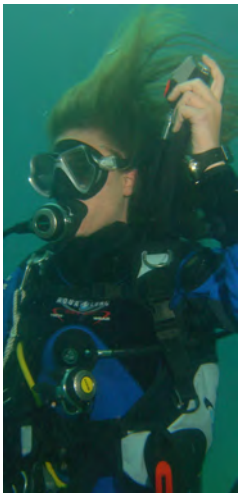
Divers lose their body heat via direct contact with the colder water. The body heat is lost via conduction. Conduction means that the warmer substance (the skin) has direct contact with the colder substance (water). An unprotected swimmer loses body heat up to 25 times faster in water than in air.

Convection refers to the fact that warmed-up water is lighter than colder water. The warmer water moves up and is replaced by colder water. Your body therefore is repeatedly heating up cold water. The working principle of a wetsuit is to keep the warmed-up water in place.



Semi-dry suits are more efficient than wetsuits in preventing warmed-up water from being replaced by colder water. Seals at the neck, ankles and wrist combined with a waterproof zipper make it difficult for the warm water to exit the suit and for cold water to enter. They prevent convection in a more efficient manner.

Dry suits come into play when preventing convection is no longer adequate in delaying the loss of body heat. A dry suit provides the diver with a layer of air around the body. Air is a better thermal insulator than water. A diver will still get cold, but the additional delay in losing body heat will make it possible to enjoy a dive in the coldest environments.

The layer of air is an advantage for thermal insulation. The air in the suit also offers options for positioning in the water that would be difficult with a wetsuit. Unfortunately the added advantage is a trade-off with inconveniences. Diving in a dry suit is not without challenges.

An additional airspace (next to lungs and BCD) makes buoyancy control more difficult. Dry suits require special maintenance. Dry suits also alter requirements for other equipment items and in most cases come with a need for additional weight. Dry suit training is needed in order to cope with the additional challenges. Dry suit training will also provide valuable information for selecting your own dry suit.

Considerations for Choosing a Dry Suit

The main considerations in deciding on a dry suit are the choice of material for the suit itself and the seals (neck and wrist), the type and placement of zippers, the type of inflator, number and placement of vent valves as well as the type and size of the boots. There are three main types of dry suit materials: neoprene, tri-laminate, and crushed neoprene. They offer different trade-offs in terms of heat retention (insulation) and buoyancy, and are thus suited for different types of diving/use.

Neoprene suits are made from the same material as wetsuits. Due to their thickness, the diver does not need thick underwear. The neoprene itself provides thermal insulation. However, neoprene compresses with depth, which means that its insulating capabilities decrease with depth. When diving with a neoprene dry suit, loss of buoyancy at depth is compensated primarily by using the BCD (to compensate for the compression of the neoprene itself), but some air is still needed in the suit to preserve comfort and insulation. The suit inflator is used to keep the air volume (in the suit) constant as depth changes. Maintaining a constant volume of air within the suit will prevent suit squeeze and maintain the insulating capacity of any underwear. Neoprene dry suits are a good choice when working in shallow depths or at the surface. Underwear is absent or thin. This exposes the diver to the weather (wind and rain) when putting the suit on or off.

Tri-laminate suits are made of thin material that does not compress with depth. These suits offer unchanged buoyancy characteristics during a dive. However, the suit does not insulate against cold, making it necessary for the diver to wear appropriate underwear. Such underwear must permit perspiration, but not water entry (similar to ski clothes). Since the suit itself is thin, the thickness of the underwear primarily defines the amount of weight needed. To compensate for loss of buoyancy during a dive, only the suit must be inflated, because tri-laminate does not compress: all buoyancy loss is due to the compression of the air in the suit, which in turn compresses the underwear which provides the primary insulation. The BCD is only used for positive buoyancy at the surface. Tri-laminate suits are not comfortable at the surface because of uneven suit compression (the legs are squeezed while the shoulders are surrounded by a huge air bubble). Tri-laminate suits are comfortable to put on and to take off. The underwear is normally thick, providing protection against cold weather.

Crushed neoprene suits are made of pre-compressed neoprene. They are used with underwear. Their characteristics are a compromise between neoprene and tri-laminate suits. This applies to the advantages, but unfortunately also to some of the inconveniences. Most are more resistant to cuts and abrasions than other types of dry suits.

Dry suit zippers come in different grades of sturdiness, durability and cost. A good zipper can account for a significant percentage of the cost of a dry suit. The most common placing of zippers is shoulder-to-shoulder. This minimizes stress on the extremities of the zipper, since they rest on parts of the body that do not exhibit drastic changes in position. In general, the ends of zippers must be placed away from joints to prevent leaks from developing with wear of the suit. The disadvantage of this type of zipper is that it requires help to open and close the suit.

A second common placing is a zipper that starts from behind the neck, across the torso, and all the way to the hip. This type of zipper is much more convenient to open/close, but the lower part of the zipper is exposed to increased stress. Several other zipper positions are on the market. Ask your local dealer for the rationale of these.

