DRY SUIT
DIVER

INSTRUCTOR GUIDE

Product No. 70233 (Rev. 01/23) Version 4.1

PADI

PADI Dry Suit Diver
Specialty Course Instructor Guide

Published by PADI
30151 Tomas
Rancho Santa Margarita, CA 92688-2125 USA

Product No. 70233 (Rev. 01/23) Version 4.1

TABLE OF CONTENTS

INTRODUCTION

How to Use this Guide 5
Course Philosophy and Goals 5
Course Flow Options 6

SECTION ONE Course Standards

Instructor Prerequisites 7
Standards at a Glance 7
Student Diver Prerequisites 8
Supervision and Ratios 8
Sequencing 9
Site, Depths, and Hours 9
Materials and Equipment 9
Assessment Standards 10
Certification Requirements and Procedures 10
Linking to Other Courses 11

SECTION TWO Knowledge Development

Conduct 13
I. Introduction 13
II. Why You Get Cold Underwater 15
III. Dry Suits and Wet Suits 17
IV. Dry Suit Construction 21
V. Dry Suit Undergarments 30
VI. BCDs, Weight Systems, and Argon Inflation Systems 32
VII. Diving a Dry Suit 35
VIII. Dry Suit Safety and Handling Emergencies 39
IX. Dry Suit Diving Guidelines 43
X. Dry Suit Care, Maintenance, Storage, and Packing 44
XI. Dry Suit Repairs 46

SECTION THREE Confined Water Dive

General Considerations 51
Performance Requirements 51

SECTION FOUR Open Water Dives

General Considerations 53
Dry Suit Dive 1 55
Dry Suit Dive 2 57

APPENDIX

Knowledge Review – Part I 60
Knowledge Review – Part II 62
Knowledge Review – Part I Answer Key 64
Knowledge Review – Part II Answer Key 65
PADI Specialty Training Record – Dry Suit Diver 67
PADI Adventure Dive Training Record: Dry Suit 69

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 Dry Suit Diver Instructor. The guide contains three sections: the first contains standards specific to this course; the second contains knowledge development presentations; and 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 Dry Suit Diver course appear in **boldface. 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

Why dive dry – simply to stay warm. No one said diving had to be cold or wet. Diving dry is the difference between withstanding the 40°F (4°C) temperature of some waters to enjoy watching a three-inch scallop's beadlike eyes spangle the edges of a brightly colored mantle. It is the difference in witnessing the powerful jaws and massive grinding teeth in a mouth of a wolf eel, hovering-by as a giant octopus propels itself by jetting water past its eight sucker-covered arms, or simply not diving at all. More often than not, in colder waters, dry suit diving can be the difference between experiencing multiple dives in one day or making one chilly wet suit dive and listening to others tell you about what you've missed on the dives you were just too cold to make.

With this in mind, the philosophy of this course is to focus on comfort diving in a dry suit. Thus, the goal of this course is to show student divers how to consider all factors when comfort diving in a dry suit. The course covers everything from choices of dry suit materials, techniques for controlling buoyancy above and underwater, dressing into and out of a dry suit, to maintenance and repair concerns. Student divers learn to use the most effective and efficient means to extend their underwater adventure into cold water – without getting cold or wet.

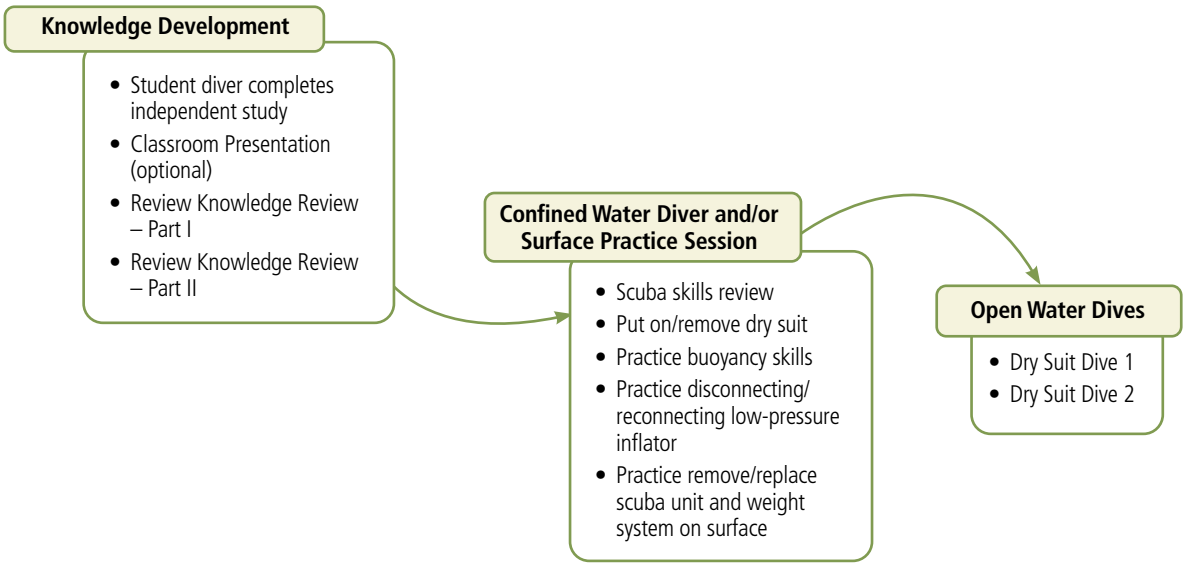
The best way to learn how to dive in a dry suit is by doing it. This course philosophy therefore, emphasizes comfort diving in a dry suit. Student divers will apply the knowledge they gain by interaction with PADI *Dry Suit Diver eLearning* or by reading the PADI *Dry Suit Diver Manual* and watching the companion video, first in a confined water session, and then on at least two open water dives.

Course Flow Options

Course Flow Options provides a look at 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 PADI *Dry Suit Diver eLearning* or the PADI *Dry Suit Diver Manual,* including the Knowledge Review – Part I, before participating in the open water dives. Knowledge Review – Part I is the same Knowledge Review that appears in the Dry Suit Diver section of PADI *Advanced Open Water Diver Manual.* 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.

Completion of a confined water dry suit practice session is required. This practical session allows student divers to practice skills such as descending in a dry suit, achieving neutral buoyancy and hovering, disconnecting and reconnecting the low-pressure inflator hose from the dry suit, recovering from a stuck inflator valve, overcoming excess gas in the feet, ascending safely in a dry suit, and removing and replacing the scuba unit and weight system while on the surface.

There are two dives to complete over a day. **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, student diver learning style, logistical needs, and your sequencing preferences



SECTION ONE

Course Standards

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

Standards at a Glance

Topic	Course Standard	
Minimum Instructor Rating	**PADI Dry Suit Specialty Instructor**	
Prerequisites	**PADI (Junior) Open Water Diver**	
Minimum Age	**10 years**	
Ratios	**Confined Water: 10:1** **Open Water: 6:1, with two additional student divers allowed with one certified assistant (maximum 8 students)**	
Site, Depths and Hours	Depth: 18 metres/60 feet recommended Hours Recommended: 12 **Minimum Open Water Dives: 2**	
Materials and Equipment	**Instructor:** • **PADI Dry Suit Diver Specialty Course Instructor Guide** • **PADI *Dry Suit Diver eLearning* or *Manual*** • Dry suit repair/maintenance supplies	**Student Diver:** • **PADI *Dry Suit Diver eLearning* or *Manual*** • ***Dry suit (with appropriate accessories)*** • PADI *Dry Suit Diving* video

Instructor Prerequisites

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

Student Diver Prerequisites

To qualify for the PADI Dry Suit Diver course, an individual must:

1. **Be certified as a PADI (Junior) Open Water Diver or have a qualifying certification from another training organization,**
2. **Be at least 10 years old.**

Supervision and Ratios

Certified assistants must have a PADI Dry Suit Diver certification (or qualifying certification)

Confined Water Dive

Completion of a confined water dry suit training session is required. This confined water practice session must be complete prior to making the first open water dive of this specialty course. During the confined water session, student divers must be directly supervised by the course instructor or certified assistant. Additional confined water sessions may be added at your discretion and may include a scuba skills review.

The maximum inwater ratio for confined water sessions is 10 student divers per instructor (10:1), with 4 additional student divers allowed per certified assistant (4:1).

Open Water Dive

A Teaching status PADI Dry Suit Diver Specialty Instructor must be present and in control of all activities. During the Dry Suit Diver open water dives, student divers must be directly supervised by the course instructor. The Specialty Instructor must ensure that all performance requirements are met.

The ratio for open water dives is 6 student divers per instructor (6:1), with two additional student divers allowed with one certified assistant to a maximum of eight students.

The course instructor must directly supervise divers on dives deeper than 18 metres/60 feet at a maximum ratio of 4:1.

Note to Instructor

For confined open water sessions or open water dives that include 10- to 11-year olds, the maximum ratio is four student divers per instructor (4:1). No more than two of the four divers may be 10 or 11. You may not increase this ratio with the use of certified assistants.

Sequencing

1. Ideally, student divers should complete Knowledge Review Part I before Dry Suit Dive One.
2. Student divers should complete Knowledge Review Part II before Dry Suit Dive Two.
3. **Training dives must be conducted in order.** You may rearrange skill sequences within a dive.

Site, Depths, and Hours

Site

Choose sites with conditions and environments suitable for completing requirements. Shallow dives will provide divers with more time to complete tasks. 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 a confined water sessions first to better prepare divers to apply skills in open water later.

Depths

18 metres/60 feet recommended

30 metres/100 feet limit for Dive 1 (Dry Suit Adventure Dive)

Hours

The PADI Dry Suit Diver course includes two open water dives that may be completed in one day. Dives 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 12.

Materials and Equipment

Instructor

- **PADI Dry Suit Diver Course Instructor Guide**
- **PADI *Dry Suit Diver eLearning* or *Manual***
- PADI *Dry Suit Diving* video (included in eLearning)
- Specialty equipment needed for student divers to perform routine dry suit maintenance and repair
  - Dry suit manufacturer's recommended repair/patching kit(s) (e.g., talcum powder, zipper lubricant, tooth brush, Aquaseal® and Cotol® curing agent or equivalent, suit patches in different sizes and made from different suit materials, various cement(s) and applicator brush).

  - Other maintenance and repair items (e.g., travel size hair dryer, lead weights, flashlight, china marker or grease pencil, soapy water, and rubber bands/jars/cans/bottles).
- As needed: accessory weights (to help student divers trim their buoyancy), neck ring (for student divers to try on unsized latex neck seals), neck/wrist seal lubricant and spare parts kit.

Student Diver

- **PADI *Dry Suit eLearning* or *Manual***
- **Dry suit with dedicated low-pressure inflator hose from the regulator, or an inflation system specifically for the dry suit, and appropriate accessories** (such as undergarment, specialized boots, and hood if necessary)**.**

  Note: All student divers must dive with a BCD.
- PADI *Dry Suit Diving* video (eLearning contains the video.)
- Access to support equipment as necessary, including but not limited to: accessory weights, neck ring (for trying on unsized latex neck seals), neck/wrist seal lubricant, dry suit maintenance items (talcum powder, zipper wax, tooth brush), manufacturer's recommended repair/patching kit, and spare parts kit.

Assessment Standards

For eLearners, check the diver's eRecord to verify successful of completion of *Dry Suit Diver eLearning,* including Knowledge Review.

To assess knowledge of divers using the manual, have divers complete the Dry Suit Diver Knowledge Reviews (located in the Appendix of this guide and in the *Dry Suit Diver Manual)* and review missed questions until they demonstrate adequate knowledge.

During open water dives, divers must perform all skills – procedures and motor skills – in a reasonably comfortable, fluid, repeatable manner as would be expected of a diver at this certification level.

Certification Requirements and Procedures

To qualify for certification, student divers must complete all performance requirements for Dry Suit Dives One and Two. The instructor certifying the student diver must ensure that all certification requirements have been met.

Linking to Other Courses

Divers who successfully complete Dry Suit Dive One may receive credit for an Adventure Dive toward the PADI Advanced Open Water Diver or Adventure Diver certifications. The Dry Suit Adventure Dive conducted during the PADI Advanced Open Water Diver course may count as the first dive toward this specialty at your discretion.

