previous divers, and trapped fuel, oil, or other chemicals in the wreck. Divers should avoid these pockets even those thought to contain air. Over time oxygen dissolves out of trapped air, so if breathed the diver could lose consciousness.

- ***What are the proper responses and actions for light failure?***

c. Light failure – If your light fails:

1. Stop and make loose contact with the line.
2. Using your free hand, locate and turn on your backup light.
3. Signal your buddies and abort the penetration. Under no circumstances should you continue the penetration on your backup light. Use the backup to allow a safe exit. This is another reason why experienced wreck divers carry three or more lights - they can continue the penetration after a single failure.
4. If your backup light doesn't work or has been lost, signal to borrow your buddy's. Abort the penetration.

- ***What are the proper responses and actions for air supply loss?***

d. Air supply loss – This should be unlikely if you follow the rule of thirds. If it does occur:

1. If you're using an H or Y valve system shut down the free flowing regulator and exit the wreck using the other. If you didn't lose much air, make a normal ascent.
2. If you're using a pony bottle switch to it and exit the wreck. You may not have enough air for a normal ascent, so make contact and secure you're buddy's alternate airsource and ascend together.
3. In either case, don't cause a silt-out while rushing to make the switch and shut down the free flowing regulator – move slowly and deliberately.
4. If you're not using an H or Y valve or a pony bottle secure your buddy's alternate second stage. Calmly, deliberately but immediately, exit the wreck.

5. If you're the reel diver, whether you're the donor or the receiver, in an air supply emergency leave the line and reel in place and exit.

Note:
The techniques for exiting the wreck using a buddy's alternate airsource depend upon the wreck and the alternate air source hose length. You should be able to swim side-by-side or over-under all the way out. If necessary, with a standard 1 metre (39 inch), the donor can go through a tighter area first with the receiver behind, gently holding onto the donor's cylinder to prevent separation. When using the TecRec configuration with the two metre/seven foot hose, the protocol is for the receiver to go first with the donor immediately behind. Inform divers they will practice using their buddy's alternate airsource (either in confined water or by doing a dry-run on the surface) before they attempt a wreck penetration dive.

5. Inside a wreck, the "thumbs up" signal to surface takes on more authority than in open water. In the overhead environment, the "surface" signal from any diver turns the penetration immediately. Because there are potentially more hazards in an overhead environment, the rule is that you do not use any time or air questioning or modifying the command to exit. When the thumb goes up, the divers go out, period.

Section Three
Open Water Dives
Conduct

There are no required confined water and/or surface practice sessions for the PADI Wreck Diver Specialty Diver course, however, developing student diver abilities in conditions that doesn't add complexity to learning new skills such as basic wreck mapping and navigation techniques before progressing to more challenging conditions, is sound instruction. Some of the underwater skills, such as knot tying, line and reel use, signaling, and navigation, are much easier to learn if you have student divers practice them in a confined water session or on the surface first. You may add confined water and/or surface practice sessions at your discretion. The confined water session may also include a scuba skills review. After completing the course, suggest to divers to dry-rehearse navigation techniques, wreck penetration procedures, and reel and line use before commencing wreck dives.

On the first dive, student divers mainly use their navigation skills to locate the wreck, practice using their diving equipment, communicating underwater, and maintaining neutral buoyancy. On the second dive, student divers swim along outside the wreck identifying and avoiding potential hazards, map the wreck marking points of interest, and survey the wreck for a future penetration dive. On the third dive, student divers practice the deployment and retrieval of a penetration line on the outside of the wreck. On the fourth dive, student divers plan and perform an actual wreck penetration dive or they organize and conduct a wreck dive outside the wreck identifying and avoiding potential hazards with their dive buddy. Divers who finish exercises with sufficient air remaining may continue to dive for pleasure and experience, at your discretion. Bottom time on each dive should not exceed the no decompression limits of the Recreational Dive Planner or each diver's computer, if used. **Regardless of how you conduct the open water dives, student divers must demonstrate the following performance requirements to qualify for certification.**

Open Water Dives

Performance Requirements

By the end of the open water dives, student divers will be able to:

Wreck Diver Open Water Dive One

- **Swim on the outside of a wreck, maintaining proper buoyancy control, and identifying and avoiding potential hazards, under the direct supervision of a Teaching Status PADI Instructor.**
- **Navigate on a wreck so that the ascent point can be located without surfacing, with the assistance of the instructor.**
- **Maintain neutral buoyancy and body position that avoids the bottom.**

Wreck Diver Open Water Dive Two

- **Swim along the outside of a wreck, in a buddy team, identifying and avoiding potential hazards.**
- **With a buddy, map a wreck (or portion of a wreck), determining approximate size and marking points of interest.**
- **Survey a wreck for a penetration dive and evaluate possible entrances.**
- **Navigate on a wreck, returning to the ascent point without surfacing.**

Wreck Diver Open Water Dive Three

- **Demonstrate the deployment and retrieval of a penetration line, for practice, on the outside of a wreck, while working in buddy teams.**
- **Swim along the deployed penetration line so as to maintain contact with the line without kicking up silt and holding on to a dive light.**
- **Navigate on a wreck so as to locate the ascent point without surfacing.**

Wreck Diver Open Water Dive Four A

- **Plan and perform an actual wreck penetration under the direct supervision of a Teaching status PADI Instructor:**
  - **Determining air supply and penetration limits.**
  - **Swimming without causing excessive silt disturbance.**
  - **Maintaining contact with the line.**
  - **Using a dive light while following a penetration line.**
- **Navigate on a wreck so as to locate the ascent point without surfacing.**

Wreck Diver Open Water Dive Four B

- **Organize and conduct a wreck dive with a buddy, but with only minimal instructor assistance.**
- **Swim on the outside of a wreck, identifying and avoiding possible hazards.**
- **Navigate on a wreck so as to locate the ascent point without surfacing.**

Open Water Guidelines for Wreck Dives

A. General Open Water Considerations

1. Involve student divers in dive-planning activities. Have student divers prepare training buoys and reference lines, penetration lines and emergency-decompression breathing equipment as appropriate.
2. Conduct a thorough briefing. The better the briefing, the more smoothly the wreck dive will proceed. Assign buddy teams according to ability (weak with strong). Penetration dives may be psychologically stressful to some individuals. Pay close attention to stress levels and behavior. Never force a student diver to make a penetration into a wreck; complete training with Wreck Dive Four B instead.
3. The use of qualified assistants is highly recommended. Assistants can help keep track of buddy teams and watch student divers waiting to complete an exercise with the instructor. An assistant at the surface can help with check in, check out procedures and be prepared to help in an emergency. It's useful to have an assistant outside the wreck supervising student divers waiting their turn to penetrate the wreck if you elect to make the penetration with all student divers in one dive. Note that all groups should be able to complete their dive within the rule of thirds. It may be feasible to have groups of two descending to the wreck in shifts, supervised by assistants.
4. It is recommended that when feasible, Wreck Dives Two and Three be conducted on the same wreck. This allows student divers to become familiar with the wreck on Wreck Dive Two (by mapping it) prior to the simulated penetration exercises in Wreck Dive Three. If you will be conducting Wreck Dive Four A, it's recommended that Wreck Dives Two and/or Three be conducted on the same wreck also so student divers can become familiar with the wreck prior to actual penetration exercises.
5. Penetration line use requires practice. Use confined water and/or surface practice sessions to practice using the penetration line. Ensure that all students have the opportunity to practice securing, deploying, following and retrieving the line.
6. Conduct penetration dives so that you (the instructor) never violate the rule of thirds, even when completing multiple penetrations with student diver groups. Doing so increases your own risk, and depletes emergency air you may need to assist a student diver. It also serves as a bad role model. High-capacity cylinders or double cylinders may help, but do not exceed your no decompression limits.

B. Wreck Diver Open Water Dives

Dive One

- ***Swim on the outside of a wreck, maintaining proper buoyancy control, and identifying and avoiding potential hazards, under the direct supervision of a Teaching Status PADI Instructor.***
- ***Navigate on a wreck so that the ascent point can be located without surfacing, with the assistance of the instructor.***
- ***Maintain neutral buoyancy and body position that avoids the bottom.***

a. Briefing

1. Dive sequence – review Dive One tasks

b. Predive procedures

c. Dive One Tasks

1. Navigation: The instructor leads, using navigation techniques appropriate for the wreck chosen. Buddy teams follow, using the same navigation techniques. During this exercise, provide student divers with an overview of the exterior of the wreck.
2. Student divers control their buoyancy and remain neutrally buoyant as appropriate. Student divers avoid silting problems through buoyancy and fin control and watch for wreck and aquatic life hazards.
3. With student divers following and observing, instructor navigates on the wreck so class reaches the ascent point without surfacing.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss the wreck condition and features, possible structure and/or aquatic life, hazards observed, and the navigation of the wreck. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time. Discuss any possible hazards in detail.

f. Log dive (instructor signs log)

Dive Two

- ***Swim along the outside of a wreck, in a buddy team, identifying and avoiding potential hazards.***
- ***With a buddy, map a wreck (or portion of a wreck), determining approximate size and marking points of interest.***
- ***Survey a wreck for a penetration dive and evaluate possible entrances.***
- ***Navigate on a wreck, returning to the ascent point without surfacing.***

a. Briefing

   1. Dive sequence – review Dive Two tasks

b. Predive procedures

c. Dive Two Tasks

   1. Student divers explore the wreck site, using navigation techniques appropriate for the site.
   2. Mapping: Each buddy team maps the wreck (or a portion of the wreck), noting points of interest, potential hazards and potential penetration entries.
   3. Assessment of limited penetration: Each team examines potential penetration entries for size and safety. Student divers should be prepared to discuss later whether there are appropriate openings on the wreck for limited penetration. If possible and appropriate openings are found, have student divers use underwater lights to examine the immediate interior of the openings, looking for obstructions, sharp edges and other possible hazards. Student divers are not to enter the wreck.

d. Post-dive procedures

e. Debriefing

   1. Student divers discuss and review their mapping of the wreck. Discuss with student divers possible penetration locations and the suitability of penetrating the wreck. Guide discussions to address what worked, what didn't work, and how navigating the wreck may be done differently the next time.

f. Log dive (instructor signs log)

Dive Three

- ***Demonstrate the deployment and retrieval of a penetration line, for practice, on the outside of a wreck, while working in buddy teams.***
- ***Swim along the deployed penetration line so as to maintain contact with the line without kicking up silt and holding on to a dive light.***
- ***Navigate on a wreck so as to locate the ascent point without surfacing.***

a. Briefing

1. Dive sequence – review Dive Three tasks

b. Predive procedures

c. Dive Three Tasks

1. Practice penetration on outside of wreck. Student divers practice securing, properly deploying and retrieving the penetration line.
2. Student divers swim along the penetration line while holding on to a dive light and moving in such a manner as to not kick up silt.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss how they dealt with the simulated penetration on the outside of the wreck. Ask student divers to comment on swimming along the penetration line while holding a dive light. Guide discussions to address what worked, what didn't work, and how they may conduct their simulated penetration dive differently the next time.

f. Log dive (instructor signs log)

Dive Four A

- ***Plan and perform an actual wreck penetration under the direct supervision of a Teaching status PADI Instructor:***
  - ***Determining air supply and penetration limits.***
  - ***Swimming without causing excessive silt disturbance.***
  - ***Maintaining contact with the line.***
  - ***Using a dive light while following a penetration line.***
- ***Navigate on a wreck so as to locate the ascent point without surfacing.***

a. Briefing

1. Dive sequence – review Dive Four A tasks

b. Predive procedures

c. Dive Four A Tasks

1. Student divers make an actual wreck penetration with instructor's supervision.
2. Student divers use correct penetration techniques. During the penetration exercise, student divers:
   a. use the penetration line as a guide.
   b. swim in such a manner as to avoid kicking up silt.
3. Return to ascent point without surfacing.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss techniques used and how they felt making an actual wreck penetration. Ask student divers to comment on the use of the penetration line as a guide and how they avoided kicking up silt. Guide discussions to address what worked, what didn't work, and how they may conduct their penetration dive differently the next time.

f. Log dive (instructor signs log)

Dive Four B

- ***Organize and conduct a wreck dive with a buddy, but with only minimal instructor assistance.***
- ***Swim on the outside of a wreck, identifying and avoiding possible hazards.***
- ***Navigate on a wreck so as to locate the ascent point without surfacing.***

a. Briefing

1. Dive sequence – review Dive Four B tasks

b. Predive procedures

c. Dive Four B Tasks

1. Instructor accompanies student divers on their planned dive.
2. Student divers navigate on the wreck so class reaches the ascent point without surfacing.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss the wreck condition and features, possible structure and/or aquatic life, hazards observed, and the navigation of the wreck. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time. Discuss any possible hazards in detail and review how the planning of the dive may be done differently next time.

f. Log dive (instructor signs log)

Appendix

Table of Contents

Wreck Diver

Knowledge Review Part I Answer Key

Note:
To assess knowledge you may review the Knowledge Review from the student diver's manual with the diver, ideally prior to participating in skill practice. Prescriptively teach answers to questions student divers may have missed or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

1. List two reasons why artifact recovery is discouraged when wreck diving:
   1. *Wrecks that are stripped are much less interesting.*
   2. *Historical wrecks must be left undisturbed for research purposes.*

2. Explain why divers must pay close attention to local laws before planning a wreck dive.
   A permit may be required, and it may be illegal to either dive on the wreck or remove artifacts.

3. Describe how to avoid the following potential hazards common to wrecks:
   Sharp objects:

   Wear protective coverings and use good buoyancy control.

   Entanglement:

   Watch where you go, avoid swimming into or under potential entanglement. Carry a knife.

4. List five dive planning and equipment considerations for wreck diving deeper than 18 metres/60 feet.
   1. *PADI Deep Diver training*
   2. *Extra tank at 5 metres/15 feet*
   3. *Nitrogen narcosis*
   4. *Short time limits*
   5. *Become trained as a PADI* Enriched Air Diver

5. List two reasons for obtaining a local orientation to an unfamiliar wreck before diving on it.
   1. *Dive techniques vary on wrecks*
   2. *Unique hazards or points of interest*

6. Explain why special training and equipment are necessary for shipwreck penetration. In your explanation, include the five hazards of entering a wreck.
   Special training is necessary because it is extremely hazardous. You can lose direction, there's no direct access to surface, restricted passages, falling objects and silt.

