

# FIRE SUPPRESSION SYSTEMS FOR ELECTRIC PORT EQUIPMENT





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## BACKGROUND

The world is in the middle of the electric revolution. The change from fossil fuel-driven machines to electric-driven has affected almost all industries in one way or another. As always with new technology, it brings new and exciting possibilities, but it also comes with the risk of misunderstandings, insecurity, and even fear, as new technology like electrified vehicles and machines replace old well-known diesel-driven alternatives.

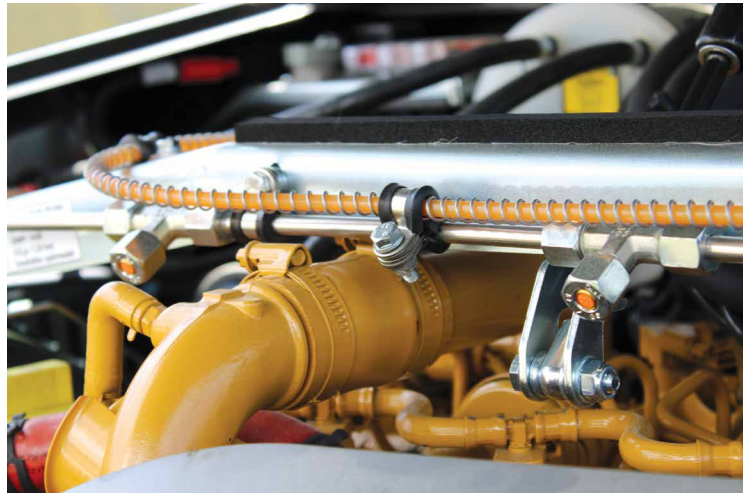
For electric machines, the risk of fire is one example of this.

Unfortunately, this lack of experience is sometimes exploited to create a market by making the customer insecure and to promote a product that might not be needed or might not do what is expected from it.

## THE PROBLEM

New technology means there will be a lack of experience. It also means that there will be both a steep learning curve and a fast development of the product. What we do today might be outdated tomorrow.

Fires or thermal incidents in vehicles and machines are more common than you would expect. Heat, fuel and oxygen are all you need. Although electric vehicles



are involved in fires less often than fossil fuel-driven machines and vehicles it sometimes seems like the fear of a fire is greater with electric machines.

So, what is the problem? When you mention fires and electric vehicles in the same sentence, most people think about the lithium-ion battery and the devastation a fire in such a battery can result in.

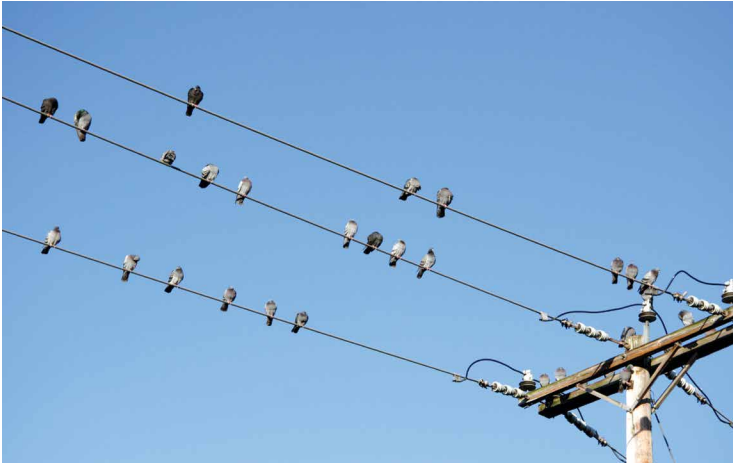
The important thing to remember is that the battery is only one object of many in an electric machine that a fire can originate from. Many other components contain fuels, components that are or can be hot etc. While there

aren't enough statistics available on fires in electric vehicles, the limited data suggests that it is more likely for a fire to start outside the battery and not involve the battery at all, rather than a fire where the battery is involved.

## SOLUTION

So, what can you do? All machine models are unique, and they are used differently and in different environments. All this matters when it comes to risk. A well-performed fire risk analysis is the first step to a safer machine and a safer workplace. If the conclusion

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from the risk assessment is that a fire suppression system is needed to mitigate risks, then it is important to choose a suitable fire suppression and detection system with a, for the area, suitable suppression agent.

