FAQS

LITHIUM-ION
BATTERY SAFETY RANGE

FIRECHIEF®
making the world a safer place









What role can extinguishers play in managing Lithium-ion battery fire risks?

There has been a steady rise in Lithium-ion battery fires in recent years as the number of devices containing them increases. Lithium-ion battery fires have unique attributes and are not like other types of fire, so it's important be able to manage the fire event should the worst happen. Here at Firechief® we are regularly asked about the role of fire extinguishers in managing and mitigating Lithium-ion battery fires. Here we answer some of the most frequently asked questions.

EXTINGUISHING AGENTS

1. Q: Which extinguishing agents are effective on a lithium-ion battery fire?

A: Conventional extinguishing agents vary in their ability to cope with a Lithium-ion battery fire. They're not effective, but their different properties mean that while some might have a level of suppression, they're not going to be able to make the fire safe by reducing, slowing, or stopping thermal runaway.

WATER: Simply using a water extinguisher on a Lithium-ion battery fire will cool it but it won't encapsulate it to form a thermal barrier around the cell in order to prevent it from propagating the reaction to the other battery cells. Once the water extinguisher is empty, the thermal runaway reaction will start all over again. So, although in effect, water will cool a lithium-ion battery, huge volumes of water will be required, and you will still need to put a barrier between the cells to stop the propagation between battery cells.

FOAM: Foam extinguishers are even less effective than a water-based agent. As the foam doesn't meet the high temperature requirements of the Lithium-ion battery fire, it simply isn't effective.

POWDER: This is completely ineffective on a Lithium-ion battery fire as it has no cooling effect and won't encapsulate the cells either.

LITH-EX: Firechief® Lith-Ex extinguishers are 83% water-based because water is the most effective method to cool. The remaining 17% is AVD (Aqueous Vermiculite Dispersion) which encapsulates to cut the cell off , thereby cutting the reaction down. You need to cool, create a firebreak, and stop the reaction, so the quicker you do that, the quicker you make it safe. This is where both the water and the vermiculite part of the agent come together.

2. Q: Will submersion in water work for small devices such as laptops, phones, etc?

A: Submersion is only as good as suppression in this instance. Once you take the device out of the water the damage done to the battery will mean that once it dries out it could very easily go back into thermal runaway.

You've also got to remember that the toxins are now in the water that was used to submerge the device so you will need to consider how you get rid of that water. Even with small devices, it's still there, and has got to be disposed of safely.

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FIRECHIEF® LITH-EX EXTINGUISHERS, AVD & VERMICULITE

3. Q: What is Vermiculite?

A: Vermiculite is a naturally occurring mineral, with a light consistency but when you break it down in your hands, it goes to very thin platelet structure (about 180 microns). This is what the agent is doing when it's going from its liquid to solid State as it's going on to the fire. Vermiculite is environmentally friendly as it is a completely natural product and is **REACH compliant.**

When you need to wash down or remove products after the fire, it is safer to be washed away and it can go back to the earth where it came from. It's actually been used in the cosmetics industry because of the film forming requirements of the agent. (Please note safe removal of a battery after a fire needs a specialist contractor).

Vermiculite is a suspension, so it doesn't require mixing. It doesn't come as a concentrate that you have to do anything with. It remains in its suspension form, within the extinguisher for the full lifetime of the product. It has a double cream consistency when you hold it in your hands (it has a viscosity of 3000 cPs).

4. Q: Why do you use vermiculite in Firechief® Lith-Ex extinguishers?

A: Vermiculite is a natural mineral with amazing thermal isolation properties. It's used in many different products but the main reason we use it in Firechief® Lith-Ex fire extinguishers is the thermal insulation properties of the minerals.

5. Q: How does Aqueous Vermiculate Dispersion (AVD) work?

A: With Aqueous Vermiculite Dispersion the water provides quick cooling while the Vermiculite is suppressing and isolating the fuel source. It then acts as a fire blocking barrier between the battery cells and provides a barrier over the top of the battery cutting it off from the oxygen source and preventing it from propagating. The vermiculite will then start to dry and forms a crust encapsulating the battery and device.

It has passed the 35-kilovolt dielectric testing and is safe from an electrical point of view.