The Dry Suit Diver Specialty may be taught concurrent with the PADI Open Water Diver course by conducting all four Open Water Diver course dives in a dry suit. Dive One skills may be accomplished any time during Open Water Diver course Dives 2–4. One additional dive (Dive Two of the specialty course) must be completed after Open Water Diver certification to earn the Dry Suit Diver certification. Once the specialty course is complete, the diver may earn credit toward the Advanced Open Water Diver course for the Dry Suit Adventure Dive.

SECTION TWO

Knowledge Development

Conduct

Student divers complete independent study by interacting with PADI *Dry Suit Diver eLearning,* or by reading the PADI *Dry Suit Diver Manual* and watching the PADI *Dry Suit Diving* video. Use these knowledge development presentations to prescriptively address student diver misconceptions, or to provide clarification on certain points of interest.

If there is a need for instructor-led presentations, such as when the *Dry Suit Diver eLearning* or *Manual* does not exist in a language student divers understand, use the following teaching outline to cover the knowledge development learning objectives and course content. The Dry Suit Diver Knowledge Reviews (located in this guide's Appendix) must be completed and reviewed before the diver is certified.

I. Introduction

Note to Instructor

Have staff introduce themselves and provide a bit of background. Have student divers introduce themselves and explain why they are interested in dry suit diving.

A. Course Goals

The goals of this program are to enable you to:

1. Develop your practical knowledge of dry suit diving.
2. Increase your diving skills.
3. Plan, organize, and make dry suit dives.
4. Improve your diving ability and provide you with additional supervised experience.
5. Encourage you to participate in other specialty training.

B. Course Overview and Schedule

Note to Instructor

Discuss the course sequence, assignments, meeting times, places and other information about all class, practical application sessions and training dives. Build excitement about the course, particularly the training sessions and dives.

C. Costs, Equipment Requirements and Paperwork

Note to Instructor

Explain all costs, equipment requirements and logistical details as necessary. Reconfirm prerequisites if appropriate, ensure all paperwork is completed – see Section One, and Paperwork and Administrative Procedures, General Standards, PADI *Instructor Manual*. Collect outstanding fees.

D. Performance Requirements and Certification

1. To qualify for any PADI certification, you must meet specific performance requirements.
    a. You pay for the course, but must earn the certification.
    b. Performance-based learning is objective – a student either meets a requirement or not; your instructor is not arbitrary in assessing performance.
2. Although you must meet all performance requirements, having difficulty does not mean you will be unsuccessful.
    a. You take a course to learn – making mistakes and needing time to master knowledge and skills is part of learning.
    b. You may pick up some things quickly and others slowly; what matters is that you demonstrate mastery – not how long it takes.
    c. You move on at the pace you learn – you may need extra dives or other practice.
3. Upon successfully completing this course, you'll receive the PADI Dry Suit Diver specialty certification.
4. Certification means that you've completed all performance requirements and are trained to:
    a. Plan, organize, make, and log open water dives using a dry suit in conditions generally comparable to or better than, those in which you are trained.
    b. 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 50 logged dives.

II. Why You Get Cold Underwater

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **Why do you get colder in water than you do in air the same temperature?**
2. **What eight variables may affect whether you feel cold underwater?**
3. **What is hypothermia?**
4. **Why is even mild hypothermia potentially a serious problem for scuba divers?**

1. Why do you get colder in water than you do in air the same temperature?

A. Water and heat

1. Water has one of the highest heat capacities of all naturally occurring substances.
2. High heat capacity means a substance must absorb a great deal of heat to increase its temperature compared to something with a lower heat capacity. It must also release a lot of heat to decrease its temperature compared to something with a lower heat capacity. Water conducts, or transfers, heat 20 times faster than air because it absorbs so much more heat than air of the same temperature.
3. Unprotected, you lose heat rapidly even in water as "warm" as 27°C/80°F. At this temperature, your body loses heat to the water faster than your body can generate it. At temperatures below 34°C/93°F, you will feel cool even after a short exposure.

Note to Instructor

Refer student divers to *The Encyclopedia of Recreational Diving* for a more detailed explanation of the effects of temperature on a diver and their body's physiological responses against a drop in core body temperature.

4. Exposure suits don't really keep you warm so much as they prolong how long it takes before you get cold. In most circumstances, even in relatively warm water given enough time you will chill, but with the ideal exposure suit, you'll finish the dive before you lose enough heat to become uncomfortable.

2. What eight variables may affect whether you feel cold underwater?

B. Eight variables affect whether you feel cold underwater:

1. Water temperature
2. Length of exposure
3. The thermal protection provided by your exposure suit and undergarment.
4. Your body's ability to generate heat. Your body's muscle mass and metabolic activity generates heat. People with more muscle mass tend to stay warmer,

but your overall metabolism rate and even whether you're hungry will cause your heat generating ability to vary.

5. Body fat composition – fatty (adipose) tissue acts as a natural insulator and helps the body retain heat.
6. Body surface area to mass ratio – light/tall divers cool faster than heavy/shorter divers, all things being equal.
7. Acclimatization – you adjust both physically and psychologically to the temperature water you are used to diving in. Example: cold water divers traveling to the tropics typically consider the water warm and require less thermal protection than local divemasters who are acclimatized to tropical water and consider it cool.
8. Activity – divers who stay in one place for extended periods tend to get colder than those who are generating heat by moving and exercising.

C. Getting cold underwater

1. Getting too cold underwater can take the fun out of a dive, but you can prevent getting cold even in very cool water.
2. Beyond comfort, getting cold underwater can be a very real safety problem.
3. Your body functions at a core temperature of approximately 37°C/98.6°F, in a very narrow range of about ± 4°C/7°F. To stay comfortable indefinitely, body heat loss must equal body heat production. This may not always be possible, but you can slow heat loss enough to remain comfortable for an extended period.

3. What is hypothermia?

D. Hypothermia is a drop in body core temperature. Most divers leave the water before severe hypothermia occurs because the diver is uncomfortable before it occurs.

Note to Instructor

Reinforce to student divers to treat shivering as a warning sign. Advise student divers that if they experience uncontrollable shivering, to end the dive, exit the water, and seek warmth. Hypothermia can create a safety concern even before it becomes severe by interfering with decision-making abilities, strength and endurance – all of which predispose divers to accidents.

4. Why is even mild hypothermia potentially a serious problem for scuba divers?

E. Even mild hypothermia can be dangerous.

1. Signs and symptoms include uncontrolled shivering, numbness, blueness, sleepiness or drowsiness and general fatigue. Severe hypothermia symptoms and signs include shivering, confusion, unconsciousness, and eventually death.

2. As hypothermia advances, it can reduce a diver's decision-making ability, strength, and endurance, all of which can lead to other accidents.

Note to Instructor

Explain to student divers that drinking an alcoholic beverage makes you feel warmer, but that you actually lose heat and get colder. Alcohol dilates skin capillaries, which increases blood flow to the skin. This creates the sensation of warmth, but the blood carries heat away from the body's core and you get cooler.

Also, that a similar phenomenon occurs if you urinate in your wet suit while diving. The fluid feels warm as it originates from inside your body and transfers to the water. Further, because urine feels warm your skin responds by shutting down its heat-saving measures. Capillaries dilate and blood flow to the skin increases, carrying away more heat from the core. The warmth sensation passes quickly as the surrounding water absorbs the heat, and now you're even colder than before.

III. Dry Suits and Wet Suits

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **What are the three main types of exposure suits recreational divers wear?**
2. **How do a wet suit and a dry suit differ in how they insulate you?**
3. **What are the advantages and disadvantages of using a dry suit compared to using a wet suit?**
4. **What six factors should you consider when choosing an exposure suit?**

1. What are the three main types of exposure suits recreational divers wear?

A. Exposure suit options
   1. Body suits (skin suits)
   2. Wet suits
   3. Dry suits

2. How do a wet suit and a dry suit differ in how they insulate you?

B. Body suits (skin suits)
   1. Lightweight, one-piece, typically made from a stretch fabric such as Lycra®.
   2. These suits are more for protection against sunburn and under-water abrasion than for underwater thermal protection.
   3. Some types provide a small amount of thermal protection appropriate for added comfort in tropical water, or for added insulation when worn under a wet suit. A downside when worn under a wet suit is that they can wick water to an area that would have had little or no water exchange.

C. Wet suits
   1. Made from low-density, neoprene foam. The foam is closed cell, which means the bubbles in the foam do not connect. This is why wet suit foam does not absorb water like the foam used in bath sponges. Wet suit foam consists of trapped nitrogen/air, which is a good insulator.
   2. When you enter the water, water seeps in and gets trapped between the suit and your skin. Your body heats up trapped water, which does not contribute to further heat loss because it does not circulate with outside water. This allows the neoprene foam to insulate you and reduce heat loss.
   3. The thicker the neoprene, the better the wet suit insulates. A body suit underneath can add insulation. A proper snug fit is critical because water circulation carries away heat and compromises the suit's effectiveness. This is why custom suits provide the most effective insulation.

D. Dry suits
   1. Made from various materials that exclude water, sealed with a special watertight zipper.
   2. The dry suit traps air or other suit inflation gas (usually argon) within the suit.
      a. Air has a much lower heat capacity than water, so the trapped air acts as an insulator.
      b. Argon gas has approximately half the heat capacity of air, and is an even better insulator. This is why some divers inflate their dry suits with argon.
   3. The suit may have insulation qualities (like a wet suit) or more commonly, you wear an insulating undergarment under the suit. The trapped air/argon acts as additional insulation, so the total insulation is more than you get with a wet suit.
   4. With a properly fitted modern dry suit and using proper techniques, most divers will be totally dry on most dives. However, there may be a residual dampness caused by perspiration – this is normal. A few divers, especially those with lean arms, may experience more frequent minor leakage caused when flexing hands form tendon grooves at the wrist, causing a momentary channel under the seal.

3. What are the advantages and disadvantages of using a dry suit compared to using a wet suit?

E. The pros and cons of using a dry suit – a dry and wet suit comparison.
   1. Dry suit advantages
      a. When worn and used correctly, it is warmer than a wet suit. That is, you can remain comfortable longer at a given water temperature.
      b. With superior insulation, dry suits reduce the likelihood of hypothermia, so have a risk reduction advantage when diving in colder water.

c. In colder water, you may be able to make more dives in a given period (within the other limits of repetitive diving) with a dry suit because you retain more heat.
d. A cold diver uses more air than a warm diver, so you may use less air when diving with a dry suit.
e. Most dry suits insulate you better at the surface after a dive. Wet suits do a poor job of keeping you warm after a dive because of cooling through evaporation. (Some dry suits have evaporative cooling.) Generally speaking, for warmth between dives a wet suit diver is best off removing the suit between dives whereas a dry suit diver is best off wearing the suit turned down to the waist.
f. Dry suit insulation usually remains constant, regardless of depth (not true for neoprene dry suits). Wet suit neoprene foam compresses with depth, so wet suits insulate less the deeper you go.
g. Dry suits don't require a snug fit and accommodate more individual variations within a given size. With a dry suit, you can lose or gain some weight without compromising fit.
h. Most types of dry suits can be repaired quickly in the field. Damp suits must be dried to perform most repairs.
i. Dry suits using undergarments allow you to vary the insulation according to the water temperature, the type of diving being done, your exercise rate and so on.
j. Individuals using wet suits typically get an initial rush of cold water upon entering the water – dry suits eliminate this.

2. Dry suit disadvantages
   a. Dry suits cost more than comparable quality wet suits. (However, they have a long life span and usually cost no more, or less per dive than a comparable quality wet suit.)
   b. Dry suits with thick undergarments are bulkier than wet suits. This makes moving, surf entries and long swims more uncomfortable or tiring than with wet suits. However, this is most common in water temperatures so cold that wet suit diving isn't really an option. One remedy for this, as you'll learn in a PADI Diver Propulsion Vehicle Diver course, may be the use of a diver propulsion vehicle.
   c. Worn out of the water on a hot day, you'll be more uncomfortable in a dry suit than a wet suit because you're keeping more heat trapped in the suit. Overheating on the surface is a very real problem for the fully equipped dry suit diver on a hot day, so it's important to put on the suit at the last possible moment, limit exercise, and enter the water as soon as possible.

d. You typically need more weight wearing a dry suit to achieve neutral buoyancy. This means carrying more weight to and from the dive site, and wearing more weight while diving.
e. Dry suits require more pre and post dive care compared to wet suits to avoid problems such as leakage. You need to commit to this increased suit care and maintenance, or you're better off with a wet suit.
f. Seals (especially the neck seal) can be somewhat uncomfortable. Properly sized seals eliminate most of the discomfort. For long surface intervals, you can use a neck-ring with silicone or latex neck seals to take the pressure off your neck. Most divers simply partially remove the suit between dives.

