

Engineering innovation: Scuba Diving



Picture courtesy of: Apeks Marine Equipment Ltd.

Discovering the underwater world

Most of us have some idea about the underwater world from watching a few documentaries on the television. Not so many of us have experienced it first-hand - it's not that easy to dive into the sea and look around, holding your breath until you turn blue.

Yet more and more people want to see for themselves what lives in our oceans. They want to swim with dolphins, discover hidden treasures in old shipwrecks or explore coral reefs. And to do so they have to be able to breathe underwater.

To be able to breathe underwater they need some carefully engineered equipment. Essential is a tank full of compressed air. Since humans don't have gills like our fishy friends, we have to take our supply of air into the water with us. And this air has to be safe.

The air you breathe

The air inside your tank must consist of the right gases. It

should be similar to the air we breathe on land. That's about 78 % nitrogen and 22 % oxygen.

The ratio of nitrogen to oxygen has to be altered the deeper you dive. If there's too much nitrogen, gas bubbles can get into your blood stream. This is called the bends, and usually means the diver has to spend a day or two in a decompression chamber. If there's too much oxygen, on the other hand, you can suffer from oxygen poisoning.

Regulating the flow

If you have a tank full of any compressed gas and you open it up, the compressed gas shoots out with some force. If the flow of air from your scuba diving tank to your mouth wasn't controlled the consequences could be disastrous.

So underwater breathing apparatus has many valves and gauges to make sure you get

Saving your supply

When you're beginning a dive - maybe paddling away from the boat or out to the middle of a lake - you don't want to have to use up your oxygen supply. So you use a snorkel.

These are simple breathing devices, allowing you to swim along the surface of the water, looking down and breathing the air above. They're also very important if you get in any trouble, and find yourself a long way away from the boat without any air left in your tank.

Snorkels are J-shaped, with a valve at the lower end of the J. They also have some form of 'splash guard' to minimise the amount of water that splashes down the end of the snorkel.



Getting the best view

Divers want to be able to see when they're underwater. Struggling to keep your eyes open to make out a few blurred shapes just wouldn't be so much fun.

That's why divers use face masks. They're a bit like a pair of goggles, except they're much larger and stronger.

The material used is important. Obviously, it must be transparent. But it also has to be strong - especially if you're diving quite deep. The water pressure will increase the further you dive, and the mask has to be able to withstand this pressure. If the mask broke you'd get water in your eyes. If it shattered you could seriously injure your face.

It also has to fit extremely snugly to make sure it's water-tight.

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the right amount of air when diving. Together they form an essential bit of kit called a regulator. Each of the valves and gauges needs to be carefully checked for safety, making sure they comply with British Standards. They also need to be stuck together with the correct seams and welds.

There are other factors to consider too. For example, air tanks have a rubber gasket at the point where the air leaves the tank. This gasket should be greased. If it's greased with silicone then you should be okay. If it's greased with something petroleum-based, on the other hand, it might just explode under pressure.

Keeping warm

Another essential bit of scuba diving gear is the wetsuit. These come in various thicknesses depending on the temperature of the water. They work by allowing a thin layer of water into the suit, which your body will heat. The suit then traps the water and keeps you insulated.

The other alternative is a dry suit - these keep you completely dry. They're only really used for very, very cold waters. And most scuba divers don't bother with such extremes!

Nigel Whitaker, a technical director at SOLA, a leading British wetsuit manufacturer, says there are currently no British Standards for the suits they make, although there is one being prepared.

However, they still have to carry out rigorous checks on their suits to make sure they're safe and they work properly.



It's not all fun and tropical fish

Scuba diving's not always about jumping into tropical waters and leisurely paddling about. Being able to breath underwater is also required for less enjoyable activities. Scuba divers are often employed to clean the underside of boats or oilrigs. There are also teams of scuba divers who have to search waters for missing bodies or essential bits of forensic evidence.

Did you know?

SCUBA stands for self-contained underwater breathing apparatus. It was invented by Frenchman Jacques Cousteau in 1943. He called the apparatus an aqualung.