7. List three aspects of a wreck that should be evaluated when diving on it.
   1. *Possible hazards*
   2. *Points of interest*
   3. *General condition*

8. Describe the three methods of navigating on a shipwreck.
   1. *Following the wreck's layout*
   2. *Feature reference*
   3. *Using a base line*

Adventure Dive: Wreck Diver

Skills Overview

- Knowledge Review
- Briefing
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Navigating the Wreck
- Returning to Ascent Point
- Ascent and Safety Stop
- Exit
- Debrief
- Log Dive – Complete Adventure Dive Training Record

Wreck Diver
Knowledge Review Part II Answer Key

Note:
To assess knowledge you may review the Knowledge Review from the student diver's manual with the diver, ideally prior to participating in skill practice. Prescriptively teach answers to questions student divers may have missed or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

9. Describe the general techniques for wreck diving in a current.
   Anchor the dive vessel by the wreck or to the mooring line, secure trail and swim line, enter water and pull yourself along swim line, descend hand over hand down to wreck, stay close to the lee side or bottom of wreck, and ascend up anchor/mooring line at end of dive.

10. List three reasons for researching the history and condition of a wreck.
    1. *To determine the wreck's historical significance.*
    2. *To determine the wreck's identity.*
    3. *To determine points of interest and potential hazards before the dive.*

11. List two sources that provide quick, basic information about diving on a popular wreck.
    1. *Dive stores/boats*
    2. *Dive magazines/guide books*

12. List two benefits of mapping a shipwreck.
    1. *To note points of interest and potential hazards.*
    2. *To assist in planning penetration dives.*

13. List four pieces of equipment for wreck penetration and state what each is used for.
    1. *Light and backup light – provides additional light as the ambient light dims when moving away from the entry point.*
    2. *Penetration line and reel – provides a visual/tactile reference to the exit point.*
    3. *Slate – mapping the wreck, write notes on for future reference, communication.*
    4. *Pony bottle – provides an alternative air source and an extra margin of safety.*

14. List the four limits for wreck penetration:
    1. *The edge of the light zone.*
    2. *Linear distance of 40 metres/130 feet.*
    3. *One-third of your air supply (use Rule of Thirds).*
    4. *Space too narrow for two divers to pass together sharing an alternate air source.*

15. Describe the proper techniques for entering, moving through and using a penetration line in a wreck.

    Tie off penetration line outside the wreck. The diver with the reel enters first, stopping, looking up, and around for hazards before proceeding. Secure line to a second point. Maintain neutral buoyancy with gentle kicks and/or by holding on to nonsharp parts of the wreck and pulling yourself around. Maintain light tension on the line and wrap it around nonsharp objects as necessary to route it. Follow the line single file, keeping the line at chest level and off to one side. Don't use line to pull yourself along. Reel diver is last to start exiting and removes line along the way.

16. Describe the proper responses and actions for each of the following during wreck penetration:

    Loss of visibility due to silting:

    Stop, maintain or make contact with penetration line by making a loose "O" around it with your hand. Follow the penetration line to the exit point without pulling on the line.

    A lost or cut penetration line:

    Stop, allow the silt to settle, cover flashlight, look for natural light. Head slowly toward the natural light.

    Light failure:

    Stop, maintain loose contact with the penetration line, turn back up light on, abort dive and head for the exit.

    Air supply loss:

    Immediately switch to pony bottle or buddy's alternate air source, abort dive and head for exit point. Make a normal accent, if possible.

PADI Adventure Dive Training Record
Adventure Dive:
Wreck Diver

Skills Overview

- Knowledge Review
- Briefing
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Navigating the Wreck
- Returning to Ascent Point
- Ascent – Safety Stop
- Exit
- Debrief
- Log Dive – Complete Training Record

Instructor Statement

"I verify that this student diver has satisfactorily completed the Knowledge Review and Performance Requirements (as described in PADI's Adventures in Diving Program Instructor Guide) for this PADI Adventure Dive. I am a renewed, Teaching status PADI Instructor for the current year."

Instructor Name: _____

Instructor Signature: _____

PADI #: _____ Completion Date: _____
Day/Month/Year

Instructor Contact Information (Please Print)

Instructor Mailing Address: _____

City: _____ State/Province: _____

Country: _____ Zip/Postal Code: _____

Phone/Fax/email: _____

Student Diver Statement

"I verify that I have completed all of the Performance Requirements for this Adventure Dive. I realize that there is more to learn about wreck diving and that completion of a PADI Wreck Diver course is highly recommended. I also agree to abide by PADI Standard Safe Diving Practices."

Student Diver Signature _____ Date: _____
Day/Month/Year

PADI Specialty Training Record Wreck Diver

Instructor Statement

"I verify that this student diver has satisfactorily completed all academic and/or any confined water training sessions as outlined in the PADI Specialty Course Instructor Guide for Wreck Diver. I am a renewed, Teaching status PADI Instructor in this specialty."

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Open Water Dives

Dive One

I verify that this student diver has satisfactorily completed Dive One as outlined in the PADI standardized guide for Wreck Diver, including:

- Navigate wreck
- Control buoyancy and avoid stirring bottom silt
- Return to ascent point
- Perform safety stop for 3 minutes at 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Two

I verify that this student diver has satisfactorily completed Dive Two as outlined in the PADI standardized guide for Wreck Diver, including:

- Explore wreck
- Map wreck
- Penetration assessment – locating potential entry points
- Return to ascent point
- Perform safety stop for 3 minutes at 5 metres/15 feetI am a renewed, Teaching status PADI Instructor in this specialty.

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Three

I verify that this student diver has satisfactorily completed Dive Three as outlined in the PADI standardized guide for Wreck Diver, including:

- Deploy penetration line on outside of wreck
- Swim along penetration line with light without kicking up silt
- Retrieve penetration line from outside of wreck
- Perform safety stop for 3 minutes at 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Four A or B

I verify that this student diver has satisfactorily completed Dive Four as outlined in the PADI standardized guide for Wreck Diver, including:

Four A

- Find penetration entry point
- Deploy penetration line into wreck
- Penetrate wreck to safe limits
- Retrieve penetration line and exit wreck
- Navigate to ascent point
- Perform safety stop for 3 minutes at 5 metres/15 feet

Four B

- Have students organize and conduct their own wreck dive
- Navigate to ascent point
- Perform safety stop for 3 minutes at 5 metres/15 feet

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Student Diver Statement

"I verify that I have completed all performance requirements for this Wreck Diver specialty. I am adequately prepared to dive in areas and under conditions similar to those in which I was trained. I agree to abide by PADI Standard Safe Diving Practices."

Student Diver Name: _____

Student Diver Signature: _____ Date: _____
Day/Month/Year

Enriched Air Diver

PADI

Specialty Course Instructor Guide

Product No. 70244 (4/10) Version 1.01

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Specialty Course Instructor Guide

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Table of Contents

Introduction

This section includes suggestions on how to use this guide, an overview of course philosophy and goals, a flow chart to show you how course components and materials work together for success, and ways you can organize and integrate student diver learning.

How to Use this Guide

This guide speaks to you, the PADI Enriched Air Instructor. The guide contains three sections – the first contains standards specific to this course, the second contains knowledge development presentations, the third covers practical application sessions, the open water dives/open water dive simulations. All required standards, learning objectives, activities, and performance requirements specific to the PADI Enriched Air Diver course appear in **boldface** print. **The boldface assists you in easily identifying those requirements that you must adhere to when you conduct the course.** Items not in boldface print are recommendations for your information and consideration. General course standards applicable to *all* PADI courses are located in the General Standards and Procedures section of your PADI *Instructor Manual.*

Course Philosophy and Goals

This course is designed to qualify recreational divers to use enriched air ("nitrox") for no stop recreational diving with an enriched air (EANx) compatible dive computer. The program addresses computer-assisted diving while using enriched air with 22 percent to 40 percent oxygen to monitor no stop limits and oxygen exposure.

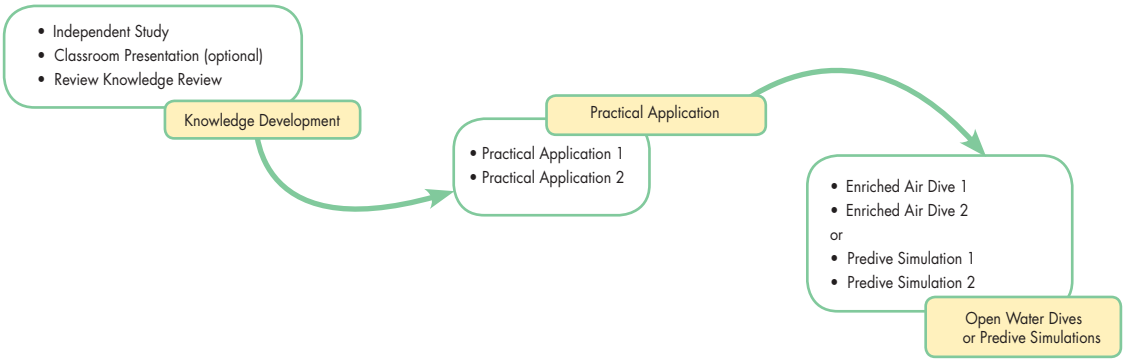
The best way to learn the procedures for diving enriched air ntirox and to apply them is by doing it. This *course philosophy* therefore is to allow students to learn how to plan and organize enriched air dives by doing so in hands-on experiences. Student divers will apply the knowledge they gain by reading the PADI *Enriched Air Diver Manual* and watching the companion video, or completing the PADI Enriched Air Diver Course Online, followed by practical application sessions in which they practice the procedures for obtaining and analyzing enriched air. They follow this with at least two open water dives, or two sessions that simulate the predive planning for open water enriched air dives.

Program Options

Step	Independent Study	Adventure Dive Integration	Instructor-Led
1	**Independent study** with manual and video (optional)	**Independent study** with manual and video (optional)	**Knowledge Development Classroom Presentation** (optional)
2	**Review Knowledge Review** Part I and Part II (optional)	**Give credit for Enriched Air Adventure Dive and collect Knowledge Review** Part I (optional)	**Review Knowledge Review** Part I and Part II (optional)
3	**Predive Simulations** (Required without dives)	**Predive Simulations** (Required without dives)	**Predive Simulations** (Required without dives)
4	**Open Water Dive One** (Optional)	**Review Knowledge Review** Part II (optional)	**Open Water Dive One** (Optional)
5	**Open Water Dive Two** (Optional)	**Open Water Dive One or Two**	**Open Water Dive Two** (Optional)

Course Flow Options

Course Flow Options provides a visual representation of how knowledge development and confined water and/or surface practice sessions support open water dives. When possible, it's preferable to have student divers read the PADI *Enriched Air Diver Manual* and complete the Knowledge Reviews, or complete the PADI Enriched Air Diver Course Online before participating in the open water dives. However, you may allow divers to complete the first course open water dive prior to doing so by conducting the Dive Today briefing and conducting the dives following the Dive Today standards.



Section One: Course Standards

This section includes the course standards, recommendations, and suggestions for conducting the PADI Enriched Air Diver course.

Note

Local laws and regulations may prohibit, restrict or otherwise affect the use of enriched air. It is the instructor's responsibility to conform to laws in force in the local area. Contact your PADI Office for more information about laws or regulations that may affect teaching this course.

Standards at a Glance

Minimum Instructor Rating	**PADI Enriched Air Instructor.**
Prerequisite Certification	**PADI Open Water Diver or qualifying certification, or enrollment in the PADI Open Water Diver course and PADI Enriched Air Diver course concurrently**
Minimum Age	**15**
Ratios	**Open water 8:1**
Site, depth and hours	Depth: **The maximum depth for training dives is 30 metres/100 feet, a PO_2 of 1.4 bar/ata for the blend used, or 18 metres/60 feet for Open Water Divers/Open Water Diver students – whichever is shallowest.** Hours recommended: 12. Open water dives: **2 Enriched Air Dives, or Predive Simulation Exercises.**
Materials	**Student: PADI *Enriched Air Diver Manual* (student), PADI Enriched Air Diving video or PADI Enriched Air Diver Course Online** **Instructor: PADI Enriched Air Diver Specialty Course Instructor Guide**
Maximum Oxygen Content	**40%**

Instructor Prerequisites

To qualify to teach the PADI Enriched Air Diver course, an individual must be a Teaching status PADI Open Water Scuba Instructor or higher.

PADI Instructors may apply for the PADI Enriched Air Instructor Specialty rating after completing a Specialty Instructor Training course with a PADI Course Director, or by providing proof of experience and applying directly to PADI. For further detail, reference Membership Standards in the General Standards and Procedures section of your PADI *Instructor Manual.*

Note

*Individuals who are not certified as PADI Enriched Air Divers or have a qualifying certification may complete the PADI Enriched Air Diver course concurrently with the **PADI Enriched Air Instructor Specialty Training course**. After completing the course, they are certified as PADI Enriched Air Divers and complete the instructor requirements after making 10 or more dives for experience. They may then submit their instructor applications.*

Student Prerequisites

To qualify for the PADI Enriched Air Diver course, an individual must:

1. **Meet one of the following:**
   - **Be certified as a PADI Open Water Diver or have a qualifying certification from another training organization, or**
   - **Be a PADI Open Water Diver course student taking the PADI Enriched Air Diver course concurrently.**
2. **Be 15 years of age or older.**

Instructor Supervision

Enriched Air Diver courses may be conducted by a Teaching status PADI Open Water Instructor (or PADI Instructor with a higher rating) who has been certified as a PADI Enriched Air Instructor.

The student diver-to-instructor ratio in open water is maximum, depending upon various factors, eight students per instructor (8:1).

It is recommended that during training dives, a PADI Instructor or certified assistant accompany Enriched Air Diver students. Indirect supervision is acceptable for certified divers using enriched air dive computers when the instructor has personally supervised the divers setting their computers with the correct blend. Certified divers who have successfully completed the Knowledge Development and the Practical Application may also be indirectly supervised. **Uncertified divers (Open Water Diver students) must be directly supervised by a PADI Enriched Air Specialty Instructor.**

If Dive 1 is conducted deeper than 18 metres/60 feet, the Enriched Air Instructor must directly supervise at a ratio no greater than 8:1.