6. Q: Has vermiculite been tested in large pile of compostable waste?

A: Yes. Taking the recycling industry as an example, the methodology they use is to compartmentalize by moving all the other material away from the fire. This means that they can then get in with the AVD to encapsulate and suppress it. It's a very effective method and especially in the recycling sector where the number of fires is growing massively due to people throwing small devices in the bin.

Firechief® Lith-Ex extinguishers can also be used on A class fires such as wood, paper, and textiles.

7. Q: Can a Firechief® Lith-Ex extinguisher be used on other classes and types of fire?

A: Yes, it can. From a Class A point of view, it is a very effective method of preventing propagation. It is also very effective on Class D but will need a different type of nozzle.

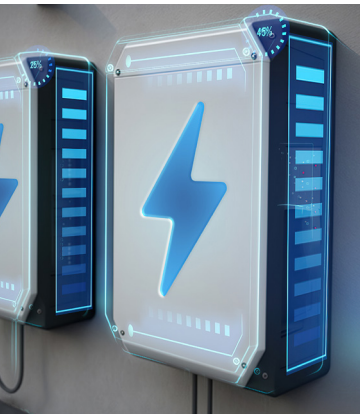
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8. Q: Are Lithium-ion batteries a Class D fire risk?

A: Lithium-ion battery fires are not a class D fire risk. Being Lithium, they do get labelled as such, but because of the makeup of the cell, and there being no free metal in a Lithium-ion battery, it is not class D. This type of fire has its own risks that are quite different to anything else.

USING FIRECHIEF® LITH-EX EXTINGUISHERS

9. Q: Are Firechief® Lith-ex extinguishers safe to use in the home, office, or a small space?

A: Absolutely. Lithium-ion battery fires in devices such as mobiles and small tools can be effectively controlled using a Firechief® Lith-Ex extinguisher but remember not to put yourself or others at any unnecessary risk within the workplace.

10. Q: What training do staff need to effectively use a Firechief® Lith-Ex extinguisher?

A: Training is really important, especially when you're dealing with lithium-ion batteries as these are a new fire risk and they are very complex fires to tackle. It's about education and understanding a lithium-ion battery and how and why they go into thermal runaway

You really should get anyone who's trained within your organisation to deal with fires to understand the lithium batteries. We're not advocating people to become firefighters, but they should all have a good understanding of a lithium-ion battery fire and how complex these fires are. This is why Firechief® offer CPD accredited courses for people to become more educated on this risk.

11. Q: Would you recommend that people use Firechief® Lith-Ex extinguishers on a fire as an initial firefighting tool or should they just be calling the fire services straightaway?

A: If you come across a fire in the early stages, and you have some training and the extinguishers, or trolleys or blankets that can buy you some time for evacuation, then fine. But if the fire has propagated past the point that it is starting to go into thermal runaway with a lot of smoke, gases, and explosions, it would be best to leave it to the professionals. Most importantly make yourself safe before you try and tackle it.

12. Q: If Firechief® Lith-Ex extinguishers suppress toxic gases and only water vapor is released, why is testing conducted using breathing apparatus? Is there a risk of inhaling toxins?

A: From a health and safety point of view, when doing any form of testing, it is mandatory to use the correct PPE. That is part of the test requirements and also ensures that we keep our fire testers safe as we can perform many tests in one day.

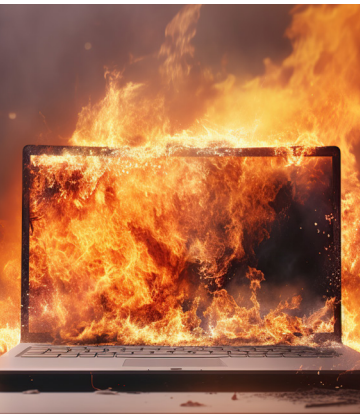
We would always recommend staying a distance of two to three metres away from the fire, being mindful of the toxins, flame reach and heat. This is where training comes in to understand the risks of these types of fire. If you are outside, stand down wind of the fire if possible so you are less exposed to it and the off gases.

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13. Q: How does one assess the risk from toxic fume inhalation when deciding whether to tackle a lithium-ion battery fire?

