

# Heavy Rescue and Lifting bags

## Introduction

When I was asked to write a piece on lifting bags, I wanted to approach it differently. Why would you want to use airbags in the first place? Rescue is not about the equipment, its about understanding the incident. If you understand the incident you will also understand why and which tools have what benefit, including lifting bags.

Lifting bags are used in Heavy rescue or USAR scenario's, so let's understand what comes to play there. Hopefully in the end of the article you will understand the role of lifting bags and the differences between them.

## Heavy Rescue, Emergency lifting, USAR and extrication.

What really do Heavy Rescue, Emergency lifting, USAR and Extrication mean and have in common?

Rescue: The act with the objective to safe a person's life and / or prevent additional injury

Extrication: A systematic act for creating space to remove a victim without uncontrolled movements or instability!

Heavy rescue: moving or stabilizing heavy objects. Requiring lifting equipment and more than normal stabilization equipment.

You can have endless discussions when what starts but they are al somewhat part of the same thing, although USAR is definitely a different area. What is important for this discussion is that in all a large part can evolve around the stabilization and lifting of heavy objects in a controlled way. It is the opposite of a recovery scenario where control and time are less of the essence.

There are three reasons why you want to perform a lifting/moving/shifting operation;

1. To get access/search for the patient.
2. To free the patient from entrapment.
3. To make or be able to perform a safe extrication (think about shifting of a load if one object is still laying on another)

## Do you know what you need to know?

Situations involving a truck, bus or other heavy object are getting more and more common. But do you know how to perform the rescue operations ones you arrive on the scene?

To give an example; Bus accidents are all to common in Sweden seen the extreme winter conditions among others. It became clear among the years this knowledge wasn't available and mistakes where made, costing lives. Over 10 years ago I was asked to research bus accidents and how they could best be handled. Over 800 operations and of course some mistakes later we think we know now how to perform them. I gladly want to share this knowledge. One of the conclusions is that it isn't complex if you follow the correct principles.

Unfortunately I get to many pictures of accidents where not the best or right method was used if you see to make an effective and safely rescue operation. Can teams be blamed for this? No not really, there are no standards in Heavy Rescue but there should be.

The same goes for stabilization, truck accidents and large scale incidents involving structures or trains.

# What would YOU do in this situation?



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## What goes wrong?

An article would be too short to discuss this in depth. But mistakes are easily made in heavy rescue. Already arriving on scene and having a scenario in front of you that you haven't trained for just lost you 20 minutes. Equipment choices, correct stabilization, where to lift can all have a dramatic effect.

Does this need to disappoint you? No not really. It isn't actually that complex ones you know the basics (but again, don't view this as all comprehensive. The message is, get training:-).

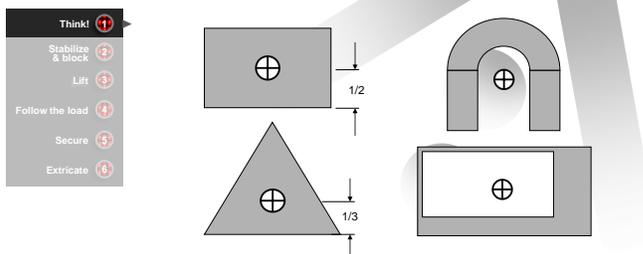
## Control of CG and Rotation points

Lifting is all about controlling your object, which basically is your center of gravity (CG). You can control the CG by using a rotation point, or pivot point. If you would not you are floating the load giving it the possibility to go everywhere.

Next you fix rotation point (there may be rotation points other than you pivot point; think Articulated bus or big Caterpillar), including the pivot point to create a stable object, which will let it remain where it is.

## Step 1 Stability gravity and center of gravity

Guess the location of the Center of Gravity!



Attention: the illustrations are for explanation purposes only. They do not represent a proper lifting scenario. A floating load should never be attempted!

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## Radius and ARC movement

Because of the pivot point lifting creates an ARC movement of the object. This can greatly effect the equipment and the control of the object and can even make it fall out. That is why lifting should always be combined with a second safety device. Every centimeter that is lifted should be secured with another device – period!

*There are some manufacturers that claim there device doesn't need it. I question there knowledge! It's not about how good the equipment is or not, you can do training or take a picture in a controlled environment, but a real rescue scenario never is! It's about performing a safe scenario without any mistakes. So always have a second safety device.*

(Again, don't view this as all comprehensive. I'm trying to give the basics from which your knowledge can grow.)

### Step 3 Lifting ARC movement

**When an object is lifted from 1 side it makes an ARC movement:**  
this means the object not only goes up, it also moves inwards!

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### Step 4 Follow the load ARC capability (of rescue lifting tools)

**DOUBLE SAFETY RULE!**  
is very important

Excessive point loads on structure! Can the structure handle this?

Rams have the same problem..

Arc capability is very poor

**Attention: lifting and stabilization device may never be the same**

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## Why lifting bags?

There are different ways to go about answering this, but let me try to answer by returning the following questions.

1. What is better, having the perfect tool for one type of scenario, or one tool for all jobs?
2. Do you know in advance how heavy or what object you are going to face?

