Reviewing the door entry procedure

1 Introduction

The Belgian fire service has a narrowly defined door entry procedure. This has been so for quite some time. Even before the current procedure, there was one in which two firefighters wearing SCBA had to pass a door. However, the firefighters were not carrying a hose line with them, which meant that the procedure was not very realistic.

In 2008, the door entry procedure was updated to include a hose line being advanced into the building. The door entry procedure is now made up out of different parts that have to be done in sequence. In 2010, this "new" door entry procedure was added to the 130 hour long firefighter training course. It is also incorporated in the current basic firefighter training course.

figure 1 A firefighter is directing a pulse into the compartment during a door entry procedure. *(Photo: German Berckmans)*

The door entry procedure is now 10 years old. Over the past 10 years, a lot of new knowledge has been gained. We now have a different view on certain things. The main point of criticism on the current door entry procedure is that we are changing firefighters into robots that perform sequential procedures. But in reality we want thinking firefighters who understand why they have to perform certain actions. It is more important to know the underlying logic of the procedure, than it is to know the actual procedure. Firefighters need to know which goals they are trying to achieve.

Due to inherent changes and also due to the fact that we are trying to move towards thinking firefighters, a review of the door entry procedure is presented in this article. The January issue of the Brandweerman in 2012 contained the 10th article in this series: *Insights concerning the door entry procedure.* That article already highlighted the use of goals to be achieved for any door entry procedure. These goals are partially revisited in this article.

2 Goals of the door entry procedure

A closed door is an obstacle that firefighters have to pass during interior firefighting operations. First of all, it is important that firefighters realize that the door entry procedure is designed to open a door behind which crews are expecting fire conditions. In other words, we do not have to perform door entry procedures on the main entry door of an

apartment building at ground level while the fire is located on the third floor. This may sound a bit farfetched, but sometimes we see crews performing a good door entry procedure at the front door of a single family residence when the fire is clearly not located behind that door. An example of this is a house fire where there is smoke showing through cracks at the rear end of the house and nothing can be seen at the front end. Odds are that the fire is located in one of the compartments in the back and that there is a closed door somewhere between that room and the entrance hall.

Performing an unnecessary door entry procedure takes time. Time is a critical factor in interior firefighting. Water has to be put onto the fire as soon as possible. We can't afford to lose time on unnecessary procedures. So door entry is only done when the crew thinks it is needed.

This leads to the first goal of the door entry procedure: We want crews to be able to swiftly pass a door, even when that door leads into the fire compartment. This means that firefighters have to decide for themselves whether it is necessary to perform door entry procedure. Next they will have to adapt the door entry procedure to the prevailing fire conditions. The goal is **speed**. However, it must never become a race. It is important to operate in a swift manner. Working too fast will lead to carelessness.

A second goal is **safety**. When the crew decides to perform door entry procedure, then a certain risk is to be expected. The door entry procedure is designed to reduce that risk as much as possible. This will be done be correctly applying water and by minimizing the flow of air into the compartment.

Assessing that risk is therefore very important. This leads to a third goal of the procedure. A good door entry procedure gives a better **size up of the situation** *(situational awareness).*

A correct door entry procedure can only be achieved through good teamwork. A critical component of that teamwork is **communication**. The firefighters involved need to communicate very well with each other.

3 What has changed?

The current door entry procedure was developed in 2008. By definition it was based on the knowledge that we had back then. Actually, that procedure is very much based on the premise of a fuel controlled fire, specifically the fire in growth stage. Over the past years, the fire service has increasingly faced under ventilated fires. The fire behavior in such scenarios is fundamentally different.

On top of that, the Thermal Imaging Camera (TIC) has become standard throughout the entire fire service. Each fire engine now has one. The current door entry procedure does take the use of a TIC into account. The TIC however, can be a valuable tool to assist in size up, especially when the room behind the door is filled with smoke.

The smoke stopper is another tool that is slowly gaining popularity in the Belgian fire service. Even more so than the TIC, the smoke stopper needs to be actively included in

the door entry procedure. Not only will the smoke stopper limit the inward flow of fresh air, it will also severely reduce the outward flow of smoke. Especially in apartment buildings, the exiting flow of hot and toxic smoke poses a serious risk. The smoke will cause lots of damage and will create all kinds of problems for other occupants. This applies even more so in hospitals and retirement homes where occupants are less self-reliant.