Hours and Depths

The PADI Enriched Air Diver course emphasizes the theoretical and operational considerations involved with using an enriched-air compatible computer for enriched air diving. Mastery of the learning objectives is demonstrated during knowledge development assessment, practical application sessions and open water dives. Because the key skills and procedures one learns to dive EANx take place prior to a dive, you have the option of using predive simulation exercises in place of actual training dives should circumstances require it.

Training dives may be integrated with other PADI course dives. **Student divers must log their participation in the PADI Enriched Air Diver course and the dives in their personal dive logs. The PADI Instructor conducting the course signs the log entries upon successful completion of training.**

Hours: **The PADI Enriched Air Diver course includes two Practical Application sessions and two open water dives/predive simulations that may be completed in one day.** The recommended course hours is 12. If a training dive will be at night, it's recommended that students have prior night diving experience or direct supervision.

Depth: **The maximum depth for training dives is 30 metres/100 feet, the depth at which a diver reaches a PO_2 of 1.4 bar/ata for the blend used, or 18 metres/60 feet for Open Water Divers/Open Water Diver students – whichever is shallowest.**

Materials and Equipment

Instructor Materials and Equipment

The following materials are required (boldfaced) or recommended (non boldfaced) when conducting the PADI Enriched Air Diver course:

- **PADI Enriched Air Diver Course Instructor Guide –** No other outlines may be used when conducting this course.
- **PADI *Enriched Air Diver Manual***
- **PADI *Enriched Air Diving* video**
- **Enriched Air Diver Exam and answer sheets**
- **Liability Release and Express Assumption of Risk for Enriched Air (Nitrox) Diving** (where legally permitted)
- **Oxygen analyzer** (at least one available for student use during practical applications and before training dives)
- **Dedicated EANx cylinder with appropriate markings as required by local community standard and/or regulations**
- Specialty Diver certificates

- Enriched Air Diver chevron
- Student Record File
- Oxygen Clean/Not Oxygen Clean cylinder decals
- Enriched Air fill log pages
- Contents stickers/tags for enriched air cylinders

Student Materials and Equipment

The PADI Instructor conducting the course must ensure that student divers have, in their possession, a personal set of the current version of required materials as listed below in boldface for study and use during the course and for reference afterward; unless the materials are not available in a language understood by the student diver. **Note: Completing the Enriched Air Diver Course Online and having access to the online manual meets these requirements.**

- **PADI *Enriched Air Diver Manual***
- **PADI *Enriched Air Diving* video** (students must view this video, but do not necessarily have to own personal copies)

  Note that completing the PADI Enriched Air Diver Course Online meets the manual and video requirements.

- **EANx compatible dive computer – defined as a dive computer that calculates adjusted no stop (no decompression limits) and oxygen exposure for differing blends of enriched air**

  Note: Students may make the training dives using an air-only computer as described in SectionThree, but they must have access to an EANx compatible computer to meet the setting, predive scroll and other performance requirements related to using it.

- **Dedicated EANx cylinder with appropriate markings as required by local community standard and/or regulations**
- **Logbook**

The PADI Enriched Air Diver course may not be conducted using closed or semiclosed circuit scuba.

See the General Standards section of the PADI *Instructor Manual* for other instructor and student equipment requirements and/or recommendations that apply to training dives.

Course Conduct and Assessment Standards

This course covers the knowledge, skills and techniques for diving with enriched air. The minimum number of recommended hours is 12, spent on knowledge development and practical application, which does not include the enriched air training dives.

To conduct the PADI Enriched Air Diver course:

1. **The instructor must follow the standardized outline in the PADI Enriched Air Diver Specialty Course Guide.** Other enriched air programs may not be used for this course.
2. **Students must complete and sign the Liability Release and Express Assumption of Risk for Enriched Air (Nitrox) Diving** (where legally permitted). (Required for dives only, not simulations).
3. **If available in a language students can read, students must read the PADI *Enriched Air Diver Manual* or complete the PADI Enriched Air Diver Course Online and turn in the completed Knowledge Review for review by the instructor.**
4. **If available in a language students understand, students must watch the PADI *Enriched Air Diving* video.** Completing the online course meets this requirement. It is recommended, but not required, that students have personal copies of the video for independent study and review after the program.

If the PADI *Enriched Air Diver Manual* and/or PADI *Enriched Air Diving* video, or the PADI Enriched Air Diver Course Online, are not available in a language the students understand, the instructor may use live presentations based on the standardized Enriched Air Diver Course outline to complete knowledge development.

5. **Students must successfully complete the Enriched Air Diver Exam and demonstrate mastery of all performance objectives during the Practical Application Sessions and the enriched air training dives or predive simulations. To be successful on the exam, the student must either score 100 percent initially, or score 75 percent or higher and have each question missed explained until mastery is achieved.** Students who complete the Enriched Air Diver Course Online complete the exam online and take the written Enriched Air Quick Review with the instructor. **They must successfully complete the Enriched Air Quick Review by either scoring 100 percent initially, or scoring 75 percent or higher and having each question missed explained until mastery is achieved.**

   The student diver must demonstrate accurate and adequate knowledge during the open water dives and must perform all skills (procedures and motor skills) fluidly, with little difficulty, in a manner that demonstrates minimal or no stress.

Certification Procedures

The certifying instructor obtains a PADI Enriched Air Diver certification for each student by submitting a completed, signed PIC to the appropriate PADI Office. **The instructor who conducts the student diver's final training session certifies the diver. The instructor certifying the diver must ensure that all certification requirements have been met.**

Open Water Diver course/Enriched Air Diver concurrent training:

When teaching the PADI Open Water Diver and Enriched Air Diver courses concurrently, it's recommended that you include the Enriched Air Dives. Open Water Diver course divers who have completed Open Water Dives 1, 2 and 3 may complete Enriched Air Dive1 combined with Open Water Dive 4, followed by Enriched Air Dive 2. Instead of enriched air training dives, Open Water Diver course student divers may perform the predive simulation exercises. In either case, the Enriched Air Diver certification is issued only after the Enriched Air Diver course requirements are met and after the student diver becomes a certified PADI Open Water Diver.

Predive Simulation Exercise Option

It's recommended that you conduct Enriched Air Dives 1 and 2 whenever possible. However, when logistics don't allow them, you have the option to conduct predive simulation exercises instead. The critical objectives of the Enriched Air Diver Specialty course are both learned and applied out of the water, and center around the physical procedures of gas analysis (and related use of logs and contents stickers) and setting an EANx dive computer appropriately before a dive, and using its predive scroll to determine no stop limits for the planned depths. Therefore, the performance requirements for the dive can effectively be addressed in a predive simulation, which can be presented in conjunction with practical application 1 and 2. The performance requirements for this simulation are as follows:

By the end of the Predive Simulation, with little or no assistance from the instructor, the student diver will be able to:

- **Demonstrate predive equipment setup, blend analysis and label confirmation for two enriched air dives with two different scuba cylinders filled with enriched air.**
- **Demonstrate how to set an EANx compatible dive computer for two enriched air blends based on the analyzed content of the two cylinders.**
- **Demonstrate how to find the maximum depth for the EANx blend for the analzyed content of the two cylinders.**
- **Plan two enriched air computer dives based on depths, times and gas supply provided by the instructor and the analyzed content of the two scuba cylinders filled with enriched air.**

Note

As with any PADI course, be mindful of local dive industry practices or regulations that supersede PADI standards when teaching the PADI Enriched Air Diver course. Contact your PADI Office if you have questions regarding any that may apply to your area.

Dive Today

You can introduce EANx diving in a way that gets the diver in the water quickly, using enriched air and an enriched air compatible computer.

To participate in Dive Today, the diver must:

- **Be at least 15 years old.**
- **Complete and sign the Liability Release and Assumption of Risk for Enriched Air (Nitrox) Diving (where legally permitted). The diver must also complete and sign other required documents as listed in the "General Standards and Procedures" section of the PADI *Instructor Manual* and/or other forms required by your local PADI Office.**

You may conduct Enriched Air Dive 1 prior to beginning knowledge development. To apply this option with the PADI Enriched Air Diver course, divers must:

1. **Be a certified PADI Open Water Diver or have a qualifying certification from another training organization; (exceptions allowed for divers participating in this program during Open Water Dive Four of the PADI Open Water Diver course.)**
2. **Successfully complete Practical Application 1 prior to Enriched Air Dive 1.** (This is easily conducted as part of the predive briefing).
3. **Listen to your Dive Today briefing as outlined for Enriched Air Dive 1** (Section Two), **with the divers demonstrating mastery and understanding. The Dive Today briefing applies to all student divers who have not completed the Knowledge Development Section.**
4. **You must personally watch divers to verify that they set their computers to the correct blend.** At the instructor's discretion, the dive credits for those who continue on in the course.

Adventures in Diving Course Links

The PADI Enriched Air Diver course links to the Adventures in Diving program in two ways.

1. **Enriched Air Dive 1 or 2 may be credited in the Adventures in Diving program toward the Adventure Diver or Advanced Open Water Diver certification, at the discretion of the instructor conducting the Adventures in Diving program. Dive 1 may not be credited if conducted as the combined Open Water Training Dive Four/Enriched Air Dive 1 option for Open Water Diver students.**

2. **At the instructor's discretion, the instructor may combine the training requirements for any Adventure Dive with the training requirements for Enriched Air Dive 1 or 2; the dive credits toward the Adventure Diver/Advanced Open Water Diver certification *and* the PADI Enriched Air Diver Specialty certification.** For example, students could make the Underwater Photography Adventure Dive and Enriched Air Dive 1, or 2, and count the single dive toward Adventure Diver/Advanced Open Water Diver and Enriched Air Diver certification.

Note

Three dives are required for Adventure Diver Certification and five dives must be completed for Advanced Open Water Diver certification.

Combined Open Water Diver Training Dive 4/Enriched Air Dive 1 Option

The combined Open Water Training Dive 4/Enriched Air Dive 1 option gives you the opportunity to introduce enriched air computer assisted diving to PADI Open Water Diver students as part of their final training dive for the PADI Open Water Diver course. If successfully completed, the dive may be credited toward both courses and certifications, at instructor discretion.

The following standards apply to this option:

1. **The instructor must be a PADI Enriched Air Instructor.**
2. **The student must have successfully completed Open Water Training Dives 1-3.**
3. **The dive must be made using an enriched air compatible dive computer as described in the equipment requirements.**
4. **The instructor must give the Dive Today briefing as outlined for Enriched Air Dive 1, with students demonstrating mastery and understanding.** (See Enriched Air Computer Dive 1 in Section Two.) You may combine this briefing with the other aspects of the Training Dive 4 briefing.
5. **Students must successfully complete Practical Application 1 prior to Enriched Air Dive 1.** (Note: Practical Application 1 introduces the student diver to gas analysis and setting enriched air dive computers, and is easily conducted as part of the predive briefing).
6. **The student must complete and sign the Liability Release andExpress Assumption of Risk for Enriched Air (Nitrox) Diving** (where legally allowed) **prior to the dive.** This is in addition to, not in place of, the other releases and documents required.
7. **Students must be directly supervised according to the ratios in the PADI Open Water Diver course.**
8. **The maximum depth is 18 metres/60 feet, or the depth at which the blend reaches a PO_2 of 1.4 ata/.bar, whichever is less.**

Note

The PADI Enriched Air Diver course materials, including this guide, reflect the dive community convention of using atmospheres *(ata – atmospheres absolute) to express partial pressures. Those in metric system areas may treat pressures in ata as bar. Although technically there's a slight difference between a bar and an atmosphere, the difference isn't significant within the pressure range that applies to diving, and it is customary to treat them as the same.*

Practical Applications

The PADI Enriched Air Diver course consists of two practical applications. Practical Application 1 introduces student divers to analyzing enriched air nitrox, confirming cylinder markings and setting enriched air dive computers. Practical Application 2 allows student divers to go through the processes of obtaining enriched air from a blending facility, and to get a direct overview of how operations blend enriched air nitrox. The following standards apply to the practical applications:

1. **Practical Application 1 must precede Enriched Air Dive 1 or Predive Simulation Exercise 1, and Practical Application 2 must precede Enriched Air Dive 2 or Predive Simulation Exercise 2.** You may combine both into a single session; if you choose to do so, **the combined session must precede Enriched Air Dive 1 or Predive Simulation Exercise 1.**
2. **Practical Application 2 must be conducted in an enriched air fill station* where you can take students through the actual process of obtaining an enriched air fill.**

**Note: The definition of "enriched air fill station" is any accepted location open to the general public that provides enriched air for enriched air certified divers. This could include dive boats or dive centers that obtain enriched air from another source as a regular service for enriched air divers. Some locations that are not open to the general public, but that follow the accepted enriched air fill procedures described in this course and/or accepted in the local diving community may also qualify. This could include enriched air fill stations supporting scientific operations or university dive programs. For more information about whether a particular facility qualifies as an enriched air fill station for the purposes of this course, contact your PADI Office.*

Enriched Air Dives

See Section Three for standards specific to Enriched Air Dives 1 and 2.

Referrals

You may refer students in training to other PADI Enriched Air Instructors by completing the current version of the Enriched Air Diver Specialty Training Record sheet. See the record sheet for specific requirements.

Schedule Options

The following lists some of the possible sequences for the PADI Enriched Air Diver Specialty course:

Dive Today Sequence

Practical Application 1 (during dive briefing)
Dive Today briefing
Enriched Air Dive 1
Knowledge Development (with manual and video, or online)
Prescriptive Review
Practical Application 2
Enriched Air Diver Exam
Enriched Air Dive 2

Integrated Sequence

Knowledge Development (with manual and video, or online)
Practical Application 1
Prescriptive review
Enriched Air Dive 1
Practical Application 2
Enriched Air Diver Exam
Enriched Air Dive 2

Predive Simulation Sequences

Knowledge Development (with manual and video, or online)
Prescriptive review
Practical Application 1
Predive Simulation Exercise 1
Practical Application 2
Enriched Air Diver Exam
Predive Simulation Exercise 2

Section Two: Course Outline

I. Knowledge Development

Note

It is recommended that you have students complete foundational knowledge development by reading the PADI Enriched Air Diver Manual *and watching the* Enriched Air Diving *video, or by completing the PADI Enriched Air Diver Course Online. This outline is provided as a reference and as an aid for conducting prescriptive reviews. You may also use it to guide formal classroom presentations when required, such as when the materials and online course are not available in a language the student understands. It is written in a presentation format for that purpose.*

A. Introductions

1. [Introduce yourself and course assistants]
2. [Have students introduce themselves and talk about their diving interests. Encourage a relaxed, informal atmosphere.]