I think the answers are logical. I see too many times conclusions being made what equipment to purchase because it looks well in a brochure or worked well in the one type of scenario. In heavy rescue or USAR you never know what you are going to face. The weight of the object may be 1 or 100 tons. The structure may be weak (like with a bus) or strong like a truck chassis (but not the cabin). Therefore you need equipment that is versatile. Well, nothing is more versatile than a lifting bag:

1. High capacity going up to 100 tons (compare this to any other device, including a ram or crane)
2. Can go anywhere! Small insertion height, low weight and large surface area (keep in mind weak structure need a larger surface area otherwise it cracks)

## The differences between bags

You can divide lifting bags into three categories:

1. low pressure 'pillow bags' (0,5-1 bar)
2. high pressure 'square bags' (8-10 bar)
3. high pressure 'NT' (10 bar)

Don't mistake the pressure with the capacity! It almost funny when somebody still says high pressure is stronger than low pressure when comparing hydraulic tools, same goes for lifting bags. Capacity works by the natural law; Capacity = Pressure x Surface area

So surface area is as important as the pressure. So how to compare performance? To check the surface area multiply it by the area. The issue with airbags is that surface area changes, airbags become rounder the higher they go. So the airbag that retains the most surface area and has the highest pressure logically have the most capacity.

Seen surface area is extremely important for the capacity keep the following in mind; Most objects don't have a flat surface area (pointed load, like axle among others). If you can't maximize the surface area, you lose that capacity of the lifting bag. 'Pillow bags' are faced with this problem most of the time (anything that isn't a flat surface becomes a problem) 'Square bags' have the same problem (although you could attempt to use wood to distribute the force, but it's somewhat ambiguous). 'NT bags' have a built-in plate to distribute smaller areas so you keep the full capacity when lifting an uneven or pointed load.

Thirdly keep in mind the ARC movement you are making. ARC movement puts a side load on the bags. This increases when you attempt to stack bags on top of each other and go higher into a lift. 'Square bags' that are stacked are unstable when side forces increase. Something straps or grip on the surface will not fix.

'Pillow bags' are basically big bags that create a lot of side forces and don't become stable until fully inflated. This is largely solved by using a wedge shaped 'Pillow bag' (which I helped to develop). It works well in bus accidents, but you still will never be able to use it for lifting an axle or uneven surface with a 'Pillow bag'.

The 'NT bag' can be connected to each other in the middle of the bag by a steel connector. This allows it to rotate with the ARC movement well. You can stack three 'NT bags' on top of each other. (Keep in mind that there is a limit how much ARC the 'NT bags' can take.) An added advantage

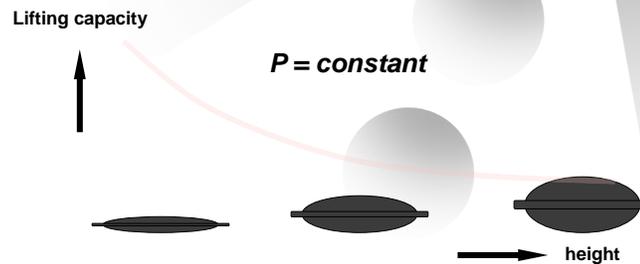
to stacking the 'NT bags' is that you can trade in height for more capacity seen your surface area can stay bigger.

### Step 3 Lifting capacity of airbags

- Think! 1
- Stabilize & block 2
- Lift 3**
- Follow the load 4
- Secure 5
- Extricate 6

The lifting capacity decreases with increasing height.

As the available contact area decreases the lifting capacity also decreases.



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### Conclusions:

Its all about understanding your scenario's and understanding how object can move controlled. Always work with a pivot point and use with a second safety. I think its key to choose equipment that is versatile. An airbag that can deal with different sceanario's. Also that it works well with other equipment like cribbing blocks and struts.

'Wedge pillow bags' work well with a object that doesn't weight so much and have a flat surface – like a bus on the side. I started working with the 'NT bags' a few years ago and was impressed by how versatile they are and the capacity they have.

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## Heavy Rescue Sweden and NATEL

I believe it's all about training and understanding scenario's that make a rescuer effective. Heavy rescue is still underdeveloped; there are no real standards and procedures. The last years I've done a lot of research on heavy rescue incidents involving trucks and busses. I work together with different companies like Scania which allows me to work with only new trucks. I always drop object from a crane to make a realistic scenario, seen I believe that this is the only way to have a good training.

With my company Heavy Rescue Sweden, I started NATEL. A knowledge platform which experts and training centers can join and where everybody can get training. It has the objective to improve the knowledge of Heavy Rescue! We share the knowledge created by workshops and trainings. 1 day workshops can be in your country or at one of the NATEL training centers. If you are a training center you can join the platform you get access to the training materials if you fit the criteria.

If you are interested in learning more about NATEL or want to sign up for a workshop or training please let us know.

Jimmy Säfström

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International Heavy Rescue **Platform** with the aim  
**to improve** the knowledge of **Heavy Rescue worldwide**

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