4. What six factors should you consider when choosing an exposure suit?

F. Six factors to consider when choosing an exposure suit system (wet suit or dry suit with undergarment) for a dive:
1. Water temperature – this is the primary consideration, affected by the wide water temperature variation globally.
2. Your thermal characteristics – if you chill easily, you'll want to opt for more insulation, and if you stay warm more easily, you may not need as much.
3. Activity level – if you'll be relatively active, you'll stay warmer than if resting in one place or swimming slowly.
4. Depth – water temperature generally decreases as you descend, though the colder the surface water, usually the less significant the change at depth. A greater consideration is that wet suits lose insulation with depth – most dry suits don't. If you're tec diving in cool water, the combination of depth and duration may make a dry suit essential.
5. Duration – is a factor in that if you plan short dives and/or single dives, depending on the water temperature, you may be able to use less insulation than if you plan longer dives or multiple repetitive dives. The longer you stay in the water, the more body heat you release to the environment.
6. Weather – for moderate temperature water, it's warm and sunny, you may opt for a wet suit, whereas if it's cold out and windy, you may be more comfortable in a dry suit, even though the water is the same temperature. Part of this is psychological, and part of this is your pre and post dive comfort. If "I'm cold" enters your thoughts during a dive, consider that an indication that you could use more insulation.

IV. Dry Suit Construction

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **Why do dry suits require a special zipper?**
2. **What are the common locations for a zipper on a dry suit?**
3. **What are the two most common types of dry suit seals?**
4. **How do you adjust a neck seal for a proper fit?**
5. **What is the carotid sinus reflex and how do you prevent it?**
6. **What two valves do all dry suits used for diving have, and what is each used for?**
7. **What are the six most common materials used to make a dry suit?**
8. **What are the advantages and disadvantages of each of the materials used to make a dry suit?**

1. Why do dry suits require a special zipper?

A. Dry suits need a special zipper because standard zippers are not watertight.
   1. Dry suits use a special waterproof zipper originally designed for use in space suits in the mid 1960s.
   2. The zipper is one of the most expensive parts of the suit – proper care of it is important.

2. What are the common locations for a zipper on a dry suit?

B. Zippers may be located in several locations:
   1. Across the shoulders – good location for easily getting into and out of a suit, but requires someone else to close zipper.
   2. From behind shoulder diagonally to opposite hip across chest – requires a longer zipper, but allows a diver to dress in/out of a suit independently.
   3. Center waist in back, through crotch to midchest – one of earliest dry suit designs a diver dresses into independently. Not commonly used, but still popular with some divers.

C. Relief zippers – short dry suit zippers to allow divers to urinate without removing suit.
   1. Not intended for use underwater.
   2. Primarily a male option, though some females have tried extra long versions for same purpose.
   3. More common are devices that permit divers to relieve themselves underwater through an adhesive collection device, tube and valve assembly. However, these are normally not needed in recreational diving, but are found more commonly in technical/commercial diving. Females with this need typically use adult size disposable diapers.

3. What are the two most common types of dry suit seals?

D. Dry suit seals

1. Most dry suits have seals at wrists and neck. A few suits also have seals at the ankles, but these are not common.
2. Silicone and Latex – Advantages
   a. Soft and supple
   b. Easy to put on/take off
   c. Easy to adjust to personal wrist/neck size
   d. Easy to replace by user
   e. Silicone and high quality latex has no memory – doesn't stretch out of shape or size.
3. Silicone and Latex – Disadvantages
   a. Does not insulate – seals can be cold spots if suit not designed to provide insulation over/under seal.
   b. May be damaged if put on or taken off carelessly
   c. Difficult to repair, although, you can patch small punctures. Many dry suits now offer quick-change seal capability, making it possible to swap a torn seal for a spare.
   d. Depending on the quality of latex, needs replacing frequently compared to neoprene. However, silicone seals usually outlast both of these.
4. Neoprene (wet suit material with nylon fabric on one side) – two types: flat sealing and fold under
   a. Flat sealing aligns the neoprene side flat against your skin in a wide, snug grip. These are typically used as wrist seals.
   b. Fold under seals are extra long and have the nylon on the inside. You pull the seal almost in place, and then fold the outer part of the seal inside so that the neoprene lies against your skin. These are typically used as neck seals, though you can get them for wrist seals, too.
5. Neoprene – Advantages
   a. May be more durable than latex, with longer life span and less likely to be damaged.
   b. Easily repaired in the field.
   c. Greater sealing area – less prone to seepage for some divers (especially fold under).
   d. Seal is insulated.
6. Neoprene – Disadvantages
   a. Not as easy to put on/take off (especially fold under).
   b. Harder to replace by user.
   c. Size adjustment more time consuming.

   d. Neoprene stretches with use, leading to size change.
7. Some dry suits, particularly those used in rental, have mechanisms for quickly interchanging wrist seals. This makes it convenient to accommodate different divers, but these aren't common on personally owned suits due to little benefit against the added expense.
8. Seal leakage
   a. Mostly around wrists, due to grooves/channels made by tendons on inside of wrist. With use, seals stretch a bit and may not seal as tightly. If you will be grabbing, making a fist, etc. a lot on a dive, set your wrist seal higher on your arm to avoid this.
   b. Hair on arms or dirt/sand under seals can cause leakage.
   c. Undergarments inadvertently tucked under seals will cause leakage.
   d. Leakage may result when venting air from the seals (an emergency procedure).
   e. Results from tears or punctures in seal, especially latex.
   f. Hair under neck seal can cause water to leak down your back.
9. Adjusting dry suit seals for proper fit.

Note to Instructor

Suggest to student divers that adjusting seals by cutting and stretching is best done by an individual trained in dry suit modification. To avoid errors requiring seal replacement it's best to visit their local PADI Dive Center or Resort or dry suit manufacturer for adjustments.

   a. General – buy your dry suit with seals (neoprene or latex) sized approximately to your neck and wrists. Neck seal should be snug, not tight, or uncomfortable. Wrist seals usually only need sizing if they are very uncomfortable.
   b. Adjusting a silicone or latex seal – seals are tapered (cone shaped). If too tight, have someone hold the seal with both hands so you can trim off no more than 5 millimeters/1/4 inch with sharp, long scissors. Some suit seals have markings showing where and how much to cut off. After a cut, put suit on and check fit. Try to leave some room for stretching over time. If in doubt, better slightly too tight than too loose – you can retrim after a dive if necessary, but you must replace the seal if it is too loose and leaks. Trim and try on seals in small increments because if you trim too much and the seal isn't tight enough, you'll have to replace the seal to get a tighter fit again.

4. How do you adjust a neck seal for a proper fit?

E. Adjusting neoprene neck seals – stretch over a round, appropriately sized object overnight, again erring slightly tight if in doubt. Do not trim a neoprene seal.

5. What is the carotid sinus reflex and how do you prevent it?

F. Do not dive with a dry suit neck seal that's excessively tight. This can cause circulation difficulties due to constriction of blood vessels passing through the neck. Some physiologists say the concern is the carotid sinus reflex.
   1. The body mistakes the pressure on the carotid arteries for elevated blood pressure and responds by signaling the heart to slow down. The heart slows, but if the pressure on the neck continues, the body perceives that blood pressure is still too high and signals the heart to slow still further. This can continue until a diver feels ill, light-headed and eventually faints.
   2. Other physiologists think that the issue is reduced jugular return due to constriction of the jugular veins. This can result in similar signs and symptoms. Whether the underlying cause is the carotid sinus reflex or blocked jugular return, losing consciousness is potentially life threatening if it happens underwater.
   3. Usually the constriction required for this to happen would make a diver feel uncomfortable well before diving. But, it's important to avoid the problem by diving with a properly adjusted seal, and by removing and resizing a neck seal before diving if it is uncomfortably tight.

Note to Instructor

Remind student divers that an excessively tight hood (dry or wet), neck seal, or wet suit collar can constrict the carotid arteries and cause unconsciousness through the carotid sinus reflex. Refer student divers to *The Encyclopedia of Recreational Diving* for more information on the carotid sinus reflex.

6. What two valves do all dry suits used for diving have, and what is each used for?

G. Dry suit valves – inflator and exhaust
   1. Inflator valves
      a. A dry suit creates an air space around your body. Like any air space, it must be equalized when you change depth. The inflator valve permits you to add air while descending to maintain neutral buoyancy and avoid a suit squeeze.
      b. Typically located in the middle of the chest, but may be located elsewhere based on user preference.
      c. Connected to a long low-pressure hose from the regulator, or to a separate small tank and special regulator when using argon. Valve is push-button operated, letting gas into your suit as needed much like the inflator on your BCD. With only a few exceptions, the hose/valve connection is the same as on your BCD inflator.

d. When not using the suit, disconnect the low pressure hose and put protective cap on valve stem to avoid puncturing suit when folded (fold so valves are outside).
e. Remember to connect low-pressure hose after putting on your scuba system and disconnecting before removing it. This can also be a consideration when assisting/rescuing a diver wearing a dry suit.

2. Exhaust valves
   a. Allow you to release expanding air as you ascend to avoid uncontrolled buoyancy and ascent.
   b. Typically located on the left shoulder or upper chest, but may be mounted on the wrist. Some suits have secondary exhaust valves on the ankles.
   c. For exhaust valves to work, you have to be "head up" (upper body upward – but not necessarily vertical in the water) so that the valve is the highest point on the suit.
   d. You can set most dry suit exhaust valves to vent air automatically. By turning the outside of the valve, you set it to hold more or less air, depending on your buoyancy requirements. As you ascend, expanding air exceeds the setting and bubbles out automatically (provided the valve is at the highest point).
   e. You can manually release air by pressing the exhaust valve. Some lower cost suits have manual-only exhaust valves.

7. What are the six most common materials used to make a dry suit?

H. Materials used in dry suit construction – all dry suits divide into two basic types: neoprene dry suits and shell dry suits. For simplicity of comparison, dry suit materials can be divided into some basic groups – neoprene foam, coated fabric, crushed neoprene, vulcanized rubber, trilaminate, and composite.
   1. Neoprene foam dry suits
      a. Same material used in wet suits, but suit is designed to keep you dry.
      b. The neoprene itself provides insulation (like a wet suit); with little or no need for an insulating undergarment.
   2. Coated fabric – Typically made from nylon with a waterproof coating on the back (such as urethane or polyurethane).
   3. Crushed neoprene – Material is neoprene crushed under pressure so it has no inherent buoyancy and little insulating quality. Suit is constructed first, and then the neoprene is crushed under pressure.
   4. Vulcanized rubber – Made from synthetic and natural rubber with no inherent buoyancy.

5. Trilaminate – Made from material originally developed for military use in gas and germ warfare – two layers of tightly woven nylon fabric with a thin layer of butyl rubber between them (the same rubber used for car tires).
6. Composite – Use more than one material to take advantage of best qualities of both.

8. What are the advantages and disadvantages of each of the materials used to make a dry suit?

I. Neoprene
   1. Advantages
      a. No need for separate undergarment for shallow dives though may be needed for deeper dives.
      b. Suit stretches and gives – one of the most comfortable dry suits.
   2. Disadvantages
      a. Very buoyant compared to many other dry suits.
      b. Like a wet suit, material compresses with depth losing insulation qualities, and some buoyancy.
      c. Like a wet suit, material breaks down over time and loses insulating ability.
      d. Difficult to repair in the field.
      e. Dries slowly (similar to a wet suit), and creates evaporative cooling when worn wet after a dive.

J. Coated Fabric
   1. Advantages
      a. Many types are inexpensive, but some newer materials are higher cost for higher quality.
      b. Light weight
      c. Dries quickly for repair in field, travel, or storage.
      d. Material has neither significant inherent positive nor negative buoyancy.
   2. Disadvantages
      a. Little or no stretch or give – requires a loose fit, which causes drag while diving.
      b. Material has no practical insulating ability.
      c. With less costly varieties, over time waterproof coating may begin separating from nylon. Once widespread, the suit will not be watertight and cannot be repaired effectively.

