

Slings

1 Introduction

The alarm rings. Dispatch relays the fire call. Shortly after, 12 firefighters in four vehicles (command vehicle, ladder truck, engine and ambulance) are heading towards the designated address. I know that a second engine and ladder truck from Schaarbeek fire station have also answered the call and are en route to the fire. Their fire station is located much closer to the fire and I expect them to arrive on scene a couple minutes before us.

While we are still driving towards the fire, Schaarbeek crews inform us of their arrival on scene. They report heavy smoke showing. This means a large working fire and chances are, our crews will be put to work as well.

After a few more minutes, we enter into the street. I can see the engine of Schaarbeek station. A single high pressure line is stretched from the engine and going into the front door. Thick, black smoke is billowing out from the top of the front door. The exiting smoke is very turbulent which means a severe fire inside.

I ask the engine driver whether he has any more information. "Everyone is inside". I try to reach the company officer through the radio. No reply.

I send in the captain from our station (Helihaven) for a size up. (In Brussels, each fire is answered with a convoy of four vehicles from Helihaven, the main station. On top of that, an engine and a ladder truck from the station nearest to the fire is also sent out).

It seems to take forever before something finally happens. The four crew members of Helihaven engine are anxious to do something. Given the intensity of the fire, I ask them to deploy low pressure hose packs so that we have a larger flow rate if needed. Quickly thereafter, I'm told that this will not be possible because low pressure hose packs are not yet implemented in the vehicles on scene. (This fire happened during a period in which coiled hose packs were being systematically placed into the engines).

Suddenly, the Schaarbeek company officer comes running out from the building. He is a captain of whom I think very highly. Back when I was still a firefighter, he was a lieutenant. I have often worked with him as company officer, and he is a very competent fellow.

He pulls off his BA mask, bends over and starts to vomit. At first I don't quite understand what is happening. Then it becomes clear that he is completely exhausted. He tells me they have found a victim inside.

I send in two of the four crew members of Helihaven to assist and ask the dispatch for a third fire engine. If the captain is forced to abort his rescue efforts, chances are the crew members are in dire straits as well.

The smoke flowing out from the door remains unchanged. It is as if there is no extinguishment being done. I start to worry.

Several more firefighters of Schaarbeek station come out exhausted. They can offer me some more information. Downstairs, a very heavy fire is raging in the basement. In the hallway downstairs, the crew has stumbled onto a victim. The victim in question is a naked and very obese male. He probably weighs about 130-140 kg. It is nearly impossible to move him.

After some time, the remaining firefighters of Schaarbeek station and the crew of Helihaven come out. They are dragging the lifeless victim along with them. The men have made an enormous physical effort.

The EMT crew commences CPR while the firefighters who still have some reserves left, start the fire attack alongside the third engine crew.

Fire attack, that is what we are good at. Pretty soon, the heavy basement fire is knocked down and we start the overhaul.

2 Rescuing victims

The transition of "Rescuing victims comes before firefighting" to "First, put the fire out" is one of the more important changes in our doctrine, the way we do business, of the past decades.

Fire development is now ten times faster than it was before. In the past, a half hour passed between the beginning of a fire and flashover. Now, it is only about three minutes. We no longer have the option to search for victims first.

Does this mean that we no longer consider the rescue of people our highest priority? No, of course not. It does mean that with most fires, the best way to improve a victim's chances of survival, is to first get control of the fire. Besides, it really is the only acceptable way to operate for our own safety.

But what happens when we find a victim while advancing toward the fire? Does the reasoning above still hold true?

In that case, we no longer have to search. We have already found the victim! Then, the attack crew turns into a (search &) rescue crew. They will evacuate the victim. It is important that they inform the chief officer that they have found a victim and are coming back out. The chief can then send in a different crew for fire attack. After all, it is crucial that the fire is dealt with as well.

Another possibility is that the fire attack crew hands over the victim to a rescue crew that has come in after them. The attack crew can then continue its search for the fire and the rescue crew can evacuate the victim. Again, good communication with the IC is crucial. In Brussels, every fire call also has both an ambulance and an emergency doctor and paramedic crew responding to the call. This is not the case in most other fire departments. There, the IC has to ask for medical aid through the emergency call center 112.

In the example above, the victim's size was so large that it required all hands on the spot to get him out. The victim in the hallway along with six crew members trying to drag him out, made it impossible to get a (high pressure) line past that spot.

3 Moving a victim

All beginnings are difficult. That is why in fire training schools, training dummies are used which weigh about 30 to 50 kg. That kind of weight is still doable for a two man crew. But, ... we are fooling ourselves. The larger part of the human populace weighs more than 70 kg.