The current door entry procedure is also built on the assumption that the door which needs to be opened is unlocked. Again, this is not always the case in real life. *Forcible entry,* forcing a closed door with a Halligan tool or another piece of equipment, is also evolving in the Belgian fire service. These techniques allow crews to quickly open locked doors. A good door entry procedure will – when needed – make use of these techniques.

figure 2 The smoke stopper certainly impacts the door entry procedure. It is important to take this into account. *(Photo: Lukas Derkits / Fire Department Wiener Neudorf, Austria)*

An improved version of the door entry procedure therefore no longer consists of 9 strictly defined segments. Crews will have to put together a door entry procedure that is tailored to their specific situation.

That door entry procedure can consist of several different parts. Some of these parts are discussed below in a chronologically possible order.

4 Possible parts of the door entry procedure.

In this paragraph we will discuss seven possible parts of a door entry procedure. It is **not** the case that all of these parts have to be used on every occasion. The goal is that the crew formulates a door entry procedure at the fire ground the moment they have to enter a new compartment. It does not matter whether the door is a regular door, a sliding door, a loft hatch, a garage door, … Crew members need to select the necessary parts described below to achieve the goals of the door entry procedure.

This means that they have to agree and communicate among themselves. Extensive training and using different training scenarios (which lead to different door entry procedures), will allow for success on the fire ground.

4.1 Approaching the door

When approaching a door, it is inspected visually. This is done by the nozzle man. He will relay that he has found a door. Next he will take a closer look at the door. He will try to gauge the circumference if possible. He will look for exiting smoke (pulsating or non-pulsating), orange glow at the bottom, coloring, flaking paint, …

The TIC can help here. When a TIC is available for the attack crew, it will often be the hose man who is carrying it. He can use the TIC to take a look at the door. In many situations, the company officer will be handling the TIC. He can then hand it over to the hose man or he can – temporarily – accompany the attack crew in during the attack. If he chooses to go in, he can observe the door entry procedure with the TIC.

When observing the door, it is important to keep in mind that the door can be a massive wooden door or a fire door. In these cases, certain telltale signs will often not be present. Such a door behaves very different from a metal door in a training container.

figure 3 The nozzle man is searching for hinges to determine whether it is an inward or an outward opening door. *(Photo: German Berckmans)*

Once at the door, the nozzle man will try to locate the hinges or stops to determine which way the door rotates. *Is it an inward opening door (aka "pushing door") or an outward opening door (aka "pulling door")?* He will communicate this to the hose man (and to the company officer if he or she is present). This too has changed over the past years. More and more modern doors have fully integrated hinges (not visible without opening the door). The presence of a stop will then tell that it is an inward opening door.

The nozzle man will also try to assess whether the door is locked. This is done by gently pushing the handle down and carefully moving the door. The goal is to ascertain if the door locked without opening it. If the door is not locked, door entry can be performed without forcible entry. If the door is locked, forcible entry will be needed.

Finally, the crew will also need to pay attention to the room they are currently in. When there is a smoke layer at the ceiling, or when the room is completely filled with smoke, that smoke could in theory ignite when there is an ignition source on the other side of the door. This too needs to be taken into account.

All this information helps to fully size up the situation. The crew will decide, based on this information, how they will handle the door entry procedure and which elements they will include.

4.2 Using a smoke stopper

The smoke stopper is a very significant improvement in firefighting. Because of the its low cost (around €450), every fire engine should be equipped with two. The smoke stopper comes in two different sizes. This way, doors of different widths can be "sealed off".

figure 4 The smoke is exiting through the upper end of the door while the rest of the door opening is used for air that is flowing in. The fresh air will cause the fire to grow faster. *(Photo: Steve Kerber – Underwriters Laboratories)*

The goal of the smoke stopper is to limit both the air that's flowing in and the smoke that is coming out. Minimizing the air flowing inward is particularly important at under ventilated fires. However, because fires are developing much faster nowadays, a good rule of thumb is to always set up a smoke stopper: If the fire has not yet become ventilation controlled upon the arrival of the fire service, it is to be expected that it will soon be ventilation controlled. Not long after drafting up the current door entry procedure, research has sufficiently shown that an open door is enough to cause a ventilation induced flashover (VIFO) in the fire compartment.

Most of the doors that firefighters encounter in a residential setting are so called "pushing doors" (inward opening doors). In those cases, the smoke stopper can be set up immediately after approaching the door. It is perfectly possible to put the smoke stopper in place before the door has been opened. If the door is a "pulling door" (outward opening door), then the smoke stopper will be installed after the door has been opened.