K. Crushed Neoprene
   1. Advantages

a. One of toughest materials. Resists abrasion, tears and punctures hence it's very popular with wreck divers.
b. Has some insulating quality (not reduced with depth); somewhat warmer than other suits using same undergarment, though this is a minimal consideration.
c. Good four-way stretch allows close tailoring and comfort. Suit can be worn comfortably for hours.
d. Very durable – may last well over ten years even with frequent use. Suits are estimated to last 1500 to 2000 dives with proper care.
e. Easy to repair.

2. Disadvantages
   a. Dries slowly – creates evaporative cooling when worn wet after a dive.
   b. Though easy to repair, damaged area must be dry to repair.
   c. Heavy – although slightly positively buoyant, weight is greater than many other suits, especially when wet.
   d. High initial investment – one of the most expensive suits, though cost per dive may be lower due to durability.

L. Vulcanized rubber
   1. Advantages
      a. Very durable suit – most popular type among commercial divers. Resists abrasion and punctures.
      b. Water runs off – no evaporative cooling and instantly dries for field repairs, travel, or storage.
   2. Disadvantages
      a. Heaviest of all suits.
      b. Some four way stretch, but not as much as neoprene/crushed neoprene.
      c. High initial cost, though cost per dive may be low due to durability.

M. Trilaminate
   1. Advantages
      a. Highly durable.
      b. Dries quickly for repair, transport, or storage. There is little evaporative cooling.
      c. Material has neither significant inherent positive nor negative buoyancy.
      d. Streamlined – low drag while diving hence popular with cave divers.
      e. Light weight and takes less space for travel, storage, etc.
   2. Disadvantages
      a. No inherent insulating qualities.

b. Not as durable as crushed neoprene.
c. Not flexible, so the suit must fit more loosely to allow range of motion.

N. Composite
1. Advantages
a. Most common – crushed neoprene from waist down, trilaminate waist up. This puts durable, stretchy crushed neoprene over high wear, high motion leg area; and lighter, quicker drying trilaminate on upper body.
2. Disadvantages
a. Cost – may be cheaper in the long run.
b. Different materials require different repair techniques. You need to have two or more sets of repair supplies and be familiar with how to use them.

Note to Instructor

Inform your student divers that thanks to the rise of computer-aided design, they now have the option of mass custom dry suits. To accomplish this, manufacturers use computer software and computer-guided fabrication to cut a dry suit's components. The computer can compare a customer's measurements to existing stock sizes and, if the fit is within a reasonable tolerance, there's no need for a custom fitting – that saves the added costs required to custom cut a pattern to the customer. But, the diver can still order the specific colors and accessories desired. The manufacturer then builds the suit exactly as ordered.

O. Additional dry suit construction considerations

Note to Instructor

Explain to student divers that some manufacturers offer dry suits intended for warm, tropical water. They're similar to cold water dry suits, except that you don't wear a hood and ankle seals (similar to wrist seals) replace the boots.

This may seem unnecessary, but diving dry in the tropics has some advantages. For one, you can precisely adjust your insulation for the dive. A second advantage is that after two or three dives, most people chill in a wet suit even in tropical conditions – with the tropical dry suit, you just add some insulation. Finally, some people find dry suits easier to put on and take off thanks to their looser fit compared to wet suits.

1. Hoods
a. Hoods may be attached to suit, and may or may not be intended to keep head dry. (There's a neck seal in either case). Material may be latex or neoprene. Latex hoods are usually dry and require an undergarment skull cap for insulation. Neoprene hoods are usually wet suit hoods. Latex hoods are fragile. Attached hood complicates how you get into a suit, though may be a bit warmer.

   b. Unattached – typically neoprene wet suit hoods. Short style wet suit hood without a cold water bib is most common, especially with neoprene neck seals. Some silicone or latex neck seal suits use cold water bib with a warm neck collar that holds the bib in place to insulate seal.

2. Boots – modern dry suits have attached boots. Since dry suit boots are typically larger than wet suit boots, you may need a second, larger set of fins when dry suit diving. Three basic styles of dry suit boots:
   a. Soft sole or socks – typically made from latex, they are easily punctured, and you must wear wet suit boots over them for protection and insulation. Found mostly on older inexpensive fabric-coated suits; seldom found on modern suits.
   b. Full sole attached boots – tough, long lasting and warm, they can be a basic boot or an entire molded boot (not just the sole), providing a range from lightweight to heavy duty, rugged versions.
   c. Crushed neoprene sock/rock boots – an option for divers who must walk over uneven, high-wear terrain. Very durable and provides excellent ankle support.
3. Gloves – wet suit gloves are the norm, though there are dry glove systems for colder waters.
   a. Preferred wet suit gloves are those that reach snugly over the seal to avoid uncovered area at wrist (also eliminates cold spot under silicone or latex seals). In coldest water, you may want to use three finger mittens, though you sacrifice dexterity. In water 12°C/54°F and up, some divers use wet suit gloves with fingertips cut off for more dexterity (sacrifices some hand protection and some warmth, however).
   b. Dry gloves may reduce your dexterity, because in some cases, unlike using wet suit gloves, once you put on your dry suit, you're wearing gloves. Dry gloves have become more popular due to quick-change seals (special zippers/ring systems). These allow you to switch between conventional wrist seals and dry gloves easily depending on the temperature. Without the quick-change system, removing and replacing dry gloves takes the same gluing and curing time as replacing a seal.
4. Knee pads – standard on most suits; elbow and butt pads often offered as option. Important construction feature for most types of diving. You can get extra large or extra heavy duty pads if you're particularly hard on the knees.
   a. Pockets – optional, and typically placed on one or both thighs. Pockets that hold knife sheaths are useful, too. Tec divers in particular like thigh pockets because they're easier to access in a tec rig.
   b. Suspenders (braces) – hold suit uniformly against your body and prevents sagging at the waist. They have a side benefit of allowing you to pull the suit top down between dives without the suit falling to your ankles.

5. Telescoping torso – part of self-dressing designs, this provides extra suit length while putting suit on and taking it off. When the suit is on, torso overlaps itself at the waist to take up extra length.
    a. Provides some adjust ability in fitting varying heights.
    b. Aids in getting into a suit yourself.
    c. It accordions when the diver bends or raises arms, affording freedom of movement without making the suit overly baggy when made from nonstretch materials like trilaminate.

V. Dry Suit Undergarments

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **How do undergarments keep dry suit divers warm?**
2. **What are six considerations when choosing dry suit undergarments?**

1. How do undergarments keep dry suit divers warm?

A. Undergarments keep dry suit divers warm
    1. Underwater, undergarments trap gas (air or argon), which has low heat capacity and therefore slows the rate at which water outside the suit carries away body heat. In addition, the undergarment material may have qualities that enhance the insulation provided by the gas depending on the way they trap gas.
    2. Above water, when not wearing the dry suit, trapped air in the undergarment insulates because it does not readily pass heat to cold air outside the suit.

2. What are six considerations when choosing dry suit undergarments?

B. Types of dry suit undergarments:
    1. Today there are many types of undergarments of different materials. They all have different advantages and disadvantages to consider. Your local PADI Dive Center or Resort can help you choose the best for you.
    2. Considerations:
        a. Cost – generally speaking, the more you can afford to invest, the more you get in terms of features, insulating ability, and wear.
        b. Thickness/insulating ability – choose your undergarment based on the water temperature in which you expect to be using your dry suit, and according to your expected activity level.
        c. Insulation characteristics when wet – some materials, such as Thinsulate®, provide significant insulation when wet, an important consideration if

you're tec diving (long decompression) or if your type of diving might delay getting out of the water with a leak (long swim to shore).

d. Care – you treat some undergarments like any other clothing. Others have more stringent care requirements.
e. Bulk – some materials insulate well with little bulk. Others are very bulky for the same insulation.
f. Fit – the garment should fit comfortably and offer full range of motion.

3. Common types of undergarments include (but are not limited to):
   a. Pile (sometimes called Wooly Bears)
   b. Bunting – looks/feels like felt
   c. Open cell foam – fabric coated foam rubber
   d. Thinsulate – a special synthetic manufactured by 3M Company that insulates well even when wet.

C. Depending on the water temperature, it may be wise to add additional layers of insulation in the torso area.
   1. Be sure that anything you wear under your undergarment has wicking properties that carry water away from you.
   2. Wearing the wrong material against your body (e.g., a cotton T-shirt or sweat shirt) will actually make you colder by trapping moisture against your skin.
   3. You have more latitude by adding layers (up to three total) over your undergarment instead of under it.

Note to Instructor

At this point, take a few minutes to assist divers with recommendations for a dry suit and undergarment based on their personal needs – the type of diving they expect to do, local water temperature, duration of dive, cost, etc.

You may want to invite local dry suit manufacturers to show and fit sample suits.

Inform your students that some dry suit manufacturers have events where they may be able to trial dive a dry suit before purchasing it. Check dry suit manufacturers' websites for information about these types of events.

VI. BCDs, Weight Systems, and Argon Inflation Systems

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **Why do you always use a BCD when diving with a dry suit?**
2. **Why do you sometimes need more weight when diving with a dry suit than with a wet suit?**
3. **What are three ways you can distribute weight evenly on your body when diving in a dry suit?**
4. **What is an argon inflation system, and what are the advantages and disadvantages of using one?**

1. Why do you always use a BCD when diving with a dry suit?

A. BCDs for use with dry suits – depending on the type of dry suit you use, it may be more efficient to control your buoyancy while underwater with your suit. Regardless of how you control buoyancy underwater, you'll always use a BCD when dry suit diving.
   1. The BCD provides emergency buoyancy if you get a substantial leak in your suit.
   2. The BCD provides a more comfortable way to float at the surface.
   3. Choose a BCD that fits over your dry suit – the one you have will probably work, but you may need to readjust it so that it does not cover or interfere with the suit valves.

2. Why do you sometimes need more weight when diving with a dry suit than with a wet suit?

B. Diving with a dry suit often requires more weight to attain neutral buoyancy than with a wet suit because you're diving with a larger volume of trapped gas surrounding you.
   1. The amount of added weight you need depends on the suit type and the undergarment type and thickness.
   2. You may need only slightly more weight or you may need considerably more.

3. What are three ways you can distribute weight evenly on your body when diving in a dry suit?

C. You can redistribute weight so that you don't have all your weight in a single, uncomfortable weight belt.
   1. Use accessory weights that let you distribute some weights to other areas of your body, such as ankle weights provided they don't affect your body attitude adversely.

2. Use smaller block weights, bullet weights or shot belts to distribute weights around the belt instead of in one or two large clumps.
3. Divide your total weight between two systems, such as between a weight belt and an integrated BCD weight system, or between an integrated BCD weight system and a weight harness system. A weight harness also avoids making your integrated BCD overly heavy for handling.
4. Remember that it isn't necessary to be able to release all your weight in an emergency – just enough to assure positive buoyancy. Using two weight systems may be an advantage in that you can ditch some of your weights with less risk of an excessively buoyant ascent.

4. What is an argon inflation system, and what are the advantages and disadvantages of using one?

D. Argon systems for dry suits – argon has about half the heat capacity of air. Some divers use argon in their dry suits to provide better insulation with a given undergarment.
   1. Argon systems consist of a small cylinder (usually strapped valve down to the left side of your main tank using a pony bottle bracket or clipped to the BCD harness on the left) and a special regulator with a low-pressure hose to your dry suit inflation valve.

Note to Instructor

Refer student divers to the discussion on argon in *The Encyclopedia of Recreational Diving.* While there, also refer them to other additional information relating to dry suit diving, including water's heat capacity, body responses to heat and cold, hypothermia, hyperthermia and carotid sinus reflex.

Argon systems do not have a second stage or mouthpiece, to prevent someone from accidentally breathing from them. Markings on the cylinder identify that the contents are not air. Because there's no second stage, the regulator must also have a relief valve to avoid hose rupture in the event of a high pressure leak.

Note to Instructor

Make student divers aware that in some areas, regulations or community practice may call for a different valve and connector for argon than used with air. Advise student divers to follow any regulations or practices that apply in their local area.

   2. It's recommended that you still have a low pressure hose coming off your air regulator that you can attach if you inadvertently use all your argon during a dive.
   3. Advantages
      a. Substantially improved insulation without a thicker undergarment.

   b. Suit inflation does not consume breathing air (though this is a minor advantage).