B. Course Goals

The goals of this program are:

1. To enable you to plan and make no decompression dives using an enriched air compatible diver computer and primarily enriched air nitrox blends containing 22 to 40 percent oxygen, remaining within accepted computer or dive table and oxygen exposure limits.
2. To enable you to obtain and care for equipment used in enriched air diving.
3. To enable you to manage and avoid possible enriched air hazards.
4. To enable you to use an enriched air compatible dive computer to apply the benefits of enriched air for recreational diving.

C. Course Overview

1. Schedule [Explain the course schedule, including the times and locations for all presentations, practical application sessions, and training dives.]
2. EANx computer dives [Give the details and schedule for the training dives.]
3. Certification
    a. Upon successfully completing this course, you'll receive the PADI Enriched Air Diver specialty certification.
    b. Certification means that you've completed all performance requirements and are trained to:
        1. Make and plan no decompression computer assisted enriched air dives within the oxygen limits you learn in this course, and while using an enriched air compatible dive computer.

2. Purchase or rent cylinders, regulators, EANx computers and other equipment for using enriched air with up to 40 percent oxygen.
3. Obtain fills for appropriate enriched air cylinders to a maximum of 40 percent oxygen.
4. Apply for the PADI Master Scuba Diver rating if you are a PADI Advanced Open Water Diver (or have a qualifying certification from another organization) and a PADI Rescue Diver (or have a qualifying certification from another organization) with certification in four other PADI Specialty ratings and have 50 logged dives.

4. Class requirements
   a. Course costs [explain all costs associated with the course]
   b. Equipment and material requirements [explain what students are expected to provide]
5. Administration

   Have students complete and sign any required paperwork that has not been taken care of.

D. Advantages and Disadvantages of Diving with Enriched Air and Enriched Air Computers.

Learning Objectives

After this discussion, you should be able to answer the following questions:

- **What is "enriched air?"**
- **What is the primary benefit of using enriched air?**
- **How does using enriched air affect no stop limits?**
- **Why is it too simplistic to say enriched air is safer than air when diving well within air no decompression limits?**
- **How does using enriched air affect narcosis when diving?**
- **What are three advantages of using an enriched air dive computer for enriched air diving?**

What is "enriched air"?

1. Definition of enriched air.
   a. Air consists of approximately 79 percent nitrogen and 21 percent oxygen. Enriched air has been enriched with oxygen, so it has more than 21 percent oxygen. Enriched air is any nitrogen/oxygen gas blend with more than 21 percent oxygen.
   b. Enriched air is also often called *nitrox,* which includes nitrogen/oxygen mixes with less than 21 percent oxygen These are used by commercial divers to reduce oxygen exposure when remaining under pressure for days at a time. For clarity, the terms *enriched air* or *enriched air nitrox* are preferred for the gas blends recreational divers use.

c. You'll be learning to use enriched air with from 22 percent to the maximum 40 percent oxygen recommended for recreational diving with an enriched air compatible dive computer. You'll also be introduced to using blends from 41 percent to 60 percent oxygen, which are common in some recreational semiclosed circuit rebreathers.

d. Enriched Air Nitrox is abbreviated EANx, followed by the percent of its oxygen content. For example, EANx36 is 36 percent oxygen, remainder (64 percent) nitrogen. In conversation, you would say "EANx36," "Enriched Air 36," "Enriched Air Nitrox 36" or "Nitrox 36."

e. Much of the training you learn in this course relates to the higher oxygen content. Higher oxygen content poses some possible but readily managed risks related to equipment and fire, and oxygen toxicity in your body.

What is the primary benefit of using enriched air?

2. The primary benefit of enriched air is to extend your no decompression limits beyond those of normal air. This has several advantages:

   a. It extends your allowable bottom time.

   b. It reduces any need to "push" (near) the air no decompression limits.

   c. It reduces your overall nitrogen load from multiple dives.

How does using enriched air affect no stop limits?

3. Enriched air extends your no decompression limits in this way:

   a. Our bodies absorb nitrogen while breathing air under pressure. Enriched air replaces some of the nitrogen you would breathe underwater with oxygen, so you absorb less nitrogen than you would for the same dive breathing normal air. Our bodies metabolize and otherwise absorb the extra oxygen, so within limits, it doesn't pose any DCS problems.

   b. This means you have longer no decompression limits (more no stop dive time) for a given depth than you do using air. How much longer depends on how much oxygen is in the enriched air. Some examples comparing the no stop times for various depths with air, EANx32 and EANx36 (based on the RDP decompression model).

Depth	Air NoD limit	EANx32 NoD limit	EANx36 NoD limit
18 metres	56 min	95min	125 min
22 metres	37 min	60min	70 min
50 feet	80 min	155 min	220 min
80 feet	30 min	45 min	55 min

c. Diving with an EANx computer, the increase in useable no stop time tends to be even greater because your computer credits you for slower nitrogen absorption when you ascend to a shallower depth. Ascending to a shallower depth (multilevel profile) rather than spending the entire dive at the same depth is typical in many recreational diving situations.

d. Based on U.S. National Oceanic and Atmospheric Administration (NOAA) tests, U.S. Navy tests dating back more than 50 years, and 20 years field experience by scientific divers, plus field experience in hundreds of thousands of dives, the no decompression limits for enriched air are considered as reliable as those used in normal air tables and dive computers.

e. Although enriched air reduces your exposure to nitrogen, it increases your exposure to oxygen, which has its own concerns. Fortunately, your EANx dive computer simplifies managing oxygen exposure, which you'll learn more about shortly.

f. Depending upon the dive depth and your breathing rate, you may still find dives limited by your enriched air supply rather than no decompression limits.

   1. For single dives, you'll probably find enriched air's extended no stop times most beneficial in the 18 metre/60 foot to 30 metre/100 foot range. Shallower, the dive is usually limited by air supply, not no decompression time.

   2. However, making *repetitive* dives, you'll find enriched air often substantially increases your dive time.

Why is it too simplistic to say enriched air is safer than air when diving well within air no decompression limits?

4. Because you absorb less nitrogen using enriched air, you might expect that using enriched air within normal air no decompression limits would substantially improve your safety. However, it's too simplistic to say that enriched air is "safer" than air because it overlooks at least two important issues.

   a. As just mentioned, higher oxygen levels create a potential hazard that hardly exists in air diving. It's easy to manage your oxygen exposure, but it undeniably adds a bit of risk that doesn't exist with air.

   b. The decompression illness (DCI) incidence rate is already so low that it is unlikely that simply reducing nitrogen can produce a *meaningful* risk reduction.

   c. Used properly, both air and enriched air have impressive safety records. but it wouldn't be accurate to say one is "safer" than the other.

   d. Safety stops, avoiding factors that predispose you to DCI (such as dehydration, smoking, excessive alcohol consumption), staying well within limits and following other safe diving practices are the most effective ways of making a meaningful reduction in your DCI risk.

e. Since conservative dive practices call for staying *well within* limits, make your dives with your computer *always* showing an ample margin before your reach a no stop limit.

f. Some divers claim they feel better after a dive with enriched air. It is probably a psychological effect more than any real physical benefit.

How does using enriched air affect narcosis when diving?

5. Enriched air and narcosis

   a. Although enriched air has less nitrogen than air does, it is not thought to reduce narcosis compared to air.

   b. This is because in theory and in test dives, oxygen has been found to be about as narcotic as nitrogen.

   c. The current thinking then, is that air and enriched air have about the same potential for narcosis. Plan your dive accounting for narcosis just as you would using air.

What are three advantages of using an enriched air dive computer for enriched air diving?

6. Although you can dive enriched air nitrox with special tables, today most divers use EANx compatible dive computers. These computers offer three important advantages:

   a. They combine the advantages of enriched air with multilevel diving for the most no stop time possible, especially when making two or more repetitive dives.

   b. Most models will or can be set to alert you if you accidentally exceed the maximum depth for your gas blend (more about maximum limits shortly).

   c. They simplify diving planning and execution by calculating both your oxygen exposure and your allowable no stop time, and warn you if you near the limits of either.

E. Equipment for Enriched Air Diving

Learning Objectives

After this discussion, you should be able to answer the following questions:

- **What is the primary concern regarding enriched air and scuba equipment?**
- **What are the requirements and recommendations for scuba equipment (other than cylinders) used with enriched air with up to 40 percent oxygen?**
- **Why does enriched air diving require a dedicated cylinder?**
- **What color coding, stickers (decals) and tags should an enriched air cylinder have?**
- **What are the two primary concerns associated with filling enriched air cylinders, and how are they avoided?**
- **Why should only qualified, reputable enriched air blenders fill enriched air cylinders?**
- **What is the potential hazard of improper enriched air filling procedures?**
- **What should you do if an enriched air cylinder or oxygen-service equipment is used with standard compressed air?**
- **How do you identify qualified enriched air blenders and enriched air service?**
- **What are the two most commonly used blends of enriched air?**

What is the primary concern regarding enriched air and scuba equipment?

What are the requirements and recommendations for scuba equipment (other than cylinders) used with enriched air with up to 40 percent oxygen?

1. The primary concern regarding enriched air and dive equipment is the potential for fire when in contact with a gas blend that has a high oxygen content. Pure oxygen and high oxygen mixes can cause materials to burn more readily, even at normal temperatures. This raises the risk of combustion. High oxygen content may also cause equipment to deteriorate rapidly. To manage this concern, apply the following guidelines to all scuba equipment you will use with enriched air nitrox, except the cylinder.
    a. The common guideline in diving is that standard scuba regulators, BCDs, SPGs and alternate air sources may be used for enriched air blends up to 40 percent. This guideline, originally based on recommendations, standards and field experience by NOAA, the US Navy and the U.S. National Institute of Safety and Health, has been in use by thousands of divers for more than a decade with a good record.

        However:

        1. Some areas have laws and regulations that require some or all equipment used with enriched air be cleaned to *oxygen service* specifications. This means it has been cleaned, lubricated and otherwise prepared to the standard required for use with pure oxygen.

2. Local practice may include markings or tags indicating that the equipment has been serviced for enriched air use and/or to oxygen service specifications.
3. Most scuba equipment manufacturers have recommendations and/or specific modifications for using their equipment with enriched air. Some state that their equipment shouldn't be used for enriched air.
4. In some areas, such as Europe, standards or regulations require a special valve and regulator on enriched air equipment (M26x2). A standard air regulator will not fit on such enriched air cylinders, and the enriched air regulators will not fit on standard air cylinders.

b. Gas mixes with more than 40 percent oxygen (more common in technical diving and with recreational semiclosed circuit rebreathers) *require* the equipment to meet oxygen service specifications in all cases.

c. Use of oxygen compatible lubricants, o-rings and other materials during servicing is generally recommended.

d. Equipment should be serviced at least annually, preferably by a scuba technician qualified to work on enriched air equipment, and/or as specified by the manufacturer. Have your equipment inspected and recleaned (if necessary) if it is exposed to anything other than water (such as oil, lubricants not recommended by the manufacturer, etc.) between annual servicing.

Why does enriched air diving require a dedicated cylinder?

What color coding, stickers (decals) and tags should an enriched air cylinder have?

2. Enriched air cylinders
   a. Enriched air requires a cylinder dedicated specifically to use with enriched air for two reasons:
      1. For safety, it's important that no one accidentally confuse an enriched air cylinder for a standard air cylinder. The cylinder must be clearly marked (more about markings in a moment).
      2. One method of blending enriched air requires putting pure oxygen in the cylinder. This is called partial pressure blending. If *partial pressure blending* with pure oxygen will be used, the cylinder and valve must meet oxygen service standards even when the final enriched air blend will have less than 40 percent oxygen.

   b. Enriched air cylinders have standardized stickers and/or tags and color coding generally agreed upon and accepted by the broad international dive community. These markings assure that you can readily identify an enriched air cylinder, determine its contents, and determine whether the cylinder can be used for partial pressure blending [It's recommended that you have examples of the following to show students during this discussion.]:
      1. Yellow cylinders should have a 10 centimetre/4 inch green band around the cylinder shoulder with yellow or white lettering reading Enriched Air, Enriched Air Nitrox, Nitrox, or a similar designation.

2. Nonyellow cylinders should have a 15 centimetre/6 inch band around the cylinder shoulder. The top and bottom of this band should be a yellow 2.5 centimetre/ 1 inch band, with the center 10 centimetres/4 inches green. The green portion should have yellow or white lettering reading Enriched Air, Enriched Air Nitrox, Nitrox, or a similar designation.
3. Enriched air cylinders should have a dated visual inspection sticker (decal) as would a standard air cylinder.
4. The cylinder should have a sticker (decal) or stamp stating that the cylinder does or does not meet oxygen service standards. (Sometimes this is part of the visual inspection sticker, but more commonly it is a separate decal because visual inspection and oxygen service are separate maintenance issues.)
5. Enriched air cylinders should have a contents sticker (decal) or permanent tag.
    a. This sticker/tag should, at a minimum, list the oxygen content of the blend the cylinder currently holds, the fill date, the maximum depth for the blend, and the name of the person who analyzed the oxygen content to verify the blender's analysis (this should be the diver who will use the cylinder).
    b. Stickers are replaced and tags rewritten when you have the cylinder refilled. Do not remove the sticker or erase the tag after using the cylinder (the blender will do this when you have the cylinder refilled).
    c. If a permanent tag is used, the cylinder's serial number is often on it to prevent accidentally getting switched to another cylinder.
6. Although these are the broadly accepted markings, in some areas local laws and regulations set differing or additional requirements. Some areas have recommendations or requirements that an enriched air cylinder be used within a given period, such as within 30 days of filling, and that the cylinder be marked accordingly. In other areas, standard air cylinders are stamped AIR ONLY, highlighting the need for a dedicated EANx cylinder.
    a. In Europe, for example, EANx cylinders have a white shoulder with a black stripe; generally the rest of the entire cylinder is white.
    b. [Describe any enriched air cylinder markings, configurations or needs unique to the local area.]

What are the two primary concerns associated with filling enriched air cylinders, and how are they avoided?

Why should only qualified, reputable enriched air blenders fill enriched air cylinders?

