FireShell

DANGER ALL WRAPPED UP

A textile solution to managing thermal runaway risks

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The Brand

FireShell is the brand name for a range of modern textile products, specifically designed to provide a thermal barrier that can cope with the heat and explosive capability of lithium batteries. Our FireShell range of products use our unique PARATEC FIRESHELL EXTREME fabric (patent pending), manufactured in the UK.

This leaflet gives an overview to the brand and the concept. Individual products each have their own flyer leaflet available on our website

The products are the result of a collaboration between a specialised UK textile business with highly experienced operational firefighters with extensive operational experience. This combination means our textile solutions offer an effective first response for members of the public or professional responders - at a cost-effective price - without compromising on safety or quality.

Fine wine and fine fabric

Producing high quality fabrics is like producing high quality wine. Blended wines are the result of winemaking magic. Vintners combine different grapes to create something original and new. Every bottle is the result of a meticulous testing and tasting process.

Creating our high-quality fabric has followed a similar process by combining the qualities and capabilities of a range of textiles to create the PARATEC FIRESHELL EXTREME fabric, a UK manufactured, unique textile blend. The experience, knowledge and credibility of Dale Intertec has been acquired over many years of providing high quality/military grade fabrics and textiles to a wide range of emergency agencies. We bring experience, understanding, and capability to the development and manufacture of our products.

Basing manufacturing in the UK ensures we can maintain the quality and consistency required of a potentially lifesaving piece of technology - we also have more control over supply chains.

Living with the dangers of Lithium

Lithium batteries are an amazing technology, a vital part of a shift to a carbon neutral economy, and their many benefits far outweigh the problems with them. As an emerging technology, when a lithium battery catches fire, it gets huge media attention. Whether it's an e-scooter, e-bike or an electric vehicle - or even just a battery power tool - the internet is full of dramatic fire footage of lithium battery fires...

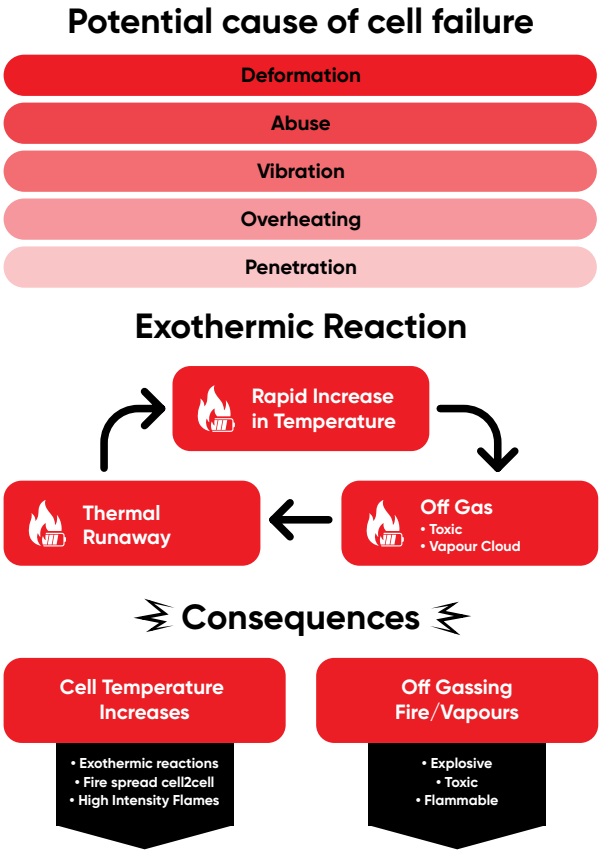
The battery industry downplays the risk and point to the limited data available which shows that the frequency of such fires is low. But low frequency doesn't change the fact that they happen, they will increase in frequency (as volume increases), and they will continue to be newsworthy. Moreover, unless we all take more responsibility for the way we dispose of lithium batteries, we will see increased waste fires causing huge environmental and societal damage.