4. Disadvantages
   a. Cost of additional system and cost of buying argon.
   b. Inconvenience of carrying extra system and getting argon fills. You can find Argon is found in some dive stores, but not all. Welding companies and other gas suppliers may also have argon.
   c. Precautions must be taken so that no one tries to breathe from an argon tank – (Not a major problem because of its small size and because there's no second stage, but a consideration. Argon is not toxic; the concern is that there is no oxygen in the gas).
   d. The decompression considerations of diving surrounded by argon gas have not been studied closely. There are no major theoretical concerns, nor have there been any reported DCS-related incidents at this writing. There have been a few anecdotal reports of skin irritation, but these may or may not have been caused by the argon. Nonetheless, if you choose to dive using argon in your suit, you must accept the risk that this has not been studied much and there could be unknown decompression risks or other risks.
5. Once set up and connected to your suit, there are no differences between argon and air in buoyancy control techniques, inflation, etc. For maximum effectiveness, most divers using argon fill and empty their suit one or two times at the surface to flush out air and replace it with argon.

Note to Instructor

Different areas may have regulations or standards of practice regarding the valves and regulator connectors used with argon and other gases. Follow local regulations/standards of practice that may apply.

If you don't have an argon system as a training aid, refer to the photo in the PADI *Dry Suit Diver Manual* to show students a typical argon system set up.

VII. Diving a Dry Suit

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **How do you put on and take off your dry suit?**
2. **How do you eliminate excess air from your dry suit after you put it on?**
3. **What's the recommended technique for maintaining positive buoyancy at the surface when dry suit diving?**
4. **How do you adjust your weight so you're properly weighted for dry suit diving?**
5. **What's the recommended technique for maintaining neutral buoyancy underwater when diving with a shell dry suit and when diving with a neoprene dry suit?**
6. **What's the recommended method for adding air (or argon) to your dry suit underwater?**
7. **What's the recommended method for venting air (or argon) from your dry suit underwater?**

1. How do you put on and take off your dry suit?

A. Putting on your dry suit

1. If it's warm out – wait until the last possible moment. If it's a cool day, you may want to get into your suit or at least undergarments right away.
2. Remove watches, jewelry, etc., and then put on your undergarments.
3. Method will vary somewhat with suit configuration.
4. Put seals on slowly and carefully. Lubricate the wrist seals if recommended by the manufacturer, using a lubricant they recommend. Make sure seals lie flat and have no hair, etc. under them.
5. Step into the legs and secure foot straps (if applicable) to minimize gas volume in the suit legs. Last, close zipper – get assistance if necessary. Hold zipper so it has no sharp bends and both tracks are flat, then close slowly, steadily and gently – never force. Check that it's all the way closed.

Note to Instructor

At this point, take a few minutes to demonstrate and/or describe how to put on different suit types that student divers will be using. If student divers have their own suits assist them into their own dry suits.

Demonstrate for student divers how to put on different types of seals while using manufacturer recommended lubricants. Once again, if student divers have their own dry suits assist them in putting on their own seals.

After this discussion, show the Diving a Dry Suit section of the PADI *Dry Suit Diving* video. The video demonstrations of the skills reinforce your presentation.

2. How do you eliminate excess air from your dry suit after you put it on?

B. Before entering the water, you'll want to purge excess air from the suit so you're not excessively buoyant at the start of the dive.

1. After putting it on and zipping up the suit, hold open the neck seal while crouching into a ball to squeeze out air. Replace seal and stand up. This is also the process you repeat to replace air with argon.

Note to Instructor

Advise student divers that they will have plenty of time to practice getting their suits on and purging their dry suits of gas during their confined water and open water dives.

2. You're now ready to put on the rest of your gear as you normally would. Remember to include checking your dry suit inflator connection and operation, and exhaust valve operation, in your predive safety check.
3. Removing the suit is the same process in reverse order. If you'll be diving again shortly, you may prefer to keep the suit half way on.

3. What's the recommended technique for maintaining positive buoyancy at the surface when dry suit diving?

C. Positive buoyancy on the surface

1. When resting or swimming at the surface, use your BCD for positive buoyancy.
2. Adding enough air (or argon) to your suit to make you that buoyant is uncomfortable because it accumulates and balloons around the shoulder area, putting pressure on your neck and pushing you down into the suit. It can also interfere with moving your arms and put undue stress on suit seams and the zipper.

4. How do you adjust your weight so you're properly weighted for dry suit diving?

D. Determining the proper amount of weight needed while wearing a dry suit.

Note to Instructor

Relate to student divers that the extra weight compensates for consumed air. Without making this correction, it may be difficult to control their buoyancy in shallow water at the end of the dive, and to make a safety stop. When diving with a dry suit, always attempt to maintain neutral buoyancy. Take the time to determine the amount of weight needed.

Inform student divers that overweighting is the number one cause of problems when dry suit diving.

Advise student divers that they will determine the proper amount of weight needed, while wearing a dry suit, during their confined water and open water dives.

1. Begin fully suited using all the scuba equipment and undergarments that you are planning to use while diving.
2. Enter the water and vent any excess air from your BCD and dry suit. Your automatic exhaust valve should be all the way open.
3. Start putting weight into your weight system(s) in small increments until you are neutrally buoyant at the surface. This generally means that holding a normal breath, you will float at eye level, and start to sink when you exhale. Record this amount in your log book for future use.
4. If you go from fresh water to salt water, or vice-versa, you will need to add or remove weight respectively by repeating this procedure.
5. If you determine your weight with a full tank, you'll need to account for weight lost to air consumption. For single tank diving, do this by adding 2–3 kilograms/5–6 pounds to your weight system.
6. Avoid overweighting. If you're over weighted you'll need to keep excess gas (air/argon) in the suit, which can be uncomfortable and cause buoyancy control problems. Divers who are properly weighted find that adjusting their dry suits for squeeze will many times also maintain neutral buoyancy. Proper weighting also prevents injury to sensitive aquatic environments.
7. If you use a weight belt as one of your weight systems, you'll find the pocketed type handy because you can add and subtract weight easily.

5. What's the recommended technique for maintaining neutral buoyancy underwater when diving with a shell dry suit and when diving with a neoprene dry suit?

E. Adjusting your buoyancy underwater – how you use your BCD will depend upon the type of dry suit you're using or whether you're tec diving.
   1. Shell dry suit buoyancy control underwater – you add air (or argon) only to the suit. Do not use your BCD until you return to the surface.
      a. This avoids a suit squeeze (severe pinching due to compression as you descend).
      b. You're not having to control two systems – adding or releasing gas as you change depth.
      c. It keeps the proper amount of air (or argon) in your undergarment for insulation.
      d. As you descend, lower your left shoulder so gas does not vent from the exhaust valve and add gas to offset compression. This maintains buoyancy and avoids a suit squeeze. At the bottom if you're properly weighted, you should need to make no more than a minor adjustment to your automatic exhaust valve so that your suit holds the right amount of gas to stay neutral. You can close the valve slightly so your suit holds more gas.

e. After starting your descent, you can shift to spread eagle position, which helps distribute added gas evenly throughout the suit.

2. Neoprene dry suit buoyancy control underwater – you add air (or argon) to your buoyancy compensator to control your buoyancy.
   a. Neoprene compresses as you descend and you'll end up with an uncomfortable amount of air in your suit if you offset the resulting buoyancy loss by adding air to your suit.
   b. Add just enough air to your suit to prevent suit squeeze as you descend.
   c. Control your buoyancy by adding air to your BCD.
   d. As you descend, control your buoyancy as you normally would in a wet suit and add enough air to your dry suit to prevent suit squeeze.
3. Tec diving in a dry suit – regardless of dry suit type (materials used in construction), while tec diving, you control your buoyancy with your BCD and add just enough gas to your suit to prevent suit squeeze.
   a. On a typical tec dive, you'll be 9 kilograms/20 pounds negatively buoyant if you're properly weighted – way too much to offset by adding air to your dry suit.
   b. Adding this much volume to your suit would be at best uncomfortable and at worst, hazardous by restricting your ability to move.
   c. Excess gas in your suit may stress the zipper (several manufacturers specifically warn that this much stress on a dry suit zipper can cause it to fail).
   d. As you descend, regardless of the type of dry suit, control your buoyancy with your BCD. Add enough air to your dry suit to prevent suit squeeze.

6. What's the recommended method for adding air (or argon) to your dry suit underwater?

F. When adding gas to your suit, do so slowly – short bursts help keep the valve from freezing up in extremely cold water. As you descend, just add short bursts every so often. If you find you need to add a lot of gas during descent to maintain neutral buoyancy, you probably need less weight.

Note to Instructor
Review with student divers how to add gas underwater to their particular dry suits.

7. What's the recommended method for venting air (or argon) from your dry suit underwater?

G. During ascents, you may vent expanding gas either manually or automatically – depending on the type of valve on the suit.

1. When using an automatic valve, open it all the way to release gas easily. As you ascend, raise your left shoulder or wrist (the exhaust valve) to vent gas automatically and/or depress the valve to vent gas manually.
2. If you're diving in a neoprene dry suit (or tec diving in a dry suit), you need to release gas from your BCD and your suit. One technique is to raise your BCD exhaust hose with your left hand while also raising your left arm. You control your BCD and expanding air automatically exhausts from your dry suit. If you're properly weighted, you should only need one hand to control your ascent this way, but if necessary, you can easily reach across with your right hand to manually vent gas while still releasing it from your BCD with your left.

Note to Instructor

Review with student divers how to vent gas underwater from their particular dry suits.

Remind student divers that they'll practice adding and venting gas to their BCDs and dry suits in confined water and on open water dives.

VIII. Dry Suit Safety and Handling Emergencies

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **What are the causes, prevention, and recommended techniques for handling suit squeeze?**
2. **What are the causes, prevention, and recommended techniques for handling excess buoyancy in a dry suit?**
3. **What are the causes, prevention, and recommended techniques for handling an accidentally released weight system?**
4. **What are the causes, prevention, and recommended techniques for handling excess gas in the legs of a dry suit?**
5. **What are the causes, prevention, and recommended techniques for handling a flooded dry suit?**

1. What are the causes, prevention, and recommended techniques for handling suit squeeze?

A. Suit squeeze is caused by descending without adding gas to your dry suit. The gas in the suit compresses, causing a squeeze. Dry suit squeeze can cause welts and bruises where the suit folds against the skin; very severe dry suit squeeze can restrict breathing and be hazardous.

1. Handling suit squeeze
   a. Cause: Disconnected inflator valve, malfunctioning inflator valve, or failure to add gas to the suit during descent. With an argon system, the cause is exhausting argon supply.

b. Prevention: Proper maintenance, check that the valve is connected and functions properly during a predive safety check. Add gas to dry suit regularly during descent. If using an argon system, be sure you have adequate supply for the dive.
c. Correction: If you discover you cannot inflate your suit, immediately stop your descent, using your BCD if necessary to restore neutral buoyancy. If using an argon system and you suspect a supply problem, connect the low pressure hose coming off your breathing regulator to your suit inflator. If you cannot correct the problem and inflate the suit, abort the dive.

Note to Instructor
After this discussion, show the Dry Suit Safety and Handling Emergencies section of the PADI *Dry Suit Diving* video. The video demonstrations of the skills reinforce your presentation.

2. What are the causes, prevention, and recommended techniques for handling excess buoyancy in a dry suit?

B. Excess buoyancy is a problem because it can cause a hazardous rapid ascent. Rapid ascent can cause life threatening lung overexpansion injuries, decompression sickness and other pressure injuries. Excess buoyancy results from several possible problems, each with its own solution.
   1. Inflator valve stuck open or leaking gas
      a. Cause: Poor maintenance (corrosion build-up) or valve freezing in very cold water.
      b. Prevention: Proper maintenance, annual suit servicing; add gas to suit in short bursts.
      c. Correction: Disconnect inflator hose and dump excess gas immediately from exhaust valve. In ascent position, modern exhaust valves will release gas as fast as the inflator adds it. If you have an exhaust valve problem, you can hold open a wrist/neck seal momentarily (you will get wet) as a last resort. Use ascent line to slow rate (if possible).
      d. If you can't vent excess gas fast enough and ascent rate increases, flare your body while dumping excess gas through exhaust valve or a seal. Body flare, fully horizontal with arms/legs spread to create drag. Make a continuous sound as you exhale to assure you don't accidentally hold your breath. End the dive. Flaring is a last resort, but may be used to restore control to, or at least slow, an uncontrolled ascent of any cause.

