To systematically search an area, you have to know where you are, where you are going and where you have been already. This requires some sort of navigation to assure you have this information.

The lightest piece of equipment to do this is the compass, which you probably already have with you as a standard equipment item. The compass allows you to swim patterns under water, which we will discuss later. In strong current a compass is not of much use.

For more complicated search patterns you can consider the use of a scuba sextant. The sextant in combination with the compass can be used to keep track of your location and the area that was already covered during the search.

Ropes and lines allow you to work in currents and limit your navigation efforts – you can concentrate completely on searching, which makes ropes and lines a better option when looking for small items. The drawback is that ropes create drag. If the rope "moves" with you during the search, it is best to have a thin line with positive buoyancy.

If the rope also functions as a safety and communications line for a diver, you should opt for a thick rope with positive buoyancy.

For some search patterns the rope is placed on the bottom as a navigation reference. In that case you should use weighted line. Weighted line is used for fishing nets and other purposes and has small pieces of lead inside to assure its negative buoyancy (an alternative option would be a line with positive buoyancy with a weight at each end).

Specific Weight List for Search & Recovery

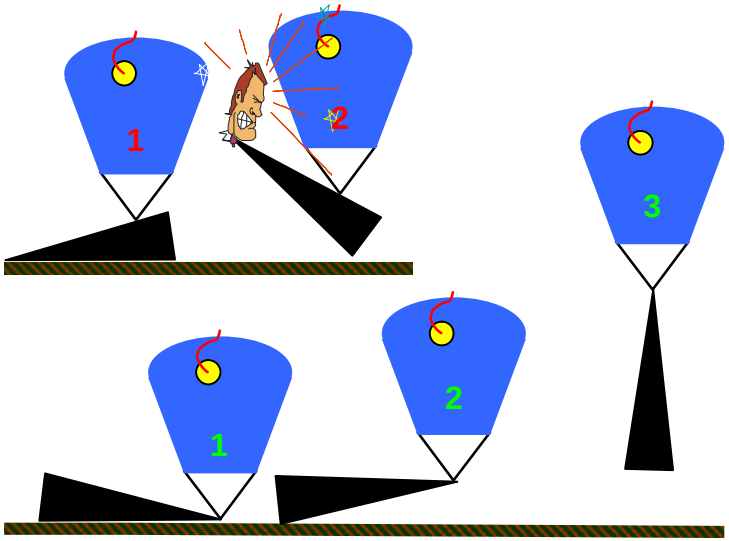
Metal, alloy or material	kg/dm^3	Metal, alloy or material	kg/dm^3
Ordinary steel	7.8 – 7.9	Silver	10.49
Stainless steel	7.48 - 8	Bronze	7.4 – 8.9
Aluminum foil	2.7 – 2.75	Iron	7.85
Melted aluminum	2.56 – 2.64	Cast iron	6.8 – 7.8
Mercury	13.6	Molybdenum	10.2
Gold	19.25	Brass	8.4 – 8.7
Lead	11.34	Platinum	21.4
Copper	8.93	Tin	7.28
Tungsten	19.1	Zinc	7.1
Asbestos	2.1 – 2.8	Bakelite	1.3 – 1.4
Concrete	2.2 – 2.45	Tar	1.2
Diamond	3.5 – 3.6	Rubber	1 - 2
Fiber	1.1 – 1.45	Graphite	1.9 – 2.3
Plaster	2.3	Linoleum	1.15 – 1.3
Marble	2.52 – 2.85	Brick	1.4 – 2.2
Mica	2.6 – 3.2	Porcelain	2.2 – 2.5
Quartz	2.5 -2.8	Glass	2.4 – 2.6
Crystal	2.9 – 3.4	Ocean water	1.02 – 1.03

The above list can be used in two different manners. You can measure an object, such as a block of concrete, and use the list to calculate its weight. Or you can use it to calculate the volume (and thus the underwater weight) of an object, such as an outboard engine of which you know the weight from the factory specifications.

Continuing on the example on page 21, we have a block of concrete with a volume of 250 liters. According to the above list, the specific weight of concrete is 2.2 – 2.45. We want to do the calculation for the "worst case", meaning that we calculate with the 2.45kg/dm^3 (highest) specific weight.

250dm^3 x 2.45kg/dm^3 = 612.5 kg. This is the weight of the object above water, and thus the weight to winch must be rated for as a minimum. Underwater we benefit from an upward force caused by the displaced water. With a volume of 250dm^3, the upward force will be 250kg (in fresh water). To lift the object we need lift bags with a volume of 612.5 – 250 = 362.5 liters.

You should also carefully look where you attach a lift bag to the object. First of all, you want to attach the lift bag to the lighter side of a long object.



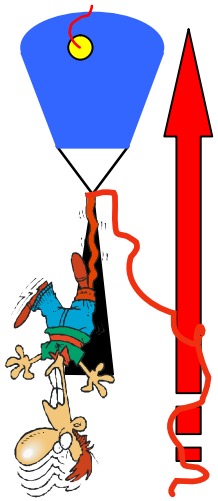
It is always preferred to attach the lift bag(s) on one end of the object. You will not be able to predict the center of gravity of the object, so the moment the lift of an object starts with a lift bag attached in the middle; it can be tilted in an unexpected position. The person who is filling the lift bag is so close that he could be injured by this unexpected movement. When the lift bag is attached on the end of the object (the lighter end), the position it will assume under the lift bag when the lift starts is predictable.

The only inconvenience of this method is that it complicates a beach exit. The object is hanging under the lift bag and sticks rather deep. If the object is lifted onto a boat with a winch, this does not really matter, but when the object must be brought on the beach, you should be able to bring it to a depth shallow enough for divers to stand.

This already means that we prefer lift bags that are not too high, but have a bigger diameter. These would bring the object higher in the water.

Safety is not the only reason to anticipate that the object might sink back to the bottom. There is also a practical reason to take this possibility into account. If you lose the object and it sinks back to the bottom, you might need to start the search all over again.

When finding the object, you have normally attached either a rope or the line from a marker buoy to it. It is recommended to leave the line or rope in place until the object is safely on land or on the boat.



Extra lines around the object do require extra discipline. Make sure you and other divers are clear from all ropes and lines before you start inflating the lift bag.

Entanglement is a risk that is related to Search and Recovery and you should always pay attention to your surroundings.

You can limit the risk of entanglement by shortening the lines – just roll in reels to the minimum length of line you need and remove any lines used for the search that are not needed anymore.

Although you need to be able to tie knots as a Search and Recovery diver, there will be many occasions on which you would prefer the use of a carabiner or a similar hook.

Search and Recovery diving has some additional hazards and safety considerations, but following the guidelines and recommendations mentioned throughout this book will help you to enjoy this special activity in a safe and responsible manner. Use common sense – not only in the selection of what you lift, but also in how you lift it.