All fires are gas fires. It is not the liquid or the solids that burn, it is the gases they release. This is of course a simple way of seeing it, but when considering this, do you really need a special fire suppression for an electric vehicle? In most cases no. Many fire suppression systems that are used for conventional vehicles today can be used with good results on electric vehicles as well. Today there are several different suppression agents in use. Each agent has its benefits and drawbacks. It is important to choose an agent that fulfils your demands and to be aware of and handle the downsides.

Research and recommendations for fire suppression of electric vehicles have changed drastically over the last 10 years. From recommending non-water-based agents to recommendation of water-based agents. The reason for this is the good cooling properties of water-based liquids. Cooling is a very effective way of suppressing a fire and water is a phenomenal chemical when it comes to absorbing heat. If you remove the heat, you will also remove or at least minimise the risk of re-ignition once the fire suppression system has been activated and emptied.

Electric machines and vehicles are subjected to water all the time; rain, road splash, washing and cleaning, high humidity, condensation etc., and they are designed for this.

It is a long-lived myth that water cannot be used to suppress fires in electric components. We all heard of the dryer or toaster in the bathtub and the myth still lives, although we know it does not work like that. In vehicles and machines, fire suppression systems are typically installed where there are no humans. To be electrocuted you need to be in contact with both the positive and negative terminal. Otherwise, you don't create a circuit and there will be no flow of current. Add to that that the high voltage parts in electric machines carry multiple safety features to avoid any dangerous situations.

There is also the possible mix-up with lithium-ion batteries and lithium batteries that could have contributed to the myth that water newer can be used near electric vehicles. Lithium batteries should not be extinguished with water since they contain lithium in their metal form, and they can react with water and create hydrogen, which reacts violently to fire. Lithium-ion batteries do not contain any metal Lithium and do not possess that risk.

It is still very difficult to extinguish a lithium-ion traction battery pack for a vehicle or machine if the battery pack is in thermal runaway. The reasons for this are:



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1. You cannot reach the source of the fire if it starts inside the battery pack and the fire suppression system is installed outside the battery pack. The agent will simply not reach the source of the fire.
2. The quantity of suppression agent needed to cool down and keep a lithium-ion battery pack under control would need to be more than it is reasonable to carry on the machine. It might be possible to buy some time for evacuation with a fire suppression system but stopping a fully evolved lithium-ion battery is very difficult.

The question you should ask is, are battery fires a high risk? Risk = Severity x Probability. The severity is high for a battery fire but the probability is in most cases low, so the risk will be low or medium. There are perhaps higher risks that you should focus on.

The two major reasons for a battery fire are collision and external fire.

A fire suppression system will not protect against collision, but it can protect a battery pack from an external fire. Given what we

know so far it is more important to ensure that a fire cannot start anywhere else in the machine and spread to the battery than to try and protect the battery.

To conclude:

- Look at the whole picture, what risks do we have within the machine? How do we use the machine? What environment is the machine used in? And so on.
- Do a risk assessment.
- Mitigate the high risks. If a fire suppression system is needed make sure that you choose one suitable for the task.
- Ensure that the machines and fire suppression system are serviced according to the manufacturer's instructions.
- Learn from your incidents. A risk assessment is only more or less qualified guessing. Time will tell if you made the correct assumptions. Be sure to revise your risk assessment if you get new facts and improve how you deal with the risks.

### SUMMARY

Fires in electric vehicles and machines are less common than in conventional machines. However,

electric vehicles and machines can still need a fire suppression system. A well-performed risk assessment is the foundation for a higher level of safety. Ensure that all aspects are included in the risk assessment. Mitigate the risks but remember to also follow up when new information is available to ensure the safety of your colleagues, employees and business.

### ABOUT THE AUTHOR

Gustav Stigsohn has a Master of Science in Mechanical Engineering from Linköping University and works at Fogmaker International as a Product Owner. Gustav started working at Fogmaker in 2010 and has worked mainly with product testing, product development and product certification of the Fogmaker Fire Suppression and Detection System.

### ABOUT THE COMPANY

Fogmaker International is a Swedish company that manufactures fire suppression systems with high-pressure water-based mist for engine rooms and other enclosed spaces. The company was founded in 1995 and has partners in more than 60 countries. There are more than 300,000 Fogmaker systems installed around the world.

## “A WELL-PERFORMED RISK ASSESSMENT IS THE FOUNDATION FOR A HIGHER LEVEL OF SAFETY.”