Note to Instructor
Explain that on the confined water dive student divers will practice disconnecting the inflator hose while underwater.

2. Exhaust valve stuck closed
    a. Cause: Poor maintenance; no predive check of valve.
    b. Prevention: Proper maintenance and annual servicing. Check valve for proper operation before the dive.
    c. Correction: Vent gas through wrist/neck seals. If available, use ascent line to slow rate. If necessary, flare body to slow uncontrolled ascent and attempt to dump excess gas through a wrist seal. End the dive.

3. What are the causes, prevention, and recommended techniques for handling an accidentally released weight system?

C. Lost weights (unable to recover)
    1. Cause: Improper release attachment; mishandling; buckle tripped on underwater object; failure to inspect weight system predive.
    2. Prevention: Be sure you're familiar with weight system; choose a weight system that's not easily tripped; use multiple weight systems to avoid extreme buoyancy if you accidentally lose weight from one; inspect weight system for proper setup and releases before dive.
    3. Correction: Flare body and dump as much gas as possible from seals/exhaust valve. If available, use ascent line to assist in slowing.

D. Over weighted
    1. Cause: Overweighting is offset by more gas in suit. During ascent, excess gas expands faster than can be vented through exhaust valve, causing buoyancy to increase.
    2. Prevention: Dive properly weighted.
    3. Correction: Stop ascent and allow exhaust valve to catch up, then continue ascent much more slowly. If unable to stop ascent, flare body and dump as much gas as possible from seals and exhaust valve. If available, use ascent line to assist in slowing rate. Surface and readjust weight before continuing the dive.

Note to Instructor

This would probably be a good time to have student divers adjust their weight systems and to become familiar with theirs and their buddy's weight system to be used on the open water dives.

4. What are the causes, prevention, and recommended techniques for handling excess gas in the legs of a dry suit?

E. Excess gas in the legs can cause a hazardous runaway ascent. It can also cause your fins to come off and make you float upside down at the surface.
    1. Handling excess gas in the legs of a dry suit

Note to Instructor

Explain that excess gas in the legs is actually a rare event. It is covered here so you know how to respond properly, but by diving properly weighted you should be able to avoid this problem.

a. Cause: excess buoyancy and allowing the legs to get above shoulder level at the same time, or ascending with legs above shoulder level. Results in an uncontrolled feet up ascent.
b. Prevention: All of above excess buoyancy preventions. Do not ascend with feet above shoulder (exhaust valve) level, or raise legs when buoyancy is in question. Some dry suits have exhaust valves on ankles to prevent this.
c. Correction: If possible, grab something to hold you in place and give you leverage. Forward roll-out – bend forward at waist. Kick hard to rotate forward and continue until head-up, feet-down position is attained. Continue to backward roll-out – arch back upward. Kick to rotate upward and continue until head-up, feet-down. Ball-tuck method – bring up knees to chest, tuck into a ball to squeeze air out of legs and at the same time roll sidewise onto back and attempt to dump air.
d. If you can't recover and end up floating upside down (legs up) on the surface, there may be too much gas and buoyancy in your legs to swim into an upright position. Inflate your BCD to bring your chest and head up to the surface, and then deflate your suit.

5. What are the causes, prevention, and recommended techniques for handling a flooded dry suit?

F. Dry suit flooding can cause you to lose buoyancy, as well as compromise your insulation and warmth.
   1. Handling a flooded dry suit
      a. Cause: Most common reasons include:
         i. Zipper not fully closed.
         ii. Damaged zipper
         iii. Material caught in zipper – sand, dirt, undergarment, etc.
         iv. Seal leakage – undergarment under seal, hair under seal, improper adjustment, age cracks, tears, snags.
         v. Exhaust valve leakage – dirty, not properly secured to suit, improperly maintained.
         vi. Tears and holes due to – seam failure, chafing, tear, puncture, delamination.

b. Prevention: Properly getting into the suit, maintenance, and care. Check zipper and be sure it is closed prior to diving. Be careful of underwater obstructions that can puncture or tear a suit.
c. Correction: Terminate dive immediately. Use BCD for buoyancy if necessary. Drop some weights if needed, but use caution to avoid a rapid ascent. If properly weighted, you will not usually need to drop weight to ascend.

IX. Dry Suit Diving Guidelines

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. What are the ten dive community guidelines for dry suit diving?

1. What are the ten dive community guidelines for dry suit diving?

A. The dive community has ten guidelines broadly accepted for diving in a dry suit.
   1. After this course, stay current with new dry suit diving procedures and techniques.
   2. Always wear a BCD for surface flotation and backup buoyancy control. While underwater in a shell type dry suit, use your dry suit for buoyancy control. When diving in a neoprene dry suit or tec diving in a dry suit of any type, use your BCD for buoyancy control and add gas to your dry suit to prevent suit squeeze.
   3. Know your equipment and emergency procedures.
   4. Practice your dry suit diving skills under controlled conditions until they become second nature.
   5. Dive with a buddy who understands your dry suit system.
   6. Use the correct amount of insulation for the water temperature you are diving in and your exercise rate.
   7. Weight yourself for neutral buoyancy at the surface – avoid overweighting. Proper weighting means you can make a 5 metres/15 foot safety stop at the end of the dive with approximately 30 bar/500 psi in your tank.
   8. Check your valves, zipper, and seals prior to each dive.
   9. Clean your suit and valves after every dive and store your suit properly. Check for leaks. Have your suit serviced yearly by a qualified repair technician.
   10. Know your limitations and do not exceed them.

X. Dry Suit Care, Maintenance, Storage, and Packing

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **What is the recommended way to clean and maintain a dry suit after diving?**
2. **What is the recommended way to clean, lubricate and maintain a dry suit zipper?**
3. **How do you store a dry suit so that you avoid damage to it?**
4. **How do you transport a dry suit so that you avoid damage to it?**
5. **What is the recommended interval for dry suit service by a professional at a dive center or the manufacturer?**

1. What is the recommended way to clean and maintain a dry suit after diving?

A. General care

1. Rinse the suit in clean, fresh water after diving. Rinse the interior if the suit leaked or if you perspired excessively.
2. Flush the inflator and exhaust valves thoroughly with fresh water.
3. Hang to dry over thick bar or something that avoids a sharp bend and crease. Put the bend at the knees or waist, and turn the suit inside out to dry the interior first if you will be wearing it soon. Avoid leaving the suit hanging in the same position for more than 24 hours. Don't hang in direct sunlight.
4. Storage
    a. Dust latex and neoprene seals (and latex boots if necessary) with pure talcum powder or as directed by the manufacturer. Never use silicone spray. Silicone spray makes it almost impossible to replace the seals if and when it becomes necessary (doesn't allow glue to bond between the seals and the suit material). Note that some seal preservatives contain silicone and are not recommended by some manufacturers.
    b. Tuck silicone or latex seals into the sleeves/suit body. Loosely roll or fold the suit with valves on the outside (if possible) and the inlet stem capped to avoid punctures during storage. Place in a sealed plastic bag to reduce exposure to ozone.
    c. Store away from heat, oil, and chemicals. Store in a dark, cool, and dry area away from ozone and hydrocarbons (water heaters, electric motors, automobile exhaust).
5. Launder undergarments if needed. Follow manufacturer's directions.
    a. Note that you wash some undergarments without detergent whenever possible. Soap and detergent residue interfere with the material's ability to wick away moisture and insulate when wet.
    b. If you need to use detergent/soap with undergarments because they're very dirty, use very small amounts, and it's important to follow with two or three more wash cycles without detergent or soap to assure that no residue remains in the garment.

2. What is the recommended way to clean, lubricate and maintain a dry suit zipper?

B. Zipper care

1. If necessary, gently clean inside and out with a soft toothbrush dipped in soapy water to remove any dirt or debris clinging to the zipper. If the zipper gets very dirty during a dive, do this (or have your buddy do this) before you attempt to unzip it.
2. Use only paraffin zipper wax to lubricate – never silicone spray. The carrying agent for most silicone sprays delaminates the zipper material and adhesives, and the spray attracts dirt. Silicone makes it almost impossible to replace the zipper if necessary (doesn't allow glue bonding between suit and new zipper). Lubricate with zipper wax before storage.

3. How do you store a dry suit so that you avoid damage to it?

C. Take special care of the zipper so it will last (it's one of the most expensive parts of the suit).

1. Store and transport suit with zipper open or closed (as recommended by the manufacturer), on top and folded gently avoiding sharp bends.
2. Have anyone helping you zip/unzip do so gently and with care.
3. Never force a stuck zipper.
4. When turning suit inside out and putting it on or taking it off, be gentle on the zipper as you turn the material.
5. When partially wearing a dry suit (like between dives) be careful not to sit or lean against the zipper.

4. How do you transport a dry suit so that you avoid damage to it?

D. Packing a dry suit for transport

1. Pack folded as for storage.
2. If possible, pack suit in its own bag – separate from other dive equipment. Always protect from sharp/ heavy dive equipment, and try to pack so that anything set on the bag (as may happen during airline travel) won't stress the zipper.
3. Most divers carry undergarments in a separate, dry bag, or in a separate dry compartment of their dry suit bag.

5. What is the recommended interval for dry suit service by a professional at a dive center or the manufacturer?

E. It is recommended that you have your dry suit professionally serviced annually by a dive center or the manufacturer. This service usually includes inflator and exhaust valve servicing, as well as locating and repairing small leaks, replacing seals as needed, and verifying the water tightness of the suit when complete.

XI. Dry Suit Repairs

Learning Objectives

By the end of this section, you should be able to answer the following questions:

1. **Why do you need to follow different repair methods for different types of dry suits?**
2. **What types of repairs is it recommended that you seek service from the dry suit manufacturer or dealer?**
3. **What are the general steps for locating a dry suit leak and patching it?**
4. **What are the general steps for servicing dry suit valves?**
5. **What are the general steps for removing and replacing seals on a dry suit?**

1. Why do you need to follow different repair methods for different types of dry suits?

A. Because different suits are made of different materials, the repair procedures vary somewhat from one suit type to another. We'll be practicing repairs on _____. Consult the manufacturer's literature and the PADI *Dry Suit Diver Manual* for specific information about repairs for other type suits, or to refresh your memory about those we're covering.

2. For what types of repairs is it recommended that you seek service from the dry suit manufacturer of dealer?

B. Major repairs
   1. The repairs you learn here are for small leaks and easily corrected problems.
   2. You probably won't have the resources to make major repairs, including large tears/holes, replacing a damaged zipper, replacing valves or replacing suit boots. These repairs need to go to the manufacturer or a qualified PADI Dive Center or Resort.
   3. This discussion includes seal replacement because you could do these repairs if you have a spare seal in a situation such as an extended dive trip. However, under usual circumstances it's recommended that you have the manufacturer or a dive center perform seal replacement.

Note to Instructor

The following information applies to most dry suits. When possible, it is recommended that you orient this presentation to the specific suits student divers will be using, according to the information provided by the manufacturer. Make this segment of the course a hands on session — allowing student divers to practice dry suit repair techniques. Important: Direct major dry suit repairs to the manufacturer or a local PADI Dive Center or Resort. For preventive maintenance, encourage divers to have their dry suits serviced once a year by a trained equipment repair technician.

Explain to student divers the types of dry suits you'll be covering in detail based on what student divers have for the course.

When possible give student divers specific references for the repair methods of their individual dry suits in the PADI *Dry Suit Diver Manual*, in their manufacturer literature, and other appropriate sources.

Before getting into repairing, review with student divers the tools and materials to keep on hand when dry suit diving. These tools and materials are usually available from the manufacturer as a prepackaged kit; with the better suits, the kit is usually included.