3. Filling enriched air cylinders
    a. There are two primary concerns associated with filling enriched air cylinders.
        1. Fire/explosion hazard. Some substances readily burn or combust in the presence of high oxygen concentrations. This includes trace hydrocarbons (lubricants) that may be found in standard compressed air.

a. Trace lubricants may accumulate over time in a compressed air cylinder, raising the potential for fire or explosion hazard if the cylinder is exposed to high oxygen percentages.

Standard compressed air from a conventional fill station should never be put into an enriched air cylinder. Enriched air should never be put into a conventional scuba cylinder.

2. Percentage of oxygen in the blend. The amount of oxygen in an enriched air blend affects your no decompression time and oxygen exposure.
   a. If the percent of oxygen varies by more than one (1) percent from your desired blend, your oxygen exposure, the maximum allowable dive depth and no decompression limits will be affected (more about this later). Your computer will adjust, but this may affect the dive you had planned.
   b. Blending must be done accurately, with the gas properly analyzed by the blender, and then by you.

b. To manage these concerns, enriched air cylinders should only be filled by reputable, qualified enriched air blenders.
   1. Qualified blenders have the proper equipment for producing oxygen compatible air and minimizing contamination of equipment that must remain in oxygen service and/or enriched air service.
   2. Qualified blenders have the special training required to produce enriched air blends and confirm their accuracy.
   3. Qualified blenders follow the operational procedures and maintain the records necessary when you obtain a fill.
   4. You'll learn more about qualified blenders shortly.

What is the potential hazard of improper enriched air filling procedures?

What should you do if an enriched air cylinder or oxygen-service equipment is used with standard compressed air?

4. Attempting to blend enriched air without following proper filling procedures can be hazardous because it raises the risk of fire/combustion.
   a. Trace lubricants in standard compressed air pose a combustion risk in the presence of pure oxygen. Putting pure oxygen in a standard cylinder and/or filling it from a conventional scuba air fill station in an attempt to make enriched air presents a high fire/explosion hazard.
   b. Therefore, never fill an enriched air cylinder that's cleaned and serviced for oxygen service with standard compressed air.
   c. If an enriched air cylinder, or any oxygen service rated equipment, is accidentally used with standard compressed air, or an enriched air fill system that is not oxygen clean, it must be serviced and cleaned by to oxygen service standards before being exposed again to more than 40 percent oxygen. Failure to service and clean it poses the hazards of explosion or fire.

d. To use air in an oxygen service rated enriched air cylinder, have it filled with oxygen compatible air by a qualified enriched air blender. The fill is treated as enriched air in all respects, including marking it as EANx21 — enriched air with 21 percent oxygen — analyzing the contents and completing all records.

e. Enriched air cylinders that are not oxygen service rated may be used for premixed enriched air blends with up to 40 percent oxygen only. They may be filled from standard air sources by a qualified enriched air blender (it will be labeled as EANx21), but should *never* have pure oxygen or enriched air with more than 40 percent oxygen put into them at any time.

How do you identify qualified enriched air blenders and enriched air service?

5. You can identify qualified enriched air blenders and service by checking the following:

   a. Gas quality verification — The operation should be able to show regular analysis of the air it uses for enriched air blending. This air should meet local standards for oxygen compatible air.

   b. Proper procedures, cylinder markings, analysis and record keeping — A lack of these may indicate that the operation isn't qualified or prepared to properly support enriched air diving.

   c. Documentation — The operation and/or individuals working there should be able to show evidence of training, such as the DSAT Gas Blender certification, and/or credentials from another institution like the Compressed Gas Association, government agencies such as NOAA or other recognized public or private bodies. [Tell students about credentials relevant to enriched air blending and service in the local areas.]

What are the two most commonly used blends of enriched air?

6. Common enriched air blends

   a. Although this course qualifies you to use enriched air blends with 22 to 40 percent oxygen, there are two standard blends you'll use most of the time: EANx32 and EANx36.

   b. These were first put into common use by NOAA in the US. Many enriched air fill stations store these because of their utility and popularity within recreational diving.

   c. If you request a blend other than EANx32 or 36, you may have to wait for the blend to be made. Some enriched air stations supply only EANx32 and 36.

F. Oxygen Exposure

Learning Objectives

After this discussion, you should be able to answer the following questions:

- **What is meant by oxygen partial pressure?**
- **How does exposure to increased oxygen partial pressure affect allowable dive time?**
- **What are the maximum and contingency oxygen partial pressure limits?**
- **What is the primary hazard of exceeding the oxygen exposure limits?**
- **What six signs and symptoms may precede a convulsion caused by oxygen toxicity?**
- **What should you do if you experience any symptoms of oxygen toxicity?**
- **How do you use an EANx compatible dive computer to manage oxygen exposure and remain within accepted limits?**
- **What should you do if you accidentally exceed the oxygen exposure limits for your computer?**

1. Diving with air within recreational diving limits, oxygen exposure is not an issue. Due to its higher oxygen content, with enriched air it can be a significant issue. You must use your dive computer to control your oxygen exposure to remain within accepted limits.

What is meant by oxygen partial pressure?

How does exposure to increased oxygen partial pressure affect allowable dive time?

What are the maximum and contingency oxygen partial pressure limits?

2. Oxygen partial pressure
    a. You measure the concentration of oxygen you're breathing with an enriched air blend at various depths as oxygen partial pressure. Oxygen partial pressure refers to the pressure exerted by the oxygen part of the gas, not the nitrogen part, hence the name *partial* pressure.
    b. Partial pressure is usually expressed in atmospheres, usually abbreviated *ata* for atmospheres absolute, or as *bar.*
        1. As you recall, an atmosphere is equal to the pressure of the air surrounding us at sea level.
        2. Oxygen partial pressure is sometimes abbreviated PO_2, or O_2 p.p., so you might see a reference, for example, of PO_2 0.21 ata.
        3. Although there is a slightly technical difference, for diving purposes 1 bar and 1 atmosphere are considered equal.

Note to instructor

Depending upon the students' certification levels and experience, you may wish to review the basic discussion on pressure and atmospheres from Section One of the Open Water Diver course.

c. Mathematically, you determine the oxygen partial pressure by multiplying the percent of oxygen in the enriched air times the depth pressure in atmospheres (bar) absolute. The deeper you dive, and the more oxygen in your enriched air blend, the higher the oxygen partial pressure.

   1. For example, if you dive to 10 metres/33 feet using EANx40, what is the partial pressure? At 10 metres/33 feet, the pressure is 2 bar/atmospheres, (1 of air and 1 of water). 40 percent oxygen x 2 ata = 0.80 ata or bar oxygen partial pressure.
   2. Don't worry – you're not going to be doing a lot of math because your dive computer does this for you. But, you need to understand where oxygen partial pressure numbers come from and what they mean because they are the basis for oxygen exposure limits.

d. The high oxygen partial pressures you experience with enriched air must be kept within limits to avoid oxygen toxicity, which can be a serious hazard. The higher the partial pressure, the less time you can safely be exposed to it.

   1. Your EANx dive computer will track your oxygen exposure much as it tracks your remaining no stop time.
   2. Stay within the oxygen exposure limits your computer displays during the dive as well as within the no stop dive limits it provides.

e. Oxygen exposure is based on partial pressure, not depth. In the previous example, the oxygen partial pressure is .80 ata at 10 metres/33 feet using EANx40. Using EANx36, you have the same partial pressure (.80 ata/bar) at 12 metres/40 feet. Your oxygen exposure is the *same* for both dives.

f. The maximum oxygen partial pressure for enriched air diving is 1.4 ata/bar. You will learn to plan your dives so that you do not exceed the depth at which a given EANx blend reaches 1.4 ata/bar.

   1. 1.4 ata is the maximum because it keeps you well within established oxygen limits appropriate for recreational diving. Planning your dive within 1.4 ata/bar partial pressure also gives you a margin for error.
   2. Some evidence suggests that as oxygen partial pressure exceeds the 1.3 to 1.4 ata/bar range, oxygen may begin to act like nitrogen with respect to bubble formation. Staying within 1.4 partial pressure reduces the likelihood of problems with this. Some individuals retain carbon dioxide, which may contribute to oxygen toxicity, and tests show a 1.4 ata/bar limit reduces the concern with this.

3. If your planned dive depth would exceed 1.4, either switch to an enriched air blend with less oxygen, or plan a shallower dive. The higher the oxygen content, the shallower the depth at which you reach 1.4. (More about this later.)

g. The *contingency* oxygen partial pressure limit is 1.6 ata/bar. Avoid planning dives with a partial pressure this high, because there is no room for error. Partial pressures between 1.4 and 1.6 should be considered a margin for error only. Divers have had oxygen toxicity near 1.6 while exerting themselves.

h. Set your computer so the maximum oxygen partial pressure it allows is 1.4. Most computers will let you do this or are preset for this limit. Almost all models alert you if you exceed the limit you set. Some computers display your current PO_2 throughout the dive, whereas others only alert you if you exceed the maximum. Your instructor and/or the manufacturer literature can give you specifics on the settings and warnings for your specific computer.

i. Exceeding accepted safe oxygen limits either by going to a depth that exceeds 1.4 with the blend you're using, and/or by disregarding the oxygen exposure limits provided by your computer, poses an unnecessary risk of *oxygen toxicity.*

What is the primary hazard of exceeding the oxygen exposure limits?

What six signs and symptoms may precede a convulsion caused by oxygen toxicity?

What should you do if you experience any symptoms of oxygen toxicity?

3. Oxygen toxicity

a. Exceeding oxygen limits can cause central nervous system oxygen toxicity (CNS toxicity).

b. CNS toxicity may cause a diver to convulse. Convulsions are not usually harmful in themselves, but underwater the diver is almost certain to lose the regulator and drown. This is the primary serious hazard of exceeding oxygen limits — a fatal accident.

c. Warning signs and symptoms may precede a CNS convulsion, but most of the time, CNS convulsions occur without warning. If they occur, signs and symptoms don't typically appear instantly. They usually appear gradually and worsen over time.

d. Warning signs and symptoms, if they do occur, include:

1. visual disturbances, including tunnel vision
2. ears ringing
3. nausea
4. twitching or muscle spasms, especially in the face
5. irritability, restlessness, euphoria or anxiety
6. dizziness

Some divers remember these by remembering VENTID — vision, ears, nausea, twitching, irritability and dizziness.

e. If you experience any of these symptoms, end the dive by beginning a *normal* ascent immediately. There is no need for a rapid or panicked ascent; just start up immediately at a normal, safe rate.

f. During a penetration dive, ascending immediately may not be possible; abort the dive and ascend as soon as possible. For recreational penetration dives, it's best to keep your oxygen partial pressure very low, or to simply use air.

g. Heavy exercise is thought to predispose you to CNS toxicity, and should be avoided, especially if you near or will near oxygen exposure limits. This is especially a concern if your dive accidentally exceeds 1.4 ata/bar. Again, staying *well within* limits gives you a margin for error and reduces your risk. If you find yourself exerting heavily, stop and rest, or even end the dive if necessary.

h. Some drugs, including the decongestant pseudoephedrine (found in Sudafed™ and other products), are CNS exciters and may predispose you to CNS toxicity. It's generally recommended that divers avoid decongestants when diving anyway (because they may wear off during the dive, leading to a reverse block). If you're taking a prescription, be sure to consult with a physician knowledgeable in diving medicine before using the drug while diving (with air or enriched air).

i. Carbon dioxide accumulation in the body is thought to predispose you to oxygen toxicity. It's important to breathe continuously (do not skip breathe) to avoid retaining carbon dioxide. If you experience headaches after a dive, as a precaution, consult a physician familiar with diving to make sure you don't retain carbon dioxide.

j. It is easy to manage oxygen exposure by staying well within the limits of your EANx dive computer and by planning your dives so you're well within the 1.4 partial pressure limit. Enriched air diving within these limits has an excellent safety record. But, you should be aware that failing to stay within oxygen limits can be life threatening.

Note to student

Because people vary in their physiology, no dive table or dive computer can guarantee that oxygen toxicity will not occur, even within accepted limits. Oxygen is a very unforgiving gas. Oxygen toxicity convulsions underwater on scuba can cause you to drown! Dive well within oxygen limits.

k. You may also hear references to *pulmonary* oxygen toxicity, which results from effects to the lungs due to prolonged exposure to high-oxygen partial pressures.

   1. Exposures of several hours long are necessary to develop pulmonary oxygen toxicity, and are *highly unlikely* when making enriched air no stop recreational dives within your computer limits.

   2. Symptoms include burning in the throat and chest, coughing and shortness of breath.

3. Pulmonary oxygen toxicity is more of a concern in technical and commercial dives that require long decompression stops using pure or high amounts of oxygen (50 percent or more).
4. Nonetheless, you should discontinue diving for a few days if you experience symptoms that could indicate pulmonary oxygen toxicity; symptoms normally resolve quickly, though you should consult a physician if symptoms are severe or prolonged.

How do you use an EANx compatible dive computer to manage oxygen exposure and remain within accepted limits?

What should you do if you accidentally exceed the oxygen exposure limits for your computer?

4. Managing Oxygen Exposure
   a. Your dive computer will assist you in managing oxygen exposure.
   b. Set you dive computer for a maximum oxygen partial pressure of 1.4 ata/bar. (Your instructor and/or the manufacturer instructions can explain how to do this with your specific model. This is usually something you only do once.)
   c. Set the computer for the EANx blend you are using for the dive. (More about this shortly).
   d. Activate your computer's scroll mode. The computer will show you the no decompression limits for depth in progressive increments (3 metres/10 feet typically). With most models, the deepest depth displayed is the deepest depth you can reach without exceeding 1.4 ata/bar. (Some models display this based on 1.6 ata/bar, in which case use the table below to find the maximum depth.)
      1. Besides scroll mode, some models display the maximum depth when you set the blend.
      2. See the manufacturer's instructions for specifics for the computer you're using.
      3. Regardless of how it's displayed, note this depth, because exceeding it would take your oxygen partial pressure above 1.4 and pose a serious risk of oxygen toxicity.
   e. Your EANx dive computer tracks your oxygen exposure, including surface interval credit, throughout the diving day much as it tracks your exposure to nitrogen. See your instructor and/or the manufacturer literature for specifics on how it determines and displays limits and remaining dive times.
      1. For repetitive dives, in scroll mode many computers show you either the no decompression limit or the oxygen exposure time remaining – whichever is shorter (usually no decompression limit)
      2. Many computers also display your oxygen exposure status as a graph or other indicator is surface mode.

