

AIR LIFT BAGS - THE BASICS

INTRODUCTION

These notes are intended for users of air lift bags who may not be trained in their use. We make no apology for the for the 'basic' nature of some of the information and ask experienced users to bear with us if we are stating the obvious. As manufacturers we are often surprised by some common misunderstandings over the behaviour of flexible buoyancy when working underwater, and hope these notes go some way towards a simple and straightforward explanation.

BASIC CONCEPTS

Because flexible buoyancy relies solely on internal *overpressure* to work, a flexible buoyancy unit will decrease in volume as it goes deeper because the air inside becomes compressed and occupies a smaller volume. Conversely, as it rises, the air inside will experience a lesser surrounding pressure and so expand to provide a greater volume.

As the amount of buoyancy (lift) is equal to weight of the volume of water displaced, it follows that if no air is gained or lost, the amount of lift varies in proportion to the depth.

In other words, a lift bag going down is compressed and provides decreasing buoyancy while a bag coming up expands and provides increasing buoyancy.

TYPES OF BAGS

There are two basic types of flexible buoyancy units with fundamental differences and purposes.

Air Lifting Bags. (ALBs)

Sometimes called 'parachute type' these are designed to dynamically lift from the seabed while dumping excess air from the *open bottom* as they ascend. Air can be fed in through the ¾" valve on the top *or* from an airline in the open bottom while the dump valve operated by a lanyard at the bottom of the bag allows good control of the buoyancy. With only a single attachment point, ALBs remain upright and stable regardless of the angle of the load and can lift from any depth.

Seaflex models provide the maximum buoyancy for the least overall height and their very robust construction makes them easy to use and hard to damage. The larger bags can be towed at speeds up to 1.5kts on the surface in moderate sea states.

Inflatable Buoyancy Units (ILBs)

Sometimes referred to a 'fully enclosed bags' or 'pontoons', these units have the primary purpose of decreasing the weight of a *static* underwater object or providing buoyancy to objects on, or *very* close to the surface. They are *not* designed or *suitable* for dynamic lifting from any depth. Their rigging requires multiple fixing points at set spacing and they must be kept **close to horizontal** at all times. Their capacity to dump excess air through Pressure Release Valves (PRVs) is limited and larger sizes (over 10t) are very liable to damage themselves if inflated underwater.

Choosing a suitable unit.

Air Lifting Bags (ALBs) are really the only sensible choice for vessel salvage and the recovery of underwater objects although they also used by offshore contractors for static buoyancy at any depth as they only need a single attachment point and are so easy to handle underwater.

When used for vessel salvage, ALBs need the minimum number of fixings, always remain stable and are easy to fill and control. During the lift they accept the high angles of trim that often occur when raising a vessel and can survive extreme situations with little or no damage. Their strength, ease of use underwater and predictable behaviour make them the most effective and safest option for any 'lifting operation'.

If the load simply needs lightening or supporting on or close to the surface, then Inflatable Buoyancy Units (IBUs) are the best choice. Typical applications are vessel draft reduction where pre-set fixings can be used or for pipe pulls where there is no possibility excessive trim angles.

IBUs are totally unsuitable for most salvage work because of the many and accurate fixing points required and their unpredictable behaviour when being inflated underwater. There is little control of the buoyancy and they are extremely susceptible to expensive damage through exceeding their permitted trim angle (see individual model's specification sheets) if the vessel lifts at one end before the other, as is almost always the case. The extra time and complexity required for underwater rigging coupled with their unpredictable and uncontrollable behaviour make these units unsafe and uneconomic for almost all salvage work. Where they can be used, on or very close to the surface, only IBUs up to 10t can be safely inflated underwater. 20t and 35t *can* destroy themselves during this process!

BAG USAGE

SAFETY

The power of a lifting bag should not be underestimated! They are the most deceptively docile pieces of lifting equipment around and just because they don't have big wires and hooks or powerful engines, people tend to forget their incredible power. A fairly modest bag, say a 5t ALB, is capable of lifting 5 family cars with capacity to spare.

POSITIONING

Just as no-one in their right mind would walk under five cars suspended on a crane hook, divers should ***never get under the load or over the bag***, nor allow their umbilicals to do so. At all times they should be aware of the consequences of gear parting and position themselves safely. While a 10t bag ripping a sampson post out of a trawlers rotten deck is a bit of a heart stopper, it's not actually dangerous *unless* you, your umbilical or the DSV are over the lift bag when it happens (or under where it's going to land on its return journey!), i.e. ***positioning*** is the first personal safety rule!

GEAR CHECK

It surely goes without saying that any lifting equipment should be carefully checked before use and doubly so if used underwater. Procedures for this are included with all Seaflex units and are mandatory under *IMCA DO-16 - Air Lift Bags - Revision 3'* guidance notes.

CONTROL TECHNIQUES

CONTROLLED LIFTING

The first and most common method is slowing the rate of a *free ascent* by limiting 'over-capacity'. For example if a 5t unit is used to lift a 1t load from the seabed it will obviously 'lift off' when 20% inflated. As the bag rises, the other 80% is filled with the expanding air until the bag has an over-capacity of 4t. (now thrust) which converts into dramatic vertical acceleration - with often dire result at the surface! Therefore *'match the lift to the load'*. One kilo extra capacity would be ideal but in practice 10% is common and 20% not unheard of.

Alternatively, a *tethered ascent* involves the majority of the load being supported on flexible buoyancy with the remainder, and controlling force, being provided by a light winch. In this way a 5t winch + 95t of buoyancy can bring up a 100t load under centimetre accurate control.

CONTROLLED SINKING

In the writer's experience there is no such thing as 'controlled sinking' using air lift bags. The moment the top of a lift bag goes below the surface it will sink, *and* at an ever increasing rate. Where air lift bags are used for 'controlled sinking' the method usually involves maintaining volume within the bag by air replenishment and hauling down to a weight on the seabed. This operation needs careful planning and even more careful control, but in some circumstance it can provide a very cost effective solution.

CONCLUSION

While these notes hoped to describe the basic characteristics and most common methods of controlling bags there are just about as many different solutions as problems, so please don't hesitate to contact us with any specific requirements not covered by these basic comments above.

MLB
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