3. What are the general steps for locating a dry suit leak and patching it?

C. Locating a dry suit leak

1. Sometimes it's easiest to locate a leak during the dive if the leak is small and you're not too cold.
    a. If you feel a leak, raise leaking area and look for bubbles (your buddy may have to help if it is on the rear part of the suit).
    b. Note spot's location on your slate – be as specific as possible so you can find it easily at the surface.
2. Useful materials/tools for finding a leak at the surface.
    a. Tub of water or bowl of soapy water with sponge.
    b. China marker/grease pencil
    c. Rubber bands or jars, cans and bottles (for closing off seals)
    d. Bright flashlight
3. Inflated suit method.
    a. Close zipper
    b. Close seals with rubber bands or put jars, cans, or plastic bottles, etc. in neck and wrist to close off seals.
    c. Inflate suit completely.
    d. Submerge in tub of water and look for bubbles, or sponge suspected leak area with soapy water and look for soap bubbles.
    e. Mark location with china marker.
    f. Search entire suspected area – there may be more than one leak.
4. Flashlight detection technique (most effective with coated fabric, vulcanized rubber and trilaminate suits – sometimes not effective with neoprene/crushed neoprene).
    a. Hold flashlight inside suit in a darkened room and shine toward suspect leak area.
    b. Look for light shining through puncture.
    c. Mark with china marker.

d. Search entire suspected area – there may be more than one leak.

D. Patching punctures or tears – basic steps

1. Area to be repaired must be thoroughly dry on both sides (you can use a small hair drier on warm/cool setting to dry area; especially useful with a wet neoprene or crushed neoprene suit.
2. Turn suit so you have easy access to area to apply patch. With most suits put patch on the inside – looks better, and stresses in use push patch against hole. However, some suits must be patched on outside, and you may need a patch on both sides in some instances.
3. Tears may only require cementing.
4. Cement and apply patch as appropriate for suit material.
5. Allow cement to bond and dry before diving with the suit again. This may be as short as an hour, or as long as 12–24 hours depending on material, cement, and type of repair being made.

Note to Instructor

Give specific patching instructions based on dry suit manufacturer recommendations. If possible, have student divers practice patching on some spare material or an old dry suit. Refer student divers to manufacturer recommendations and the PADI *Dry Suit Diver Manual*.

This is a perfect opportunity to invite a dry suit manufacturer representative to help with guiding this part of the course and to work with student divers.

4. What are the general steps for servicing dry suit valves?

Note to Instructor

The requirements for each valve can differ significantly. Servicing dry suit valves is a procedure recommended only for individuals who are trained and qualified in dry suit repair by the manufacturer.

Remind student divers that this information is presented to them for familiarity with what is required, but should be left to the trained professional.

E. Valve tear down and cleaning

1. Disassemble valve – some makes require removing the valve from the dry suit; this calls for ungluing and regluing the valve. Others may be torn down and cleaned without removing from suit.
2. Clean parts in soap and water or as recommended by manufacturer.
3. Replace worn or damaged parts.
4. Lubricate as specified by the manufacturer.
5. Reassemble and recement to dry suit (if necessary) according to manufacturer guidelines.

5. What are the general steps for removing and replacing seals on a dry suit?

F. Seal replacement – another job that you probably want to leave for your PADI Dive Center, Resort or the suit manufacturer to handle. Alternatively, you can be prepared to replace seals easily by choosing a suit with a quick-change seals system. These systems also allow you to switch between wrist seals and dry glove systems.

1. Remove old seal
2. Clean the area where the new seal will attach (with some suits, removing the old seal accomplishes this simultaneously).
3. Glue the new seal in place (method will vary depending on latex or neoprene seal, and dry suit material).

Note to Instructor

This is an optional activity. Follow the specific instructions supplied by the dry suit manufacturer. You can refer student divers to manufacturer literature and the PADI *Dry Suit Diver Manual.*

Dry suit seal replacement will vary depending on latex or neoprene seal and dry suit material.

Caution student divers that some glues and glue hardeners are toxic. Note all warnings and heed precautions listed, including adequate ventilation, wearing protective rubber gloves, and wearing eye protection.

Recommend to student divers that it's generally best to have the manufacturer or their PADI Dive Center or Resort handle seal replacement. If they need to replace the seals themselves and have never done it, allow as much as two hours (not counting glue-drying time.) Tell student divers to take their time and proceed carefully according to manufacturer guidelines. If they believe they'll be in situations in which they may need to replace seals, it's a good idea to practice their first replacement under the guidance of someone experienced in replacing seals on their type dry suit.

SECTION THREE

Confined Water Dive

Conduct

This confined water dive is required. Student divers must complete this confined water dive prior to making the first dry suit open water dive of this course. The confined water dive provides time to eliminate potential equipment problems, allow student divers to try-out their dry suits, and practice basic skills.

General Considerations

It is highly recommended, but not required that student divers use the same type of dry suit, dive equipment, and accessory equipment during the confined water session they intend to use on their open water dives.

Performance Requirements

By the end of the confined water dive, student divers should be able to:

1. **Put on and remove a dry suit with the aid of another diver if necessary for that model dry suit.**
2. **Demonstrate how to conduct a buoyancy check at the surface while wearing a dry suit with undergarments (when needed) and full scuba equipment.**
3. **Demonstrate neutral buoyancy by gently rising and falling in a controlled manner during inhalation and exhalation for one minute.**
4. **Demonstrate neutral buoyancy by hovering (without kicking or sculling) near the bottom for one minute.**
5. **Disconnect and reconnect the low-pressure hose from the dry suit inflator valve while underwater.**
6. **Perform a neutrally buoyant ascent from the bottom, at a rate no faster than 9 metres/30 feet per minute.**
7. **Demonstrate one technique for recovering from excess gas in the feet.**
8. **Remove and replace both the scuba unit and weight system while on the surface.**

I. Suggested Sequence

A. Briefing

1. Dive sequence – review confined water dive tasks.

B. Predive Procedures

1. Evaluate student diver equipment for suitability for dry suit training.
2. Assist student divers with equipment adjustments for use with dry suit.

C. Confined Water Tasks

1. Demonstrate dressing into, purging excess air, and dressing out of a dry suit.
2. Buoyancy check at surface.
3. Neutral buoyancy by gently rising and falling during inhalation and exhalation.
4. Neutral buoyancy by hovering.
5. Disconnect and reconnect the low-pressure inflator hose from the dry suit valve.
6. Excess gas in feet recovery training — in shallow water at or below the surface, have student divers raise their feet above exhaust valve level and inflate suits until they're slightly positively buoyant, then practice recovering using forward or backward roll, or ball tuck methods.
7. Ascending from the bottom.
8. Remove and replace scuba unit and weight system while on the surface.

D. Post-dive procedures

E. Debriefing

1. Have student divers discuss the tasks performed – what worked and what didn't work, and why.

F. Log confined water dive (instructor signs log book/approves digital log)

SECTION FOUR

Open Water Dives

Conduct

The PADI Dry Suit Diver Specialty course has two required open water training dives. You may add training dives for additional experience as needed for student divers to demonstrate mastery. However, **student divers must demonstrate mastery of all performance objectives for each dive prior to progressing to the next training dive.**

On the first dive, student divers mainly work on neutral buoyancy, both gently rising and falling with inhalation and exhalation and hovering. On the second dive, student divers practice disconnecting and reconnecting the low-pressure hose from the dry suit inflator valve while underwater wearing gloves. Divers who finish exercises with sufficient air remaining may continue to dive for pleasure and experience, at your discretion.

Student divers must wear a BCD during open water dives. In addition to the typical predive equipment familiarization exercise, dive buddies should orient themselves to their partner's dry suit system (specifically knowing how to add and vent gas). During the predive check, dive buddies check valve, zipper, and seal functions before entering the water.

Prior to certification, student divers must demonstrate mastery of all performance objectives.

Dives, Times, Depths and Gases

1. **The minimum number of dives for certification as a PADI Dry Suit Diver is two open water dives.**
2. **All dives must be planned as no stop (no decompression) dives.**
3. The recommended maximum depth is 18 metres/60 feet.

General Considerations

1. Involve student divers in dive-planning activities.
2. Pay particular attention to how much weight student divers use with their dry suits. Have student divers weight themselves so they are neutrally buoyant with a near-empty cylinder. At the end of each dive, student divers make a safety stop at 5 metres/15 feet.

3. Confirm that each student diver's undergarment (if worn with the particular suit) provides sufficient insulation for the water temperature, taking into consideration their exercise rate.
4. **Student divers must wear a BCD during open water dives.**
5. In addition to the typical predive equipment familiarization exercise, dive buddies should orient themselves to their partner's dry suit system (specifically knowing how to add and vent gas). During the predive check, dive buddies check valve, zipper, and seal functions before entering the water.
6. Remind student divers of the possibility of a suit squeeze during descent. Explain how to prevent a suit squeeze by maintaining a minimum volume of air in the suit.
7. It may be appropriate to provide a descent/ascent line for student divers to use if necessary to control their descent/ascent rate. To complete the course successfully, they should be able to control their rates without the line, but it may be useful as they learn and master dry suit buoyancy control.
8. Choose a dive site, preferably a sandy bottom, where fragile marine life will not be damaged during buoyancy skills practice for descents, ascents, pivots, hovers etc.
9. Divers who finish exercises with sufficient air remaining may continue to dive for pleasure and experience, at your discretion.

Sequence Options and Dives

1. Ideally, student divers should complete Knowledge Review – Part I before Dry Suit Dive 1.
2. Student divers should complete Knowledge Review – Part II before Dry Suit Dive 2.
3. **Training dives must be conducted in order.** You may rearrange skill sequences within a dive.

Dry Suit Dive 1

Performance Requirements

By the end of Dry Suit Dive 1, student divers should be able to:

1. **Put on and remove a dry suit with the aid of another diver**
2. **Adjust the amount of weight needed to be neutrally buoyant (float at eye level) at the surface, while maintaining a normal breath and when both the dry suit and BCD are completely vented of air.**
3. **Perform a controlled descent, avoiding suit squeeze.**
4. **Demonstrate neutral buoyancy by gently rising and falling in a controlled manner during inhalation and exhalation for one minute.**
5. **Maintain neutral buoyancy near the bottom by hovering (without kicking or sculling) for one minute.**
6. **Maintain neutral buoyancy during the dive and avoid accidentally kicking up silt or touching the bottom.**
7. **Perform a neutrally buoyant ascent from the bottom, at a rate no faster than 9 metres/30 feet per minute.**
8. **Perform a safety stop at 5 metres/15 feet for at least three minutes.**
9. **Remove and replace, on the surface, both the scuba unit and weight system.**

I. Dry Suit Dive 1

A. Environment: Open Water

B. Maximum Depth: 30 metres/100 feet

II. Suggested Sequence

A. Briefing

1. Evaluate dive site conditions.
2. Identify facilities at the dive site.
3. Explain interesting and helpful facts about the dive site, including bottom topography, bottom composition, depth range and points of interest (use a dive site map if appropriate).
4. Describe entry and exit techniques for the dive site.
5. Have buddy teams plan their turn pressure, ascent pressure and reserve pressure for the dive based on gas supply limits.
6. Review the dive sequence and performance objectives.
7. Review communication and other emergency protocols as required by local regulations.

B. Predive Procedures

1. Have divers prepare dry suits and all standard equipment.
2. Put on all equipment.
3. Remove excess air from dry suit.
4. Review check-out/in procedure with surface support staff (as required).

C. Dry Suit Dive 1

1. Predive safety check – includes checking dry suit function and reviewing use with buddy.
   a. Buddies conduct a predive safety check.
   b. Watch for and correct errors as appropriate.
2. Entry
3. Buoyancy check and proper weighting
4. Descent – watching for suit squeeze.
5. Neutral buoyancy – gently rising and falling during inhalation and exhalation.
6. Neutral buoyancy – hovering.
7. Dive within planned depth and times, and well within dive computer limits at all times.
8. Ascent
   a. Divers ascend at a maximum rate not exceeding 9 metres/30 feet per minute or according to a dive computer.
   b. Divers complete a safety stop for minimum three minutes at 5 metres/15 feet.
9. Exit
   a. Divers establish positive buoyancy at the surface.
   b. Divers remove and replace, on the surface, both the scuba unit and weight system.
   c. Divers exit the water appropriately for the environment, with assistance as necessary.

D. Post-dive Procedures

1. Check in with surface support staff (as required).
2. Divers stow equipment and exchange cylinders as appropriate.

E. Debriefing

1. Provide positive reinforcement and assess performance.
2. Have student divers critique themselves on their performance. Add your observations as appropriate.
3. Log the dive (instructor signs log book/approves digital log).