Boots are commonly attached to the dry suit. Some suits have socks only which require the diver to wear boots over them. In very cold areas, you can opt for gloves that are attached to the dry suit. Dry gloves keep you warm more effectively, but complicate using your fingers. In most cases the glove is “clicked on” after putting the suit on.

The primary consideration for suit inflators (which are almost always placed in the centre of the chest area) is that they must have a sunken button to avoid accidental inflation (e.g., when bumping against something).

Every suit also has at least one release valve, which acts as a suit deflator and safety valve (against over-inflation). These valves are generally placed in locations that can be raised over the body mass, to allow for easy venting of excess air. A common placement is on the upper arm. Placing in the forearm makes it easier to vent air, but also increases the likelihood of leakage (since the forearm moves more/faster). Some suits have a secondary valve in the leg, to allow for air release when the diver is in an (undesirable) feet-up position.

The valves allow the diver to adjust their resistance through a rotating, spring-loaded mechanism. When purchasing a new suit, it is important to determine the appropriate setting for the suit, seals and weights used by the diver; this will generally take several dives. When entering or exiting through surf, it is advisable to completely close the valve in order to prevent water leakage.

Seals are generally necessary at the wrists and around the neck. Seals are either thin (such as latex seals) or thick (neoprene seals). Neoprene seals are a good insulator due to thickness, but are leakier (allowing water in the suit) because they do not adapt well to muscle and tendon motion (e.g., those found in the wrists). However, if one is not using a dry suit when writing or otherwise using the hands underwater, neoprene seals adequately. Neoprene seals aid in thermal protection, last longer and are easier to put on and take off. For the neck seal, neoprene offers an additional advantage. The inside of the seal has a nylon lining which makes it easy to pull the seal over the head. Once the seal is put in place, the top of the seal should be folded inward (the same applies to latex seals).

Latex seals are easier to repair than neoprene, but do not offer as good insulation as neoprene. They are recommended as wrist seals for divers who move their hands and fingers a lot because they adapt well to muscle and tendon motion. They are the most common type of seal. Generally, repairing damaged seals is a major undertaking because of the need to use contact glue, which sticks immediately. This requires perfect alignment the first time the materials are brought together. Neck seals in particular are difficult to repair without proper equipment.

Divers should thus take care not to damage the dry suit seals. Putting talcum powder on seals before putting the suit on makes it easier to slide in. When taking the suit off, move slowly to work yourself out of wrist seals step by step. Pay attention not to damage the seal with your nails and avoid jewellery with sharp edges. To put the neck seal on and to take it off, work with both (flat) hands. Check the seals and the zipper before entering the water.

Skill Training for Dry Suits

Skill training for using a dry suit starts with putting the suit on and taking it off. The seals of the suit are sensitive and require the diver to use specific techniques to prevent damage. For some actions, such as turning the top of the neck seal inward, you may welcome the help of your buddy. After putting the suit on, squat to force excess air out.

To dive comfortably and safely in a dry suit, you should be able to perform all diving skills that are part of the Scuba Diver and Open Water Scuba Diver courses. As part of your dry suit training, you will thus perform the skill reviews for both of these courses in a dry suit.

While trying out a dry suit, assume different positions in the water. When the air in the suit can move freely, it will travel to the highest point. The air bubble then stabilizes you in that position. An advantage of a dry suit is thus the possibility to hover vertically, horizontally or at your side.

It is not easy for the air to end up in the booties of the dry suit, but if it does the diver could experience an uncontrolled feet-up ascent. Most dry suit divers dive with slightly bent knees. This restricts the air flow to the booties, as does a weight belt. Feet-up ascents are thus rare. If it happens, an uncontrolled feet-up ascent must be stopped. This is done by grabbing your knees and pulling them against your body while violently turning your body. Stretch the legs when they are below the waist. Then correct your buoyancy.

Consequences for Other Equipment

When using a boot-integrated dry suit, fins must be bigger to fit the boot. Additionally, the foot pocket must extend farther than the hard plastic of the fin strap, in order to avoid scratching the boot (causing suit damage).

The regulator first stage must accommodate an additional inflator hose (for the suit). In most cases dry suits have an inflator connector that can be turned. If that is not the case, the regulator must have a port for an intermediate pressure hose available at the side where the suit connector is located.

The buoyancy control device (BCD) used with a dry suit should generally be a little larger than the one used with a wetsuit by the same diver. (It may be possible to adjust the straps of the same BCD, rather than requiring a second unit; experimentation is needed.)

When diving with a dry suit, more weights are generally needed than with a wetsuit. To avoid overloading the belt buckle, weights should be distributed between the weight belt and an integrated weight system in the BCD. This provides the added advantage to drop only part of the weights in case of an emergency. A diver may also need small ankle weights, to counter any tendencies of the suit to get into a feet-up situation (which is undesirable and tricky to get out of).

Wrist-mounted instruments (e.g., compass, computer) are also problematic when using a dry suit, due to the significant variance in volume and the possibility of damaging the wrist seals. For this reason, integrated consoles are preferred when using a dry suit. Similarly, leg-mounted knives or other instruments should be avoided.