A: When you're dealing with a lithium battery fire, there are toxic gases, such as hydrogen fluoride, hydrogen cyanide, hydrogen chloride, carbon monoxide and carbon dioxide to name a few. Any exposure to these is bad for you. You also get moisture droplets of ethane and methane within the gas and within an enclosed area a vapour cloud explosion (VCE) can also happen.

The levels will depend on how much you're exposed to and will differ depending on which type of battery, how big the device is. Electric vehicles emit huge amounts of toxic gases which is why the fire brigade need to understand what they're attending so they can use the right correct equipment.

14. Q: Which fire extinguishers would you recommend for electric buses?

A: Electric buses are a complex fire situation because of where the batteries are likely to be positioned – either underneath the drive train or in a section of the roof.

Most important with buses is protection of the passengers and the driver and the safe evacuation of the vehicle. If the batteries are accessible, a suppression system would allow for evacuation of the vehicle.

Due to the size of these vehicles, the fire is likely to be very intense.

15. Q: How effective are extinguishers on EVs if direct access to the battery is required?

A: For any suppression agent to be effective, you need to gain access to the battery cells which will depend on the vehicle involved. Each vehicle will have its own safety data sheet showing the position of the batteries and how you can gain access to the battery cells. This is information that the emergency services will likely have.

If a fire is progressing and has already propagated through the battery cells, a car fire blankets could be used to tuck around the vehicle – but only if it is safe to do so. This will buy you time until the emergency services arrive to dealing with the incident.

16. Q: How effective are Firechief® Lith-Ex extinguishers on EVs or other devices where the battery is less accessible?

Electric vehicle fires are very complex, and it is always best to leave them to the professionals such as the Fire & Rescue Service, who may simply let the EV burn out if it's in a controlled way and safe to do so.

17. Q: Once a fire has been contained or put out, how long before it's safe to approach and move the battery?

A: Under test conditions, we leave it for at least 30 minutes before careful inspection and using a thermal imaging device to check the temperature. By that time, it has started to cool down and the encapsulation has hardened. At that stage, we would generally consider it OK for us to move.









Under normal conditions however, we would recommend leaving it to cool for as long as possible – several hours ideally. What you must be careful of is that any of the thermal runaway or the swelling hasn't caused damage to the other cells. You can sometimes see a delayed reaction and then hours or days later they might still go back into thermal runaway. Make sure to keep the burned battery away from other materials while you're waiting for it to be recycled and taken away .

18. Q: What are the environmental impacts of using Firechief® Lith-Ex extinguishers?

A: Firechief® Lith-Ex extinguishers contain just water (83%) and vermiculite (17%) and will not cause any damage as vermiculite is an environmentally friendly product. It is a natural mineral mined from the ground. Every single batch of vermiculite is batch tested to ensure that it's pure.

STANDARDS & MAINTENANCE

19. Q: How likely is it that Firechief® Lith-Ex Extinguishers will become compliant with British Standards?

A: At the moment, there is no Lithium-ion battery fire standard, but the internal EN NTA 8133 Dutch standard is becoming the most globally recognized standard and is being adopted by BSI, as their test standard for Lithium-ion Battery fire. We hope this will be adopted as quickly as possible and in the meantime are working with other standards agencies to certificate and verify our products as much as possible, so they already hold the Marine Directive, CA, UL Independent test, and BSI Kitemark for the A fire rating. In effect, they hold as many standards as are available currently.

20. Q: What are the recommendations for servicing, refilling and extended maintenance of Firechief® Lith-Ex extinguishers in line with BS5306?

A: Firechief® Lith-Ex extinguishers can be serviced annually just like any other extinguisher under BS5306. However, they cannot be refilled so we recommend that after 5 years they are taken out and replaced with new units, unless they've been used in which case they need to be replaced at that time just like any other extinguisher.

21. Q: Is there a need for a new colour category for Lithium-ion battery fire extinguishers and are there plans within the industry for creating a new category to cover Lithium battery type fires?

A: At the moment as there is no standard but because these are life-saving devices they really need a proper standard. That will mean that as well as having a proper fire test standard, we will also have proper symbols and the proper colouring for extinguishers that can tackle lithium battery fires.

ADDITIONAL RESOURCES:

E-Book 'Lithium-ion Battery Fires – a guide to the risk that isn't going away but can be managed'

Podcast – Lithium-ion Battery Fires – what you need to know

Firechief® Academy CPD accredited training courses