Dry Suit Dive 2

Performance Requirements

By the end of Dry Suit Dive 2, student divers should be able to:

1. **Put on and remove a dry suit, with the aid of another diver if appropriate for that model dry suit.**
2. **Perform a controlled descent, avoiding suit squeeze.**
3. **Disconnect and reconnect the low-pressure hose from the dry suit inflator valve while underwater wearing gloves.**
4. **Maintain neutral buoyancy during the dive and avoid accidentally kicking up bottom silt and/or touching the reef.**
5. **Perform a neutrally buoyant ascent from the bottom, at a rate no faster than 9 metres/30 feet per minute.**
6. **Perform a safety stop at 5 metres/15 feet for three minutes**

I. Dry Suit Dive 2

A. Environment: Open Water

B. Maximum Depth: 18 metres/60 feet recommended

II. Suggested Sequence

A. Briefing

1. Evaluate dive site conditions.
2. Identify facilities at the dive site.
3. Explain interesting and helpful facts about the dive site, including bottom topography, bottom composition, depth range and points of interest (use a dive site map if appropriate).
4. Describe entry and exit techniques for the dive site.
5. Have buddy teams plan their turn pressure, ascent pressure and reserve pressure for the dive based on gas supply limits.
6. Review the dive sequence and performance objectives.
7. Review communication and other emergency protocols as required by local regulations.

B. Predive Procedures

1. Have divers prepare dry suits and all standard equipment.
2. Put on all equipment.
3. Remove excess air from dry suit.
4. Review check-out/in procedure with surface support staff (as required).

C. Dry Suit Dive 2

1. Predive safety check – includes checking dry suit function and reviewing use with buddy.
   a. Buddies conduct a predive safety check.
   b. Watch for and correct errors as appropriate.
2. Entry
3. Buoyancy check and proper weighting
4. Descent – watching for suit squeeze.
5. Disconnect/reconnect low-pressure inflator hose to dry suit.
6. Dive within planned depth and times, and well within dive computer limits at all times.
7. Ascent
   a. Divers ascend at a maximum rate not exceeding 9 metres/30 feet per minute or according to a dive computer.
   b. Divers complete a safety stop for minimum three minutes at 5 metres/15 feet.
8. Exit
   a. Divers establish positive buoyancy at the surface.
   b. Divers exit the water appropriately for the environment, with assistance as necessary.

D. Post-dive Procedures

1. Check in with surface support staff (as required).
2. Divers stow equipment.

E. Debriefing

1. Provide positive reinforcement and assess performance.
2. Have student divers critique themselves on their performance. Add your observations as appropriate.
3. Log the dive (instructor signs log book/approves digital log).

APPENDIX

Dry Suit Diver

Knowledge Review – Part I

Complete this knowledge review to hand in to your instructor for review. If there's something you don't understand, review the related material. If you still don't understand, have your instructor explain it to you.

1. Explain why even mild hypothermia can be a problem for divers, and how to avoid it.

2. How do you check for proper weighting when diving in your dry suit?

3. Why is it important to not dive with an excessively tight neck seal?

4. How do you attain positive buoyancy at the surface, attain and maintain neutral buoyancy underwater, and prevent dry suit squeeze when dry suit diving?

5. Describe how to add air to your dry suit while underwater.

6. How do you vent air from your dry suit while underwater?

7. What should you do if you become too buoyant due to excess air in your suit?

8. How do you cope with too much air in your dry suit legs/feet?

9. What should you remember about breathing if caught in a runaway or rapid ascent?

10. List what you should do if your dry suit floods.

Student Diver Statement:

I've reviewed the questions and answers, and any I answered incorrectly or incompletely I have had explained to me and/or reviewed the material, so that I now understand what I missed.

Student Name _____

Signature _____ Date _____

Dry Suit Diver

Knowledge Review – Part II

Complete this knowledge review to hand in to your instructor for review. If there's something you don't understand, review the related material. If you still don't understand, have your instructor explain it to you.

11. Explain how a wet suit and a dry suit differ in the way they insulate you.

12. List six factors to consider when choosing an exposure suit for a dive:
    1.
    2.
    3.
    4.
    5.
    6.

13. Explain what the carotid sinus reflex is, what causes it and how to avoid it.

14. List the six most common materials used in constructing dry suits:
    1.
    2.
    3.
    4.
    5.
    6.

15. Explain the purpose of an argon system and the advantages and disadvantages of using one.

16. What causes a dry suit squeeze, and how do you prevent it?

17. Explain what to do if you accidentally become excessively buoyant?

18. Describe the recommended maintenance and regular service for a dry suit.

19. Describe the basic steps for locating and repairing a leak in a dry suit.

20. List the repairs that it's recommended you have the manufacturer or your PADI Dive Center or Resort handle.

Student Diver Statement:

I've reviewed the questions and answers, and any I answered incorrectly or incompletely I have had explained to me and/or reviewed the material, so that I now understand what I missed.

Student Name _____

Signature _____ Date _____

Dry Suit Diver

Knowledge Review – Part I Answer Key

Note to Instructor

To assess knowledge, review the Knowledge Review student divers completed in their PADI *Dry Suit Diver Manual*. Prescriptively review answers to questions student divers may have missed, or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

1. Explain why even mild hypothermia can be a problem for divers, and how to avoid it.
   It interferes with clear thinking, saps away strength and endurance. To avoid, always wear adequate thermal protection before, during, and after a dive.

2. How do you check for proper weighting when diving in your dry suit?
   Wearing a dry suit, undergarment, and all regular equipment, you should float at eye-level while holding a normal breath with an empty BCD. When you exhale, you should sink.

3. Why is it important to not dive with an excessively tight neck seal?
   An excessively tight neck seal can cause carotid sinus reflex, which results in changes in your heart rate and possible unconsciousness.

4. How do you attain positive buoyancy at the surface, attain and maintain neutral buoyancy underwater, and prevent dry suit squeeze when dry suit diving?
   At the surface, add air to BCD, not dry suit. Underwater, if wearing a shell dry suit add air to the dry suit to adjust for neutral buoyancy. Underwater, if wearing a neoprene dry suit or if you are wearing a dry suit for tec diving, add air to your BCD to adjust for neutral buoyancy. Add a little air to your dry suit on descent to prevent dry suit squeeze.

5. Describe how to add air to your dry suit while underwater.
   Short, light bursts of air.

6. How do you vent air from your dry suit while underwater?
   In a feet-down position, vent air through the exhaust valve regularly and gently.

7. What should you do if you become too buoyant due to excess air in your suit?
   Disconnect inflator valve hose (if it started the problem). Immediately dump air from exhaust valve or by pulling the neck or wrist seals open – flair body while dumping air to create drag.

8. How do you cope with too much air in your dry suit legs/feet?
   Rapidly tuck into a ball while rolling on to your back – dump air immediately if needed.

9. What should you remember about breathing if caught in a runaway or rapid ascent?
   Be sure not to hold your breath during the ascent.

10. List what you should do if your dry suit floods.
    Terminate dive immediately. Use BCD to regain buoyancy – drop weights if necessary. Service your dry suit if necessary.

Dry Suit Diver

Knowledge Review – Part II Answer Key

Note to Instructor

To assess knowledge, review the Knowledge Review student divers completed in their PADI *Dry Suit Diver Manual*. Prescriptively review answers to questions student divers may have missed, or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

11. Explain how a wet suit and a dry suit differ in the way they insulate you.
    Wet suit – water seeps in and is trapped between the neoprene and your body. Your body heat warms the water and the neoprene provides insulation. Dry suit – the dry suit traps air (or another gas), which has a much lower heat capacity than water. The air, undergarments, and dry suit all act as insulators.

12. List six factors to consider when choosing an exposure suit for a dive:
    1. **Water temperature**
    2. **Your thermal characteristics**
    3. **Activity level**
    4. **Depth**
    5. **Duration**
    6. **Weather**

13. Explain what the carotid sinus reflex is, what causes it and how to avoid it.
    Pressure on the carotid arteries in the neck causes the heart rate to slow to overcome what it perceives as elevated blood pressure. This may result in light-headedness and loss of consciousness. It may be caused by an excessively tight dry suit neck seal. Avoid it by properly fitting or adjusting the neck seal.

14. List the six most common materials used in constructing dry suits:
    1. **Neoprene foam**
    2. **Coated fabric**
    3. **Crushed neoprene**
    4. **Vulcanized rubber**
    5. **Trilaminate material**
    6. **Composite suits**

15. Explain the purpose of an argon system and the advantages and disadvantages of using one.

    Purpose – alternate dry suit inflation system.

    Advantages – provides better insulation than air for a given undergarment and draws from a separate gas system (doesn't deplete breathing supply).

    Disadvantages – cost of obtaining and maintaining argon system, level of care required to prevent anyone from breathing it, and little study of decompression consideration of diving surrounded by argon.

16. What causes a dry suit squeeze, and how do you prevent it?

    Suit squeeze occurs when you descend without adding gas to the suit. Prevent it by making sure the inflator is connected and operating properly, and add gas regularly during descent.

17. Explain what to do if you accidentally become excessively buoyant?

    Disconnect the inflator hose (if that's the cause) and dump excess gas immediately through the exhaust valve. Vent gas through your wrist or neck seal, flare your body as you ascend and vent gas from exhaust valve and seals, and use a line to control your ascent.

18. Describe the recommended maintenance and regular service for a dry suit.

    Rinse the dry suit in clean, fresh water after diving. Flush the inflator and exhaust valves thoroughly. Hang over something that won't crease or stain it away from direct sunlight. Clean zipper with a soft toothbrush and warm soapy water. When dry, dust the wrist and neck seals with pure talcum powder or as recommended by manufacturer. Annual professional service is recommended as preventative care.

19. Describe the basic steps for locating and repairing a leak in a dry suit.

    Use a flashlight, submerge the inflated suit, or put soapy water on the inflated suit to find leak. Repair neoprene, crushed neoprene, coated fabric and trilaminate suits by patching from the inside. Clean and dry the area and apply a patch with the appropriate cement. Vulcanized rubber suits are patched on the exterior. Clean and dry the area and apply the correct patch to the suit.

20. List the repairs that it's recommended you have the manufacturer or your PADI Dive Center or Resort handle.

    Seal replacement, zipper replacement, and valve overhauls.

PADI Specialty Training Record

Dry Suit Diver

Instructor Statement

I verify that this student has satisfactorily completed all knowledge development training sessions and/or any confined water training sessions as outlined in the PADI Dry Suit Diver Specialty Course Instructor Guide. I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name _____ PADI # _____

Instructor Signature _____ Completion Date _____

Dive 1

I verify that this student has satisfactorily completed Dive 1 as outlined in the PADI Dry Suit Diver Specialty Course Instructor Guide including:

- Gearing up – remove excess air from dry suit
- Buoyancy check with dry suit
- Controlled descent – watch for suit squeeze
- Neutral buoyancy – rising/falling and hovering
- Dry suit dive for fun and pleasure
- Ascent, safety stop for 3 minutes at 5 metres/15 feet
- Remove and replace scuba and weight belt on the surface

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

Instructor Name _____ PADI # _____

Instructor Signature _____ Completion Date _____

Dive 2

I verify that this student has satisfactorily completed Dive 2 as outlined in the PADI Dry Suit Diver Specialty Course Instructor Guide including:

- Gearing up – remove excess air from dry suit
- Controlled descent – watch for suit squeeze
- Dry suit dive for fun and pleasure
- Disconnect/reconnect low-pressure inflator hose to dry suit
- Ascent, 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 _____

Student Diver Statement

I verify that I have completed all performance requirements for this PADI Dry Suit 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.

Student Name _____

Student Signature _____ Completion Date _____

PADI Adventure Dive Training Record

Adventure Dive: Dry Suit

Skills Overview

- Knowledge Review
- Briefing
- Gearing Up
- Predive Safety Check (BWRAF)
- Entry
- Buoyancy Check with Dry Suit
- Controlled Descent
- Neutral Buoyancy – Gently Rise and Fall
- Neutral Buoyancy – Hovering
- Dry Suit Dive for Fun and Pleasure
- Ascent – Safety Stop
- Scuba Unit and Weight System Remove and Replace at Surface
- Debrief
- Log Dive – Complete Training Record

Instructor Statement

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

Instructor Name _____ PADI # _____

Instructor Signature _____ Completion Date _____

Instructor Contact Information (Please Print)

Instructor Mailing Address _____

City _____ State/Province _____

Country _____ Zip/Postal Code _____

Phone _____ 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 dry suit diving and that completion of a PADI Dry Suit Diver course is highly recommended. I also agree to abide by PADI Standard Safe Diving Practices.

Student Name _____

Student Signature _____ Completion Date _____