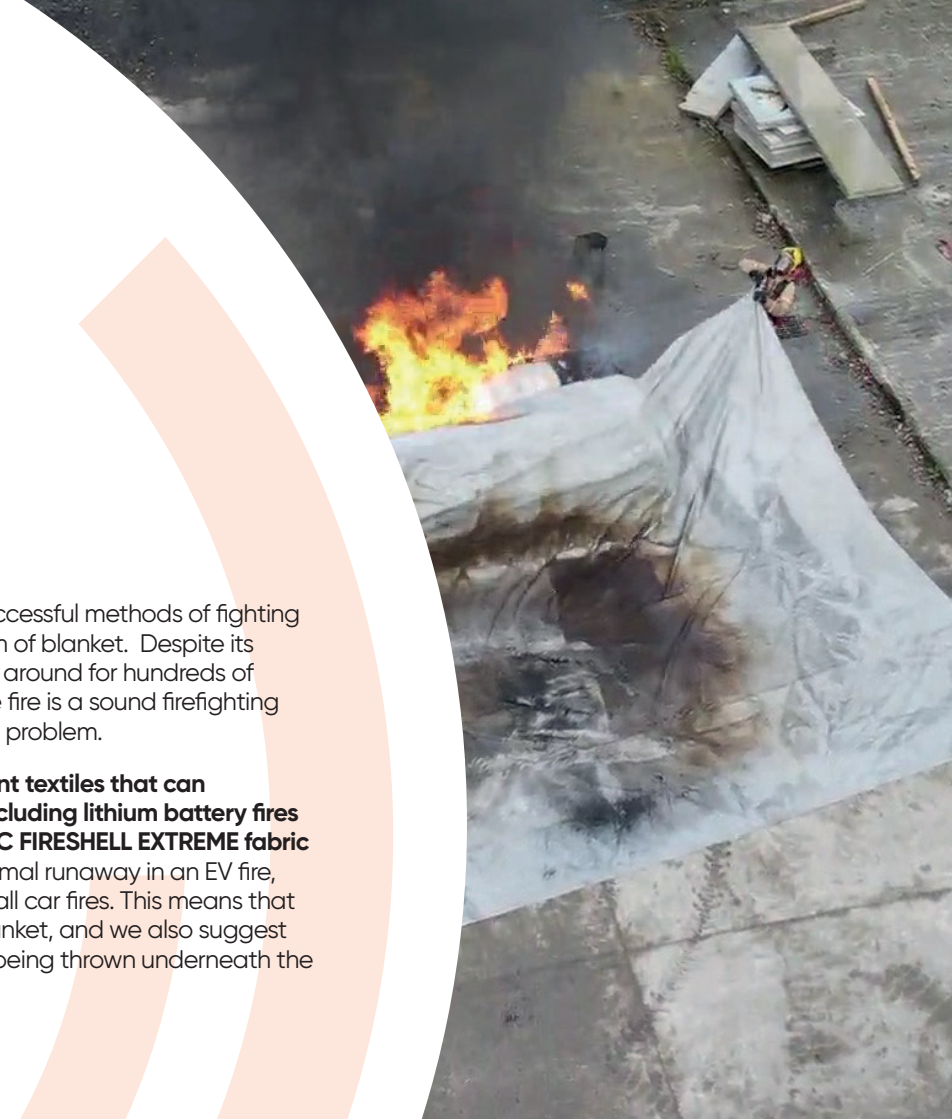
Lithium batteries (LBs) are a major asset to reduce the impact of climate change, and are here to stay, but they do represent a new fire problem - it's called thermal runaway. It occurs if/ when a single cell in a battery is damaged or is faulty which causes an accelerating release of heat inside a cell. Thermal stability is lost, the single cell fire quickly spreads from cell to cell, and soon cell venting, fire, and occasionally explosion occurs.

Thermal Runaway present new challenges

The first challenge is the uncertainty/randomness of LBs going into thermal runaway, which can be quite spectacular and, in a social media world, - very photogenic. But fires have always been frightening - and thermal runaway needs managing just like every other fire risk we manage. The second challenge is that the thermal runaway is exothermic, which means that it generates its own heat, and therefore they can be a very difficult fire to fully extinguish.