One technique often used to pick up and move persons, is the rautek lift (extremity lift). This technique is well suited for EMT crews. Especially when the second EMT responder picks up the legs (and in doing so, carries part of the load), this will allow for a swift evacuation. However it is a technique that puts a lot of strain on the backs of the EMT personnel.

The technique ceases to be useful in a fire situation. Here, fire crews are working in almost zero visibility and sometimes underneath hot smoke. Below the smoke layer, working conditions are bearable; in it, it's another story. That is why firefighters should stay low. All standing techniques should be avoided.

Especially during night time, naked victims are to be expected. Then it becomes very difficult to get a hold on them. Slings can provide a solution to that problem.

4 Slings

Slings come in all different sizes and colors. They are frequently used in sports climbing, but are also often used with lifting appliances. They are almost always some type of webbing stitched into a loop. In both climbing and construction, these slings are always tested and guaranteed to hold a certain load. In climbing, slings with a working load of 2,2 kN are common. These slings can hold up to 2,2 tons.

It goes without saying that slings do not have to be that strong for firefighting purposes. Slings used for moving a victim, will never be subjected to such heavy working loads.



Figure 1 Two slings for sports climbing. Both have a working load of 2,2 kN. The top one is 1m20 and the bottom one is 2m30.
(Photo: Filip Lemmens)

Still, the slings used for climbing are common in firefighting as well. It does not hurt that they are much stronger than necessary. And the big advantage is that they are readily available in almost every store that sells sporting goods for climbing.

In the fire service of Brussels, a couple of firefighters had ordered a custom tubular webbing sling of 3m20. With that sling, they can carry out both simple and complex methods of victim extraction.

France has developed the Rhinovac. This is a custom made open sling for firefighting purposes with a carabiner attached to one end. That carabiner is stitched into a small loop at the end of the sling. The entire sling can also be made into a loop. Then the carabiner has to be clipped in a handle loop at the other end of the sling. This creates a larger loop.



Figure 2a and 2b The Rhinovac stretched out and made into a loop. (Photo: Karel Lambert)

5 Using slings to rescue victims

A simple technique that can be used with all types of slings is attaching the **sling to the lower legs**. By doing this, a simple and effective attachment point is made and the victim can be easily dragged out of the building.

When starting victim extraction with a sling during a fire, it is important that the victim is on his back. If one were to drag the victim out over his belly, chances are there will be severe injuries to the face.



There is a quick and easy way to check whether a victim is on his back or belly. This can be done by locating and bending the knees of the victim. If the leg bends upward (as shown on Figure 3), then the victim is on his back. If this is not the case, the victim has to be turned onto its back before anything else can be done.

Figure 3 By bending the knee, it becomes clear whether or not the victim is on its back. (Photo: Karel Lambert)

It may also be that even though the victim is lying on his back, he is facing the wrong direction. When the victim's head is facing the doorway and we want to evacuate feet first, we would have to turn the victim around. In a large area this is not that difficult. In a

narrow hallway, it is a lot harder to pull off. But again, there is a technique that can be used.

This technique means bending both knees towards the body. The firefighter will hold the victim's legs in this position and move his own arm underneath the head. The he or she can rotate the victim on its back.



Figure 4, 5 and 6 The technique for quickly turning a victim around in a small space. (Photo's: Karel Lambert)

The easiest and simplest way to attach a sling to a victim is the following: both legs of the victim are placed inside the loop (see 7). Next the part of the loop that is located under the legs, is pulled up through the legs (see figure 8). The part that is over the legs is then run through the part that was pulled up, and pulled tight (see figure 8). This creates a solid handle on the legs (see figure 9). The victim can then be easily dragged by one or more firefighters (see figure 10). The downside of this technique is that the victim's head is not protected during the evacuation.



Figure 7, 8, 9 and 10 Step 1: The sling is placed under the legs. Step 2: The bottom part of the sling is pulled up between the leg and the upper part is run through. Step 3: Run the upper end all the way through and pull it tight. Step 4: The victim can now be dragged feet first. (Photo's: Karel Lambert)

Another easy way for evacuating a victim involves placing a **sling around the upper body**. First we have to verify whether the victim is lying face up (bending the knee upward as shown in figure 3). Then, both ends of the sling are placed under the armpits (see figures 11 through 14). Both ends are put over the shoulders, each end at its specific side, and are then run through the center part of the sling. When pulling the entire sling tight, the center part must be guided underneath the head. This is a quick way for creating a handle on a (naked) victim. The knot feels rather uncomfortable to the victim, but it allows for a quick extraction.

There are numerous other techniques as well for tying a sling onto a victim. These are often more complex, which make them less suited for use during fire ground operations. After all, most of the actions have to be performed using only touch. This makes that some specific techniques are practically impossible to pull off for most firefighters. A number of techniques do offer certain benefits in conditions where there is no smoke. In good visibility, techniques can be used which can quickly "wrap up" a person. It then becomes possible to drag, carry, pass through a window, hand to the ladder crew and even safely lift a victim using a block and tackle. During operations where people are difficult to get to using other equipment or where there are numerous victims, these techniques can be of value.