3. In recreational, no decompression diving, oxygen exposure rarely limits you unless you spend a lot of time at a depth near the 1.4 bar/ata PO_2 limit. Nonetheless, you need to monitor your exposure because it can limit your dive.

Maximum and Contingency Depth Table

Blend	Maximum Depth (1.4)	Contingency Depth (1.6)
29%	38 m/126 ft	45 m/149 ft
30%	37 m/121 ft	43 m/143 ft
31%	35 m/116 ft	42 m/137 ft
32%	34 m/111 ft	40 m/132 ft
33%	32 m/107 ft	38 m/127 ft
34%	31 m/103 ft	37 m/122 ft
35%	30 m/99 ft	36 m/118 ft
36%	29 m/95 ft	34 m/114 ft
37%	28 m/92 ft	33 m/110 ft
38%	27 m/89 ft	32 m/106 ft
39%	26 m/85 ft	31m/102 ft
40%	25 m/83 ft	30 m/99 ft

Note: Blends with 28% oxygen or less are not shown because they have maximum depths deeper than the 40 metre/130 foot depth limit for recreational diving.

f. It's recommended that you have a surface interval of at least one hour between enriched air dives whenever possible, especially if you exceed more than 50 percent of your computer's allowable exposure. This is believed to further reduce the likelihood of oxygen toxicity.

g. If your planned dives may cause you to approach or exceed oxygen exposure limits, switch to an enriched air with less oxygen and/or plan your dives to shallower depths.

h. If you accidentally exceed the maximum oxygen exposure limits for your computer, ascend slowly, make a safety stop and end the dive. Do not dive for 24 hours, or as stipulated by the computer manufacturer.

Note: Logging oxygen exposure.

Because different computers display oxygen exposure differently, logging oxygen exposure after a dive depends upon the dive computer. Some display percent of oxygen exposure used, and some show simple bars on a graph. Therefore, the exposure to record in your logbook may be precise, or more general based upon how the computer provides the information.

G. Oxygen Analysis and Obtaining Enriched Air Fills

Learning objectives.

After this discussion, you should be able to answer the following questions:

- **Who must personally verify the analysis of the oxygen content in an enriched air cylinder before it is used?**
- **What are the procedures for analyzing enriched air?**
- **What is the standard of practice for the accuracy of enriched air analysis?**
- **What cylinder marking should you check to compare your analysis against?**

1. Present your PADI Enriched Air Diver certification to the blending station and choose the enriched air blend you would like to use (availability may vary). You next confirm the percentage of oxygen and nitrogen in the blend.
   a. You need to know this to set your EANx compatible computer for the oxygen content.
   b. You must tell the computer the correct percentage of oxygen for it to be able to calculate your oxygen exposure, no stop limits and emergency decompression (should it be required).

Who must personally verify the analysis of the oxygen content in an enriched air cylinder before it is used?

2. Enriched air is analyzed by the blender after blending. Nonetheless, the diver who will be using a cylinder of enriched air must also *personally* verify the oxygen analysis of the cylinder.
   a. Normally, this means that you will analyze the cylinder contents yourself using an oxygen analyzer.
   b. In some instances, another qualified person may perform the analysis with you watching and reading the oxygen content from the analyzer personally.
   c. Do not dive with a cylinder of enriched air if you have not *personally* verified its contents. There are *no* exceptions.
      1. If the cylinder contains an enriched air blend different from what you believe it to be, you may face a substantial risk of DCS or drowning (due to oxygen toxicity).
      2. Personally checking is an important safety principle that reduces risk by providing a double check of the initial analysis, verifying that the cylinder has been correctly marked as containing that blend, and confirming that the cylinder wasn't accidentally confused with another.

3. Remember that it's your personal safety on the line. Know what gas blend you're diving.

d. It's important to avoid the possibility that someone else uses and refills an enriched air cylinder without your knowledge, or that the cylinder you analyzed isn't accidentally confused with another, between your analysis and when you dive.

1. Keep the cylinder some place where it won't accidentally be used by someone else.
2. If there's ever any doubt or question about the cylinder's contents, or whether cylinders may have been confused, reanalyze the contents.
3. It's a good practice to reanalyze your cylinder contents just before the dive, even if you analyzed it earlier.

What are the procedures for analyzing enriched air?

What is the standard of practice for the accuracy of enriched air analysis?

3. Analyzing enriched air.

a. Oxygen analyzers differ from make to make in their use, so consult the manufacturer's instructions. A suitable analyzer should read in increments of .1% (a tenth of a percent) or less.

b. However, the following steps generally apply to using all oxygen analyzers:

1. Always begin by calibrating the analyzer, and recalibrate the analyzer any time it has been turned off and then back on. When possible, it is best to calibrate the analyzer using 100 percent oxygen as well as air, and/or a known enriched air blend, but you can also calibrate using air only with most analyzers and have sufficient accuracy. Adjust the analyzer (see manufacturer guidelines) to read 20.8 percent to 21 percent oxygen while reading air. (Check the manufacturer specifications for calibrating the particular analyzer.)
2. The flow into the analyzer must be the same for the enriched air as for the calibrating air.

a. Too high a flow may make the analyzer read too high an oxygen figure. For most analyzers, the flow rate should be less than four litres per minute.

b. For some analyzers, you open the cylinder valve slightly and allow the gas to flow through. Others use flow restrictors that connect to the low pressure hose on your regulator for greater accuracy.

c. It is best to calibrate from a cylinder of compressed air, though it is acceptable to calibrate some analyzers using the surrounding ambient air (follow manufacturer guidelines).

d. Don't recalibrate the analyzer using room air if you've been analyzing a lot of cylinders indoors because there may be residual oxygen around the sensor. Humidity can also affect analyzer readings. If you've been analyzing several cylinders or in a highly humid area, calibrate using a cylinder of compressed air.

3. After calibrating, flow enriched air through the analyzer at the same rate (a substantially different rate may reduce the accuracy of the analysis.) The analyzer displays the percentage of oxygen, usually to a tenth of a percent (e.g. 32.1%)

> **Note**
> *It's recommended that you open enriched air cylinder valves slowly. This avoids the heat associated with rapid pressure change, and helps further minimize potential fire concerns.*

   a. Enriched air partial pressure blended in your cylinder may need time to mix evenly before analyzing (depends upon blending method). You can speed this process by rolling the cylinder back and forth. Premixed EANx and other blending methods don't require waiting. Consult the blender if you have any questions about whether the blend is ready to be analyzed.
   b. Store the analyzer in the driest environment possible because moisture affects the accuracy of the analysis. Don't blow into the sensor because your breath has moisture.
   c. The analyzer sensor uses a consumable chemical and must be replaced periodically. Sensors last one to five years, but should be replaced even sooner if the analyzer fails to perform within given tolerances (see manufacturer literature). Sensors may last longer when stored in sealed plastic bags.
   d. If in doubt about analyzer accuracy for any reason, compare the unit against one or more other units known to be accurate and/or against a known gas blend; consult the manufacturer as necessary. Don't use an analyzer with doubtful accuracy.

4. Required accuracy.
   a. The standard of practice for enriched air analysis is plus or minus 1 percent. Minor variations (less than 1 percent) between the blender's analysis and yours are normal, but a substantial variation should be confirmed by using another analyzer.
   b. Most enriched air computers use 1 percent increments. Round up or down to the closest whole percent (e.g., round 31.2 percent to 31 percent and 31.8 percent to 32 percent), unless the computer manufacturer literature has a different recommendation.

What cylinder marking should you check to compare your analysis against?

4. After analyzing the blend, follow these steps:
   a. Confirm that your name, the actual gas blend analysis (yours) and the blend's maximum depth are marked correctly on the cylinder contents sticker or tag.
   b. Sign the dive operation's enriched air fill log, which typically lists the cylinder number, the gas blend, the blend's maximum depth and your name. (If the

operation brings the cylinders to the dive site for you, they will usually have a fill log to sign with them.)

c. Secure the cylinder where it will not be confused with other divers' cylinders.

d. After the dive, leave the contents sticker or tag in place. The blender uses this to confirm the residual blend inside, and will replace these. It's acceptable to write "used" or "empty" on the sticker or tag, however.

5. Different areas and dive operations may have some variations on analysis procedures. To summarize, though, the key points are:

   a. Be sure you *personally* verify the oxygen analysis of the enriched air blend.

   b. Set your EANx computer to the closest 1 percent (unless the manufacturer states otherwise).

   c. Be sure the cylinder is marked with your name, the EANx blend and blend's maximum depth.

H. Guidelines for Diving with Enriched Air Dive Computers

Learning Objectives

After this discussion, you should be able to answer the following questions:

- **What four guidelines apply to diving with an enriched air dive computer?**
- **How do you set your enriched air dive computer?**
- **What happens if you forget to set your enriched air computer before a dive?**
- **What should you do if your enriched air dive computer fails during a dive?**

What four guidelines apply to diving with an enriched air dive computer?

1. When diving an enriched air dive computer, follow these guidelines:

   a. Know the EANx blend's maximum depth and stay shallower by watching the depth display. Remember to plan your dive, and dive your plan. Use the maximum depth warning as a secondary alert.

   b. As you already learned as an Open Water Diver, stay well within limits. With EANx, this means the no stop and oxygen exposure limits. Watch both the no stop and oxygen exposure displays on your computer. If you begin to near a limit, ascend until your computer displays a longer limit. Stay that shallow or shallower for the rest of the dive.

   c. Each diver should have an individual enriched air dive computer set for the blend the diver is using. Variations in depths as well as any variations in the blends will result in differences in the no stop times and oxygen exposure the computers calculate. As you would when diving air, stay within the limits of whichever buddy's computer gives the most conservative readings.

   d. Make safety stops and follow all other conservative safe diving practices.

How do you set your enriched air dive computer?

What happens if you forget to set your enriched air computer before a dive?

2. As previously discussed, before you dive with an enriched air computer, you must set it for the oxygen percentage you found when you analyzed your gas blend.
    a. How you set your computer varies with the model, but is generally a matter of entering a "set" mode and scrolling the blend percentage to the correct number and locking it in. (Your instructor and/or the manufacturer instructions explain how to do this with your specific model. You do this before each dive and you will practice setting your EANx computer as part of this course.)
    b. If you forget to set the blend, some computers will either go into an error mode or default to a worst-case mode that calculates assuming 50 percent (or even 100 percent) oxygen and 79 percent nitrogen (an impossible mix, but yields very conservative numbers). Other computers remain set for the last blend you used until you change it. It's common to dive the same blend for multiple dives and you should reset your computer if you change blend. Keeping the blend set avoids unnecessary resetting when diving the same EANx for multiple dives. Some of these types will go into an error or warning mode if you don't dive for 12 to 24 hours and then forget to set the blend, but not all models.
    c. If set for air, virtually all enriched air computers will stay set for air from one dive to the next without entering the error mode.
    d. See the manufacturer literature for information about setting the enriched air blend and error functions for your particular computer. Remember that failing to have your computer set for the EANx blend raises the risk of DCS or oxygen toxicity.

What should you do if your enriched air dive computer fails during a dive?

3. Dive computers are very reliable, and failures are very rare. Nonetheless, if your computer fails during a dive, immediately ascend, make a safety stop at 5 metres/15 feet for 3 minutes or longer and end the dive.
    a. Some divers wear a backup (second) EANx computer so they can continue diving, even in the unlikely event of a failure.
    b. Another option is to keep a written record of EANx blends, maximum depth, bottom times and surface intervals. If your computer fails (during or between dives), you can use tables to calculate your no stop limits and oxygen exposure for subsequent dives. (Explain to students you can teach them how to use tables if they are interested).
    c. If you weren't wearing a backup computer and tables are not an option, do not dive for at least 12 hours (or longer if specified by the manufacturer) before resuming with a working dive computer or tables.
4. Using an air-only computer with EANx
    a. If you do not have an enriched air compatible computer, you can still dive EANx using an air-only computer.

b. Stay within the computer limits as you would breathing air. The advantage of enriched air in this situation that you can get closer to the computer's no stop limits and not be "pushing" them (though you should still stay reasonably *within* limits and not dive to them).

c. Air-only computers do not track your oxygen exposure. You can accommodate this one of two ways:

   1. Use the DSAT Equivalent Air Depth and Oxygen Exposure Tables to determine your maximum depth for the blend and to track your oxygen exposure based on the maximum depth you reach during each dive. [Explain to students that you can teach them to use these tables if they're interested.]
   2. Alternatively, you keep your oxygen exposure within accepted limits and stay above the maximum depth if you:
      - Use an EANx blend with 32% or less oxygen.
      - Limit your depth to 30 metres/100 feet.
      - Stay within your computer's no decompression limits.
      - Limit your total dive time for the entire day to 160 minutes.

d. Option 2 is obviously more limiting than Option 1, but far simpler to apply and adequate for many diving situations.

I. Diving emergencies and enriched air.

Learning Objectives

After this discussion, you should be able to answer the following questions:

- **What action should you take if a diver convulses underwater?**
- **What action should you take if a diver is suspected of having decompression illness after a dive using enriched air?**

What action should you take if a diver convulses underwater?

1. If a diver convulses underwater (due to oxygen toxicity or for any other reason), the generally recommended action is to handle the emergency as you would for an unresponsive diver underwater.
   a. Hold the diver's mouthpiece in (if still retained). Do not attempt to replace it if it is out of the diver's mouth.
   b. Immediately surface the diver, establish ample positive buoyancy for yourself and the victim, and check for breathing.

c. Call for assistance as needed and available and begin inwater rescue breaths if the victim isn't breathing. Take the diver to the boat or shore, and help remove the diver from the water.

d. Once out of the water, check for a heart beat and breathing. If they're absent, begin/continue rescue breaths and/or CPR. In any case, contact emergency medical care. If the diver is breathing, begin first aid for DCI as a precaution.

e. Even if apparently fully recovered, the diver should be examined by a physician.

f. This recommendation is based on the U.S. Navy procedures, which the Divers Alert Network defers to in this situation because there's been little study of this in recreational diving.

g. Some experts recommend that if a diver's mouthpiece is in place, to hold it there and begin the ascent only after the convulsion subsides. After the convulsion ends, bring the diver immediately to the surface. This recommendation is based on the possibility that a convulsing diver may hold his breath.

h. In any case, the primary concern is getting the diver to the surface to prevent drowning, and so you can begin first aid and get help.