4.3 Cooling the smoke

When there is smoke in the room leading up to the door, then firefighters will have to cool that smoke before opening the door. If a fire is burning fiercely in the next compartment, flames could exit through the open doorway. The smoke in the adjacent room could possibly be sufficiently mixed with air so that the mixture is inside the flammable range. Any flames coming through the door, could ignite the smoke air mixture. Some form of *fire gas ignition (FGI)* will occur: either a *flashfire* (ignition without pressure buildup) or a *smoke explosion* (ignition with pressure buildup). This poses a serious hazard for the attack crew. Particularly when the room they are in is furnished. The furniture might very well be unaffected by the smoke layer. But as soon as it ignites because of the FGI, the heat transfer to the furniture will be huge. If sufficient oxygen is available, a fire will form in the room that will quickly progress to flashover. This is not a good thing when the attack crew is positioned at the door and has to withdraw through the entire room to get out.

It is possible to make this outcome less likely by pulsing twice into the smoke layer directly above the attack crew while they are positioned at the door. The idea is for the water droplets to evaporate in the smoke layer and remain there right in front of the door in the form of steam. So ideally this is done just before the door is opened. That way, an area with a lot of steam is formed in front of the door. Then, if flames were to come through the opened door, they would hit the steam filled smoke layer making the odds of ignition much smaller.

In the case of an inward opening door, the smoke stopper can be set up before opening the door. The smoke stopper that is folded upwards (see figure 5), will likely prevent any flames from coming out. Two pulses at the outside of the door, will then be unnecessary.

4.4 Forcible entry

figure 5 Combination of working with the halligan tool and use of the smoke stopper during a door entry procedure. *(Photo: Pieter Maes)*

If the door is locked, it will have to be forcibly opened. Modern techniques using a halligan tool, allow this to be done in a short amount of time. The Belgian fire service is gathering increasingly more knowledge on this topic. It is important that every firefighter knows how to use these tools effectively and efficiently.

During forcible entry, the smoke stopper will be folded up so that it is out of the way of the crew working the door.

As soon as the door has been forced, the sheet of the smoke stopper can be folded down again further reducing the outward flow of smoke.

4.5 Opening the door and using water

Next, the door is opened by the hose man. The nozzle man will take a look inside. *Is there a clearly defined smoke layer inside? How high is the smoke layer? Is the seat of the fire in here? Is the room filled with smoke from top to bottom? Is there a big inward flow of fresh air?* If the company officer is also at the door, he can monitor the situation using the TIC. The hose man should be looking up to see what is happening at the top of the door. *Is there a lot of smoke flowing out? What color is that smoke? Are there flames exiting through the door?*

The actions to be taken depend on the situation behind the door:

- Behind the door there is a smoke layer that has dropped down from the ceiling to about 1 meter. In that case, the nozzle man will aim the nozzle into the room and flow a long pulse (fog pattern). Water needs to be flowed into the room to cool the smoke layer behind the door. After all, the goal is to enter in a safe manner. This requires that the area where the crew is about to position themselves, is cooled first.

- Behind the door is a fully developed fire. This means that there is at least one other opening in the room. A fully developed fire uses a lot of oxygen. When the door is closed and there is no other opening available, then there is insufficient air to

support a fully developed fire. In the case of a fully developed fire, the nozzle man will perform an indirect attack. He will use indirect extinguishment to knock down the fire (two or three circular movements with a narrow fog pattern and a flow rate of at least 400 liters per minute). Next he will use direct attack to cool any remaining object(s) on fire to achieve full extinguishment. Again the TIC is extremely helpful in these kinds of situations.

- The room behind the door is completely filled with black and hot smoke. This is a situation where the entry door just might be the only opening into the room. Another possibility is that the door leads into a nearby part of a room ("a dead end") that has a fully developed fire on the far side. In the part nearby, there are no flames because there is not enough oxygen there. In either case, flames could quickly form because of the fresh air flowing in through the door. Again in either situation, an indirect attack could be used. Of course the door needs to be closed again after flowing in the water to maximize the effect of the steam. Next time the door is opened up again, the nozzle man can switch to direct attack, supported by the TIC, to tackle the fires that produce the black and hot smoke.

figure 6 Using a sling, the hose man is able to fully open the door while retaining control. *(Photo: Karel Lambert)*

Whatever the case may be, it is important that the nozzle man gets a good look on the situation behind the door and that there is enough room for him to work the nozzle. This means that the hose man has to open the door far enough to achieve this. In the earlier days of door entry procedure, firefighters were taught to open the door 10 cm at the most. This is not a workable method. Often the door will have to be opened 40 cm or more. If a sling is used, the door can be swung open completely. It is important that the hose man retains control of the door and that he is able to close it again when needed.

The time during which the door stays open, can vary depending on the conditions. It does not have to be superfast anymore. After all, you cannot properly observe the situation in the room when the door is only open for five seconds and during those five seconds, you also have to flow three pulses into the room. One exception to this is when opening the door is immediately followed by flames exiting through the doorway. Then it is instantly clear what kind of situation we are dealing with.