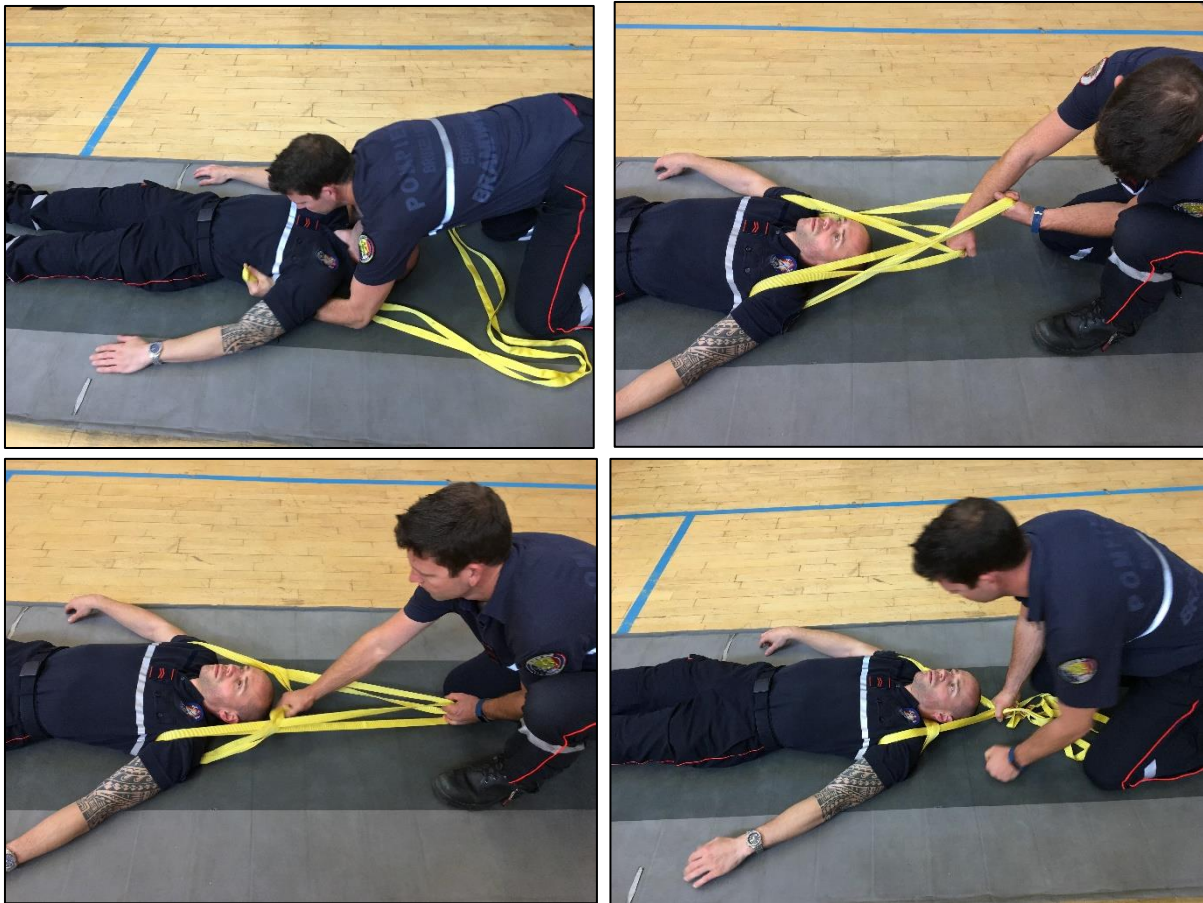


Figure 11, 12, 13 and 14 Step 1: Put the two ends of the sling under the armpits. Step 2: Put both ends in one hand and bring them back from the top of the shoulders. Run both ends through the bottom center part of the sling. Step 3: Continue to pull back the ends and guide the center part of the sling under the victim's head. Step 4: Take hold of both ends at an appropriate length in order to easily drag the victim. (Photo's: Karel Lambert)

6 Critical comments

Each of the applications illustrated above requires training. The more complicated the method, the more training will be needed. After all, there is a significant difference between tying a difficult knot in perfect visibility with bare hands and doing the same in heavy smoke, using only touch while wearing firefighting gloves and a breathing apparatus.

We have to be realistic about those things. Not everyone will be able to master all of these techniques and maintain the level of expertise needed to use them on the field. The time allocated to training and exercise is too limited for that. Over the past years, a large number of topics have been added – rightly so – to the firefighter training curriculum. Choices will have to be made. In some fire departments, victim extraction during a fire is extremely rare. For other fire houses, they happen almost regularly. It goes without saying that in the latter case, those crews will have to spend more time training the use of slings than their colleagues who almost never need to carry out a rescue.