What action should you take if a diver is suspected of having decompression illness after a dive using enriched air?

2. If a diver is suspected of having decompression illness after an enriched air nitrox dive, administer oxygen and first aid, and obtain emergency help exactly as you would if the diver had been diving using air.

   a. If possible, inform emergency personnel and the recompression facility that what the diver's time and depth was, that the diver was using enriched air nitrox, and what the blend was.

   b. In a DCI emergency, if you run out of emergency oxygen before you can get a breathing patient into emergency medical care, have a responsive patient breathe any enriched air available from an appropriate scuba regulator. While not as beneficial as 100 percent oxygen, enriched air has more oxygen than air and may help. It certainly won't hurt.

   c. There is at least one equipment manufacturer that makes a system that allows an unresponsive diver to breathe enriched air from a scuba cylinder should it be necessary after running out of emergency oxygen.

J. Enriched Air Diver Exam

[Administer and grade the final exam. Review any questions missed with students and have them initial the corrections and sign the exam. Students who score less than 75 percent should be counseled and given an opportunity to study before retaking the exam.

Students who complete the PADI Enriched Air Diver Course Online complete the exam online, then complete the Enriched Air Quick Review with you prior to certification.]

Section Three: Practical Applications, Open Water Dives and Predive Simulations

I. Practical Application 1

Performance Requirements

After this session, the student will be able to:

- **Demonstrate how to use an oxygen analyzer to determine the oxygen content in an enriched air blend.**
- **Demonstrate how to verify cylinder content data and sign the fill log.**

A. Practical Application 1 must precede Enriched Air Dive 1.

1. It may be conducted in the field before the dive, or during knowledge development when discussing oxygen analysis. It may also be combined into a single session with Practical Application 2, and conducted while orienting students to obtaining fills at an enriched air blending station. You may also make it part of the predive briefing for Enriched Air Dive1 and have students analyze the actual cylinders they'll be using.

B. After your demonstration and their practice, students should be able to analyze enriched air repeatedly within the accepted one percent tolerance required for enriched air use.

1. Show students how to analyze enriched air with one or more analyzers and flow restrictors (multiple types are recommended, as available).
2. Remind students that the analyzer must be able to read within .1 percent to be used with enriched air.
3. Emphasize calibrating the analyzer with dry air (from a cylinder, not room air in a humid climate), and maintaining the same flow with the enriched air as with the calibrating air to avoid inaccuracy.
4. After your demonstration, have students practice using different analyzer systems (as available) and on different cylinders. All students should *personally* analyze one or more cylinders as well as watch each other.

C. After analysis, have students confirm the information on the contents sticker or tag.

1. Depending upon how you schedule the course, students may not yet have learned to set their computers for EANx and the determine maximum depth.
   a. If this is the case, you may provide them with the maximum depths for their blends.
   b. If conducting Practical Application 1 as part of the predive briefing for Enriched Air Dive 1, you may also use the opportunity to show them how to set their EANx compatible computers maximum oxygen partial pressure, the EANx blend, and how to use the scroll mode to find the maximum depth.
   c. You may show students how to use the DSAT Equivalent Air Depth Table or the Maximum and Contingency Depth Table in the PADI *Enriched Air Diver Manual* to find the maximum depth for their blends.
2. Student divers should also confirm that the cylinder is properly marked in addition to the contents sticker or tag with required color markings, their name and the maximum depth for the blend.

D. Have student divers practice completing and signing an enriched air fill log. Depending upon logistics, these can be practice log sheets (if practicing on cylinders they will not actually be diving) or the actual log (if analyzing the cylinder or cylinders they'll be using for the enriched air training dives).

II. Enriched Air Dive1 or Predive Simulation Exercise

Performance Requirements

By the end of this dive, students should be able to

- **Execute a dive within the no stop limits, maximum depth and oxygen exposure limits established by the instructor during predive planning.**

  or

- **Plan a dive within the no stop limits, maximum depth and oxygen exposure limits established by the instructor.**

A. General Considerations

1. Enriched Air Dive 1 allows student divers to apply the basic concepts you present in the Dive Today briefing or that they learned in more detail in the Knowledge Development Section. The emphasis is on predive planning and making the dive within the limits established during planning and assisted by their dive computers.

2. Assign logistical duties to staff and review emergency protocols.
3. The use of qualified assistants is highly recommended. Assistants can help keep track of buddy teams. An assistant at the surface can help with check-in and check-out procedures and be prepared to help in an emergency.
4. **Following each diver's computer, the planned bottom time and depth should not exceed the no decompression limits, oxygen exposure limits or maximum depth (1.4 ata/bar PO_2) for the blend.**
   a. Certified students may dive with indirect supervision.
   b. The instructor must personally supervise setting the computers and confirm they're set for the correct blend.
   c. Open Water Diver students who are combining Open Water Training Dive 4 with Enriched Air Dive 1 must be directly supervised following the depth limits and ratios of the Open Water Diver course.
   d. You may allow divers to use air-only (not EANx compatible dive) computers for the training dives. (See #9 below.) **However, students must still meet performance requirements by demonstrating how to set and use an enriched air compatible computer for dive planning.**
5. It's preferred, though not absolutely necessary, that divers in each buddy team use approximately the same enriched air blend. This gives them approximately the same limits. Regardless, emphasize that the dive limits must be based on whichever diver nears a limit first – a diver with higher oxygen will have a shallower maximum depth and a diver with lower oxygen will have shorter no stop limits.
6. The combination of multilevel computer diving and enriched air diving means that gas consumption usually ends the dive instead of the no decompression limits. Although students should already be in the habit of watching their SPGs, it's doesn't hurt to remind them to monitor their cylinder pressures, not just no decompression times.
7. **You must present the Dive Today briefing for Open Water Diver students, and for certified divers who have not completed the Knowledge Development Section.**
8. **Practical Application 1 must precede Enriched Air Dive 1.** In Dive Today situations, this is easily accomplished by making Practical Application 1 part of the briefing and dive planning as student divers analyze their gas for the dive.
9. **If students will dive using air-only computers, the maximum allowable oxygen content is 32%, the maximum depth is 30 metres/100 feet (or shallower if a shallower limit applies) and their total dive time for the day may not exceed 160 minutes.**

B. Dive Today Briefing.

1. The Dive Today briefing provides the basic information necessary for divers to make a supervised recreational enriched air nitrox dive using an EANx dive computer prior to completing the course knowledge development. If students have not completed the Knowledge Development either with the PADI *Enriched Air Diver Manual* or with

the PADI Enriched Air Diver Course Online, give the Dive Today briefing (see the Appendix) in addition to the general briefing for Enriched Air Dive1.

C. Enriched Air Dive 1

1. Briefing (in addition to Dive Today Briefing)
   a. Evaluate the conditions.
   b. Facilities at the dive site.
   c. Entry technique and location.
   d. Exit technique and location.
   e. Depth ranges.
   f. Interesting and helpful facts about the dive site.
   g. Dive planning
      1. **You and your staff watch and assist students in correctly setting their enriched air dive computers, confirming the settings. Remind students that if a computer fails during the dive, the team should immediately end the dive.**
      2. **Confirm maximum depths based on oxygen content.** To address conditions, logistics, diver experience and/or other considerations, you may also recommend a maximum dive depth shallower than the maximum based on oxygen content. Instructor may also recommend a dive time shorter than required by the no stop limits.
      3. **If students have completed the Knowledge Development Section and the Enriched Air Diver Exam and are making the dive indirectly supervised, review the dive plan.**
   h. Emergency procedures.
   i. Buddy team selection.
2. Predive procedures.
   a. Prepare personal equipment.
   b. Analyze enriched air if not using the cylinder from Practical Application 1 and/or for additional practice
   c. Prepare contingency 5 metre/15 foot stop air/enriched air supply, if appropriate.
   d. Don personal diving equipment.
   e. Predive safety check – buddies confirm EANx compatible dive computers for their individual blends
3. Proper entry for local environment.
4. Descent
5. Dive within planned depth and times, and well within dive computer limits (no stop limits and oxygen exposure limits) at all times.

6. Ascent — safety stop at 5 metres/15 feet.
7. Post-dive procedures.
   a. Make exit appropriate for environment.
   b. Stow equipment and exchange cylinders as appropriate. Remember to leave contents stickers/tags on the used cylinders for blender reference.
   c. Check the computers/gauges of indirectly supervised students to confirm staying within the dive plan.
8 Debriefing — comments on student performance.
9. Log dive. (Sign logs; log should record EANx blend used.)

D. Predive Simulation Exercise 1

1. Ask divers to demonstrate predive equipment setup, blend analysis and label confirmation for an enriched air dive with a cylinder filled with enriched air.
2. Provide depth, time, and gas supply and have divers plan an EANx computer dive based on the analyzed content of the scuba cylinder filled with enriched air. This includes divers setting their individual computers properly, determining maximum depths based on the oxygen content and scrolling the computer. Divers should also provide maximum depths and time limits that account for logistics and environmental variables you provide.
3. You may combine Predive Simulation Exercise One and Two, however two separate scuba cylinders filled with enriched air should be used.

III. Practical Application 2

Performance Requirements

After this session, the student will be able to:

- **Demonstrate the procedures for obtaining an enriched fill and/or renting an enriched air cylinder from an enriched air fill station.**

A. Practical Application Two: It is preferable to conduct the session at an enriched air fill station typical of where local divers obtain enriched air.

1. The emphasis is on the hands-on learning and practicing requesting, analyzing, verifying the cylinder decals/tags and completing and signing the fill log.
2. You may combine Practical Application 2 with 1, but they must precede Enriched Air Dive 1 or Predive Simulation Exercise 1.

B. Procedures for obtaining an enriched air fill.

[Take students through filling procedures, including making the request, analyzing, verifying the contents sticker (decal)/tag, noting the maximum depth, and completing and signing the station's enriched air fill log. Have students practice (use a dummy log if the cylinders will not actually be used by the students) until they can walk through the procedure, including gas analysis, without assistance.]

C. Fill station orientation (optional)

[Show students how the operation blends enriched air, cleans and services equipment for oxygen service and other enriched air related processes. The operation's blender or other qualified person may conduct this orientation as appropriate.]

IV. Enriched Air Dive 2 or Predive Simulation Exercise

Performance Requirements

By the end of this dive, with little or no help, students should be able to

- **Execute a dive within the no stop limits, maximum depth and oxygen exposure limits established by the instructor during predive planning.**

  or

- **Plan a dive within the no stop limits, maximum depth and oxygen exposure limits established by the instructor.**

A. General Considerations

1. Enriched Air Dive 2 allows student divers to apply the basic concepts they learned in the Knowledge Development Section and began practicing under instructor guidance in Enriched Air Dive 1. Students should be able to perform all required setup and planning steps nearly independently, with the instructor simply confirming and interceding only as necessary to prevent an error that could compromise safety.
2. Assign logistical duties to staff and review emergency protocols.
3. The use of qualified assistants is highly recommended. Assistants can help keep track of buddy teams. An assistant at the surface can help with check-in and check-out procedures and be prepared to help in an emergency.
4. **Following each diver's computer, the planned bottom time and depth must not exceed the no decompression limits, oxygen exposure limits or maximum depth (1.4 ata/bar PO_2) for the blend.**
   a. Certified students may dive with indirect supervision.
   b. You must personally supervise setting the computers and confirm they're set for the correct blend.
   c. You may allow divers to use air-only (not EANx compatible dive) computers for the training dives. (See #9 below.) **However, students must still meet performance requirements by demonstrating how to set and use an enriched air compatible computer for dive planning.**
5. It's preferred, though not absolutely necessary, that divers in each buddy team use approximately the same enriched air blend. This gives them approximately the same limits. Regardless, emphasize that the dive limits must be based on whichever diver nears a limit first – a diver with higher oxygen will have a shallower maximum depth and a diver with lower oxygen will have shorter no stop limits.
6. The combination of multilevel computer diving and enriched air diving means that gas consumption usually ends the dive instead of the no decompression limits. Although students should already be in the habit of watching their SPG, it's doesn't hurt to remind them to monitor their cylinder pressures, not just no decompression time.

7. **The Knowledge Development Section and Practical Application 2 must precede Enriched Air Dive 2.**
8. **The maximum allowable oxygen content for Enriched Air Dive 2 is 40%. The student: instructor ratio is 8:1.**
9. **If students will dive using air-only computers, the maximum allowable oxygen content is 32%, the maximum depth is 30 metres/100 feet (or shallower if a shallower limit applies) and their total dive time for the day may not exceed 160 minutes.**

B. Enriched Air Dive 2

1. Briefing (in addition to Dive Today Briefing)
   a. Evaluate the conditions.
   b. Facilities at the dive site.
   c. Entry technique and location.
   d. Exit technique and location.
   e. Depth ranges.
   f. Interesting and helpful facts about the dive site.
   g. Dive planning
      1. **You and your staff watch students correctly set their enriched air dive computers, confirming the settings.** They may consult their computer manufacturer instructions as needed. This may be repeated until students demonstrate mastery and can do so with little or no assistance from the instructor or staff.
      2. **Assess and confirm maximum depths based on oxygen content determined by students.** To address conditions, logistics, diver experience and/or other considerations, you may set other time and depth limits the students must plan their dives within.
      3. **Assess the dive plan for appropriateness.**
   h. Emergency procedures.
   i. Buddy team selection.
2. Predive procedures.
   a. Prepare personal equipment.
   b. Analyze enriched air if not using the cylinder from the Practical Application(s) and/or for additional practice
   c. Prepare contingency 5 metre/15 foot stop air/enriched air supply, if appropriate.
   d. Don personal diving equipment.
   e. Predive safety check – buddies confirm EANx compatible dive computers for their individual blends

3. Proper entry for local environment.
4 Descent
5. Dive within planned depth and times, and well within dive computer limits (no stop limits and oxygen exposure limits) at all times.
6. Ascent — safety stop at 5 metres/15 feet.
7. Post-dive procedures.
    a. Make exit appropriate for environment.
    b. Stow equipment and exchange cylinders as appropriate. Remember to leave contents stickers/tags on the used cylinders for blender reference.
    c. Check the computers/gauges of indirectly supervised students to confirm they stayed within the dive plan.
8. Debriefing — comments on student performance.
9. Log dive. (Instructor signs log; log should record EANx blend used.)