Sometimes (not always), the door will need to be closed again. Often this is to allow the steam to cool and inert the smoke. It also allows for the firefighters to briefly exchange thoughts, decide and communicate on what the next actions are going to be. This too leads to a safer working environment.

4.6 Discussion and communication

If the door is closed again, information should be shared among the firefighters of the attack crew. *Maybe the nozzle man now has a pretty good idea of where the fire is located. Maybe the hose man or the company officer saw something on the TIC*. It is important that all of the crew members have all of the info. Then they can decide on what actions to take next. There are several different options:

- Opening the door a second time and entering the compartment while staying on the left or right hand side.
- Opening the door a second time and taking another good look with the TIC. The crew can search the room for the seat of the fire or potential victims.
- Opening the door a second time and performing a direct attack on a fire that has been located.
- …

4.7 Going in

When the crew decides to go in, it is important that enough hose line has been drawn up. A extra loop can come in handy. Figure 7 shows a hose man monitoring his partner on the TIC. Both have just entered a new compartment through the door. Before starting their door entry procedure, the crew has put an extra loop in place. Next, the hose man will advance into the room while dragging the extra loop with him. The advantage of this method is that there is always an extra 10 meters of hose line moving along with the attack crew. Should the hose line coming from the outside get stuck anywhere, the crew has that extra 10 meters available. This is usually enough to reach the fire.

figure 7 The nozzle man has gone in and is following the left side wall. The hose man is watching with the TIC and will follow shortly pulling in the loop that is now outside. *(Photo: German Berckmans)*

As soon as the nozzle man is inside, he will start cooling the smoke. Most likely he will use long pulses. He will also start advancing. The hose man will make sure that enough hose is inside the room before he follows in at a few meters distance. He can opt to drag the extra loop with him. The crew members maintain contact verbally. The firefighter holding the TIC can use it to observe the fire behavior, to search for victims and also to monitor (the actions of) his colleague.

If a smoke stopper is not used, it is recommended that someone keeps the door closed as much as possible (a *door man*). That way, both air flowing in and smoke flowing out are limited.

5 What do we no longer do?

There are also some things that have become obsolete. This is mostly due to more knowledge. We now understand fire behavior better than we did ten years ago. The section below discusses some things that we used to think were important, but are now no longer done.

5.1 Wetting the door

One of the things that was taught in the past, was wetting the door. This is something completely different than two pulses directed into the smoke layer right in front of the door. These pulses are meant to create a steam filled area in the smoke layer which will act as a buffer for any potential flames exiting from the door.

Wetting the door is exactly that: flowing water onto the door. Instructors would tell that the height of the smoke layer could be read on the door. The part of the door that corresponds with the smoke layer would cause the water the evaporate. Most of the time this is not true. It takes some time for heat to fully transfer to the other side of the door. The door would also get damaged by that heat. For the water to evaporate, the temperature on the outside of the door would have to exceed 100 °C. *If that is indeed the case, how hot would it be on the inside of the door? And in what condition would the door be in?*

5.2 Strictly defined positioning

In the current door entry procedure, a lot of emphasis is put on the positioning of the nozzle man and of the hose man. The opening direction of the door and the place of the door handle, define how both crew members should position themselves. Often this leads to good results, but not always.

It is impossible to imagine a set of positions that will always yield a good result. That is why we no longer hold to strictly defined positioning. Each crew member has a task to do. Both of them have to observe the situation. The nozzle man has get water into the compartment in the right shape and amount when necessary. The hose man has to operate the door.

Any set of positions that allows the attack team to achieve their goals effectively and efficiently, is a good one. The crew members will have to decide for themselves what the best positioning is for the situation at hand. It could also be that the door is opened and the nozzle man discovers a wall next to door which limits his view and his ability to effectively get water inside. A good solution would then be to close the door again and reposition to get better results once the door is opened back up again.

5.3 Temperature check

In the past, a temperature check was performed right after making entry into a compartment. This was done by aiming a single pulse directly above the nozzle man. The goal was to assess how hot it was in the compartment. The nozzle would then look at the effect of the water, listen for hissing sounds of water evaporating and feel if any water droplets would fall back down again.

Over the last few years, the realization grew that we need to make this assessment each time we cool smoke. Every single pulse can yield that information:

- What is the water doing?
- What is the smoke doing?
- Is there a hissing sound?
- Do I see/hear water droplets fall back down?

So it is no longer necessary to perform a temperature check like we used to. As soon as the nozzle man has passed the door, he can start gas cooling. This allows for a faster advance towards the fire.

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