Another choice will have to be made regarding the material. The rhinovac is a fine piece of equipment, but it is also fairly complex. Creating the loop in heavy smoke is not that simple. This will require some training. On the other hand, the complexity of the tool offers

more options. Another downside of the rhinoevac is the sling length. It will be hard to make a loop round the upper body of a big and heavy person. The rhinoevac is too short for that.

The custom sling of 3m20 that is used in Brussels, offers several advantages, but it is rather lengthy for some basic applications. This can be solved by folding the sling and doubling it up. A double sling of 1m60 is created. Doubling it up and keeping it that way however, is easier said than done in a *zero-visibility* environment. On the other hand, a long loop offers a number of additional options that aren't usable during a fire, but which can be used during other incidents. For instance, incidents involving a large number of casualties such as terror attacks. Again, we have to be realistic and state that terror attacks are much more likely to occur in Brussels. Therefore the Brussels firefighters should expect, prepare and train for such an event. This cannot be said for the majority of Belgian firefighters in other parts of the country.

A commercially sold sling, can be acquired at any length. Undoubtedly these have fewer applicable uses, but they also require less training. Probably there is an ideal length with which several techniques can be easily achieved. This will have to be studied further. The use of slings in other types of interventions other than fire, has to be looked at as well.

If a cheap sling can be found, with which several basic applications can easily be taught and with which that knowledge can easily be maintained, then that sling would be welcome addition to our standard intervention equipment.

7 Other applications

The sling can also be used at other times during firefighting operations. During door entry procedure, crews are taught that one of the firefighters has to maintain control of the door. This often means that the door cannot be opened very far. The arm of the firefighter holding on to the door has limited reach.

However, a lark's head knot can be made round a door handle (see figure 15). This is a very simple knot and allows for the door to be opened completely while still retaining control. The downside to this method is that the lark's head sometimes slides off the handle while the door is open. This usually happens with smooth open handles. When dealing with knobs or closed handles the knot stays put. With a bit of training it is even possible to attach the lark's head knot on the inside of the door. The knot will remain taut and cannot slide off.



Figure 15 and 16 A lark's head knot is attached to the door handle or door knob. The door can then be closed with a quick pull and the firefighter keeps control of the door.

Another use of the sling is a bit more complicated. Sometimes firefighters have to overcome an obstacle (e.g. climb through a window or over a wall). An obstacle which can easily be overcome in casual sportswear, is a lot more challenging while wearing full turnout gear. This quickly adds about 25 kg of extra weight. By taking one end of the sling in hand and dangling the other end, a foot hold is made (see figure 17). Now the leg muscles can be used to navigate the obstacle. Such simple tricks make firefighter work a bit easier.

As opposed to the "knots" required to extract victims, these applications are very simple. Showing these things once and training them once, are usually all that is required for someone to be able to use the technique themselves.



Figure 17 and 18 The vaulting box represents a window sill at one and a half meter height. Such an obstacle is not that easy to pass while carrying a load. By gripping the sling at the far end in the hand, a loop is left dangling at the front. This loop can be used as a foot hold. The firefighter can push himself up using the legs. Since leg muscles are much stronger than arm muscles, it becomes possible to clear the obstacle in full turnout gear with BA. (Photo: Karel Lambert)

8 Word of thanks

As is often the case, I did not come up with the ideas described above. I get inspired by other people. This time it was Pieter Maes who inspired me. Pieter is the man behind BIN ("Brandweerman In Nood", the Belgian equivalent of Fireground Survivability). The focus of BIN is on how firefighters can help and save themselves when in peril. There is however an interesting overlap here, with how firefighters can help and save victims. Alongside Patrick Vanderweyen and Eric Plas, both company officers in the 11th company of the Brussels Fire Department, Pieter has introduced the sling as a firefighter tool. The people of the 11th company have organized a group purchase for 3m20 slings, and now almost everyone is carrying one of those slings on their gear. It is beautiful to see such ideas, gathered from meeting with colleagues abroad, find their way into the Belgian fire service. It shows that there are a lot of ideas coming from firefighters and crews themselves, which can greatly improve how we do business on a daily basis.

9 Sources

- [1] *Instructor's course for the Large Volume Cell at PIVO (2017), John McDonough & Karel Lambert: Lesson evacuation techniques by Pieter Maes*
- [2] *Course Casualty extraction team – CET (2017) Lambrechts Robert & Moortgat Danny*
- [3] *Demo by Pieter Maes, Patrick Vanderweyen and Eric Plas*
- [4] *Pieter Maes, personal communication, 2008-2017*