C. Predive Simulation Exercise 2

1. Ask divers to demonstrate predive equipment setup, blend analysis and label confirmation for an enriched air dive with a cylinder filled with enriched air. They should do this with little assistance from the instructor or staff.
2. Provide depth, time, and gas supply and have divers plan an EANx computer dive based on the analyzed content of the scuba cylinder filled with enriched air. This includes divers setting their individual computers properly, determining maximum depths based on the oxygen content and scrolling the computer. Divers should also provide maximum depths and time limits that account for logistics and environmental variables you provide. Confirm that student divers accomplish these appropriately, but they should be able to complete the dive planning, setup and setting the computers with little or no assistance from the instructor or staff.
3. You may combine Predive Simulation Exercise One and Two, however two separate scuba cylinders filled with enriched air should be used.

Appendix

Knowledge Review Answer Key

Knowledge Review – Enriched Air Diver

1. What is the primary benefit of using enriched air nitrox? What advantages does this provide?

   The primary benefit is that it exposes you to less nitrogen. This has the advantages of longer allowable bottom times, less need to push the air no decompression limits, and less overall nitrogen load when making multiple dives.

2. How does using EANx affect narcosis while diving?

   Because oxygen and nitrogen have similar narcotic properties, using nitrox doesn't reduce your narcosis. You should plan the dive accounting for narcosis just as you would with air.

3. What is the primary concern regarding enriched air nitrox and equipment? What are recommendations for using equipment, other than cylinders, with enriched air with up to 40% oxygen? (Consider local regulations in your response, if appropriate.)

   The primary concern is the high oxygen content, which can cause a fire or explosion. With equipment other than cylinders, the general recommendation is that you can use regular scuba equipment for EANx blends with up to 40% oxygen. However, local laws or regulations may require special cleaning or fittings; follow any that apply. (Answers related to local regulations will vary.)

4. What is the potential hazard of improper enriched air filling procedures?

   The potential hazard of improper enriched air filling procedures is a fire or explosion. Another concern is the correct percentage of oxygen in the blend.

5. List the markings that, according to broadly accepted dive community practices, you should have on a scuba cylinder used for enriched air nitrox. Are these markings used everywhere?

   1. *A band around the cylinder shoulder reading NITROX, ENRICHED AIR or the like. Yellow cylinders should have a 10 centimetre/4 inch green band. Non yellow cylinders should have a15 centimetre/6 inch band. The top and bottom of this band should be a yellow, 2.5 cm/1 in. band, with the center 10 cm/4 in of green.*
   2. *A dated visual inspection sticker*
   3. *A sticker indicating whether the cylinder is rated for oxygen service*
   4. *A contents tag or decal (sticker) that lists the EANx blend, the diver's name, the fill date and the maximum depth of the blend.*

   The markings are not used everywhere because local laws or practice may require different or additional markings.

6. What are the oxygen partial pressures of the maximum and contingency depth limits for a given enriched air blend? What is the primary hazard of exceeding oxygen limits? How do you avoid the hazard?

   The PO_2 of maximum depth limit for a particular blend is 1.4 ata/bar. The contingency limit is 1.6 ata/bar The primary hazard of exceeding oxygen limits is drowning due to having a convulsion underwater. You avoid the hazard by remaining well within oxygen limits and shallower than the maximum depth.

7. What signs and symptoms may precede a CNS convulsion? Do these always precede a convulsion?

   The signs and symptoms are visual disturbances (including tunnel vision), ear ringing, nausea, twitch or muscle spasms (especially in the face), irritability, restlessness, euphoria or anxiety, and dizziness. They do not always precede a convulsion.

8. Describe how to use an EANx compatible dive computer to remain within accepted oxygen exposure limits. What should you do if you accidentally exceed the oxygen limits of your computer?

   To use an EANx compatible dive computer to manage oxygen exposure and remain within accepted limits, set the maximum oxygen partial pressure for 1.4. Set the computer for the EANx blend you're using. Scroll the computer no stop limits (or use a table) to find the deepest allowable depth within the 1.4 maximum limit. Stay above that depth by watching your depth – use the computer warning a secondary alert only. Stay well within the maximum oxygen exposure limits of your computer at all times, and when possible, allow at least an hour between dives. See the manufacturer for specifics about these settings and how your computer displays oxygen exposure. If you accidentally exceed the oxygen limits of your computer, ascend immediately, make a safety stop and surface. Do not dive again for 24 hours, or as recommended by the computer manufacturer.

9. Who must personally verify the oxygen analysis of a cylinder of enriched air? What is the procedure for doing this?

   The diver who will dive the cylinder must personally verify the oxygen analysis of the enriched air in it. The procedure is to use an oxygen analyzer. Calibrate the analyzer with air at a controlled rate using a flow restrictor or meter. Analyze the enriched air using the same flow. Compare your analysis with the analysis listed by the blender on the contents sticker or tag. Complete the fill station's fill log.

10. What should you do if your enriched air computer fails during a dive?

    If your enriched air computer fails during a dive, immediately ascend, make a safety stop at 5 metres/15 feet and surface. Do not resume diving for 12 hours, or as recommended by the computer manufacturer.

11. What should you do if a diver convulses underwater?

    If a diver convulses underwater, your priority is to get the diver to the surface. Treat the diver as an unresponsive diver. Hold the mouthpiece in if it's in the mouth, but don't waste time trying to replace it if it's not. Take the victim to the surface, establish ample buoyancy, check for breathing and call for help. Provide rescue breaths if the victim isn't breathing. Get the victim to the boat or shore and check for a pulse and breathing. Provide CPR as necessary while waiting for EMS. Some experts recommend that if the victim's mouthpiece is in place, hold it there and wait for the convulsion to subside before surfacing the victim.

12. What should you do for a diver suspected of having decompression illness after an enriched air dive?

    Follow the procedures just as you would for an air dive: Provide emergency oxygen and first aid/CPR as necessary, and contact EMS, DAN and/or other appropriate emergency services for the area. When possible, tell emergency personnel the particulars about the diver's dive profile, including depth, time and whether the diver was using a dive computer or tables and what the blend was. If you run out of oxygen before reaching emergency care, you can provide a breathing patient with enriched air available.

Student Statement: I've reviewed the questions and answers, and for any I answered incorrectly or incompletely, I now understand what I missed.

Name _____ Date _____

Dive Today Briefing

The Dive Today briefing provides the basic information necessary for divers to make a supervised recreational enriched air nitrox dive using an EANx dive computer. Give the Dive Today briefing (see the Appendix) in addition to the general briefing for Enriched Air Dive1.

The Dive Today briefing may follow, precede or be combined with gas analysis and Practical Application 1.

Avoid overwhelming student divers with too much detail beyond what's outlined. Students will get the detail when they complete the Knowledge Development.

Emphasize the need to stay within oxygen limits.

I. Benefits of enriched air nitrox

A. Enriched air nitrox increases your allowable no stop dive time by reducing the amount of nitrogen you breathe underwater. It does this by replacing some of the nitrogen with oxygen. Since you breathe less nitrogen, you have longer no decompression limits.

B. The increased no stop time can be substantial, especially when making repetitive dives.

C. Your enriched air dive computer combines the advantages of enriched air diving with multilevel diving, giving you the maximum no stop time possible. It also simplifies planning and executing the dive.

D. Over the last decade, hundreds of thousands of dives have illustrated that enriched air has an impressive safety record when divers follow proper procedures.

II. Issues with enriched air nitrox.

A. The added oxygen in enriched air nitrox presents potential problems you don't have diving with air. Enriched air diving procedures are straightforward, and were created to manage these problems.

B. The most important concern is *oxygen toxicity.*

1. Oxygen toxicity is not a concern diving air within recreational limits, but it is with EANx because it has more oxygen.
2. Part of the dive plan includes determining the maximum depth for the blend you're using. The higher the oxygen content, the shallower the maximum depth. We'll do that together, and you will make the dive well within the depth limit.
3. Exceeding this maximum depth can cause a convulsion underwater, which can cause you to drown. Take this very seriously – within accepted limits enriched air has proven itself very safe to dive with, but it is very unsafe if you neglect or disregard the limits.

4. You want to avoid heavy exertion underwater with enriched air, because it can increase oxygen toxicity concerns. If you find yourself exerting heavily during the dive, slow down and rest. End the dive if necessary.
5. By staying within the limits of the dive plan, oxygen toxicity is *highly* unlikely. As a precaution, be aware of the following oxygen toxicity symptoms: tunnel vision, ringing in your ears, nausea, facial twitching, irritability and dizziness. If you experience any of these, signal your buddy and end the dive immediately.

C. It's important to personally verify the oxygen percentage of the enriched air you use on a dive.

1. This is why you personally analyze the gas and sign the fill log that attests to it.
2. The oxygen content is needed to set your enriched air computer and to determine the maximum depth.

D. There are special concerns regarding the higher oxygen content of enriched air nitrox with regard to equipment. You'll learn about these later in the course.

E. This dive does not qualify you to use enriched air nitrox without supervision. You need to successfully complete the entire course and be certified as a PADI Enriched Air Diver.

Frequently Asked Questions

Why doesn't using enriched air nitrox produce a meaningful safety benefit when used within air limits?

It doesn't because the decompression illness (DCI) incidence rate is already so low that simply reducing nitrogen isn't likely to produce a *meaningful* risk change. Statistical estimates suggest that using enriched air within normal air limits only reduces mathematical risk a fraction of a percent. The DCI incident rate is estimated as .004 percent (one in 25,000 dives) to .001 percent (one in 100,000 dives); if you cut that by half (which is very unlikely), the best you could do is reduce incidence .002 percent. Used properly, both air and enriched air have impressive safety records. Following safe diving practices such as making safety stops, avoiding dehydration, etc., appears to be a far more effective way of making a meaningful safety improvement in diving.

What references discuss the narcotic qualities of oxygen?

Among PADI materials, the *Encyclopedia of Recreational Diving* discusses it extensively in section Five, The Physiology of Diving. For a more extensive discussion, look to Bennett and Rostain's Inert Gas Narcosis, chapter 9.2 in the 5th Edition of Bennett and Elliott's *Physiology and Medicine of Diving,* available from Best Publishing, Flagstaff, Arizona. Online, the Rubicon Foundation has many papers on the subject you can download. You may find one of many of these, Linnarsson et al, 1990, available at http://archive.rubicon-foundation.org/dspace/handle/123456789/7316.

Why don't our local cylinders have the green and yellow bands shown in the course materials?

The green and yellow band that says "Enriched Air" or similar is part of the identification convention accepted by the broad international dive community. However, in some areas local laws and/or practices differ from these conventions. In such cases, the local regulation or practice applies.

PADI Specialty Training Record
Enriched Air Diver

I verify that this student has satisfactorily completed all knowledge development training sessions and the Final Exam as outlined in the PADI **Enriched Air Diver** Specialty Course Instructor Outline. I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name _____ PADI# _____

Instructor Signature_____ Completion Date _____

Practical Application 1

I verify that this student has satisfactorily completed the Practical Application Session as outlined in the PADI **Enriched Air Diver** Specialty Course Instructor Outline including:

• Oxygen analysis • Verifying cylinder content data • Signing fill log

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name _____ PADI# _____

Instructor Signature_____ Completion Date _____

Practical Application 2

I verify that this student has satisfactorily completed the Practical Application Session as outlined in the PADI **Enriched Air Diver** Specialty Course Instructor Outline including:

• Demonstrate the procedures for obtaining an enriched air fill and/or renting an enriched air cylinder from an enriched air fill station

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name _____ PADI# _____

Instructor Signature _____ Completion Date _____

Open Water Dives or Predive Simulation Exercise

Dive One or Predive Simulation Exercise One

I verify that this student has satisfactorily completed Dive One as outlined in the PADI **Enriched Air Diver** Specialty Course Instructor Outline including:

- Execute a dive within the no stop limits, maximum depth and oxygen exposure limits established by the instructor during predive planning
- Perform safety stop at 5 metres/15 feet
- Return to ascent point

OR this student has satisfactorily completed Predive Simulation Exercise One.

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name _____ PADI# _____

Instructor Signature_____ Completion Date _____

Dive Two or Predive Simulation Exercise Two

I verify that this student has satisfactorily completed Dive Two as outlined in the PADI **Enriched Air Diver** Specialty Course Instructor Outline including:

- With little or no assistance, plan an enriched air dive within the no stop limits, maximum depth and oxygen limits established by the instructor.
- Analyze enriched air
- Execute the planned dive within the limits determined during the dive plan
- Perform safety stop at 5 metres/15 feet
- Calculate repetitive group and oxygen exposure at end of dive

OR this student has satisfactorily completed Predive Simulation Exercise Two.

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name _____ PADI# _____

Instructor Signature_____ Completion Date _____

I verify that I have completed all performance requirements for this PADI **Enriched Air Diver** specialty course. I am adequately prepared to dive in areas and under conditions similar to those in which I was trained. I agree to abide by PADI Standard Safe Diving Practices.

Diver Name _____

Diver Signature _____ Date _____

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ENRICHED AIR FILL LOG

I understand that the cylinder________________________, obtained on______________
(tank serial number) (date diver receives fill)

from________________________ contains enriched air with __________ percent oxygen
(dive operation) (oxygen analysis)

as determined by____________________ and my personal analysis, which may be used to
(blender)

a maximum depth of__________________. The cylinder pressure is ______________ .
(maximum depth @ 1.4 ata PO_2) (pressure in bar/mpa/psi)

______________________________ ______________________________
(diver's name, enriched air certification & number) (diver's signature)

I understand that the cylinder________________________, obtained on______________
(tank serial number) (date diver receives fill)

from________________________ contains enriched air with __________ percent oxygen
(dive operation) (oxygen analysis)

as determined by____________________ and my personal analysis, which may be used to
(blender)

a maximum depth of__________________. The cylinder pressure is ______________ .
(maximum depth @ 1.4 ata PO_2) (pressure in bar/mpa/psi)

______________________________ ______________________________
(diver's name, enriched air certification & number) (diver's signature)

I understand that the cylinder________________________, obtained on______________
(tank serial number) (date diver receives fill)

from________________________ contains enriched air with __________ percent oxygen
(dive operation) (oxygen analysis)

as determined by____________________ and my personal analysis, which may be used to
(blender)

a maximum depth of__________________. The cylinder pressure is ______________ .
(maximum depth @ 1.4 ata PO_2) (pressure in bar/mpa/psi)

______________________________ ______________________________
(diver's name, enriched air certification & number) (diver's signature)