In addition, lithium fires always emit a complex vapour cloud of highly flammable toxic gases, including hydrogen fluoride & hydrogen chloride. These fires can have more intense and hotter flames, there is a chance of debris release, and reignition can occur hours or days after the initial failure. These unique features means that any intervention tools and techniques developed, must be based on an understanding of these unique challenges.





Initial intervention

For many years, one of the earliest and most successful methods of fighting fires has been to smother the fire with some form of blanket. Despite its simplicity, and the fact that blankets have been around for hundreds of years, the first response tactic of smothering the fire is a sound firefighting principle that can still be applied to this modern problem.

The key to success is to use modern fire-resistant textiles that can withstand the heat and shock of all car fires, including lithium battery fires such as our unique and purpose made PARATEC FIRESHELL EXTREME fabric (patent pending). A blanket cannot stop a thermal runaway in an EV fire, nor can it stop the emission of toxic gases from all car fires. This means that caution must be exercised when removing a blanket, and we also suggest the use of a suitable firefighting hand grenade being thrown underneath the blanket to assist in fire reduction.

The FireShell response

FireShell have been looking at this problem for several years to truly understand the role of smart textiles as part of the solution. We have developed 4 initial product ranges.

FireShell

Cars & large vehicles

A large fire blanket for all cars including electric cars. Some examples of its applications include car parks, car rental depots, workshops, ferries, charging stations, highway patrol (AA, RAC), vehicle recovery companies, etc. Manufactured to 6m x 8m, complete with 8 hi-vis grab handles, folded & rolled, supplied in a bespoke heavy duty contamination containment carrying system.

SinBin

Safe quarantine of small batteries

In sport, a sin bin is an area where players who misbehave are quarantined as a penalty for bad behaviour. Our sin bins containers enable potentially dangerous (badly behaved) batteries to be quarantined to avoid a potentially dangerous thermal event.
If a small battery (such as a power tool) starts to raise concern, put the battery in the SinBin and leave it submerged until it is safe. The full SinBin kit comprises a 220 litre heavy duty drum c/w vented lid & tamper evident steel ring, Sand, SinBin blanket cover and 3 transfer pads. Individual sin bin covers are also available for customers who already have heavy duty drums.

FireFleece

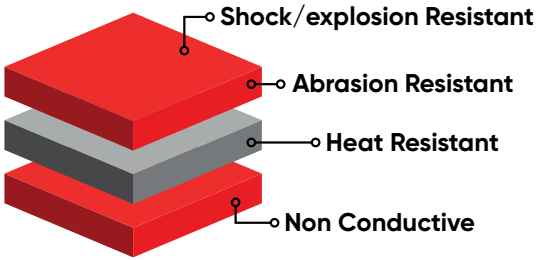
Small vehicles (Forklifts etc)

A smaller blanket for smaller vehicles such motorcycles, mobility scooters, forklift trucks, etc. Manufactured to 3m x 4m, complete with high vis grab handles, folded & rolled.

FireBag

A purpose made range of bags to protect lithium batteries in transit. For example FireBag Bike - an E-bike battery bag. Even though there is a small chance of spontaneous ignition of an e-bike lithium battery, it can and does happen. Many e-bike battery fires and explosions occur every year due to malfunctioning and aging batteries. The biggest issue is that unless there is obvious damage to a battery casing, internal faults than can lead to a thermal runaway can be invisible. A safe transport and storage solution prevent injury and stops fire from spreading. Other examples include our safe flight bag which has space to safely transport an iPad, cell phone and other electronics, and has RFID protection built in.

Please note: A repair kit is available separately which is suitable for repair of all main products. All products are manufactured in the UK and therefore bespoke sizes, combinations etc are available on request.



What makes these products different to other blanket/textile products?

Our approach has two major attributes - the quality of our material and the fact that the textiles used have been specifically selected and tested to make sure they can solve a specific set of fire related problems. The challenge is that the material of the textile must be able to withstand heat and fire intensity of new energy technologies such as lithium batteries.

Simultaneously, the product should not be overweight, it should not be difficult to handle or deploy, and it should use the latest fibres available to meet specific performance standards. In short, a new fabric is needed. The approach has been to really focus on the input standards (the design criteria) of the blanket material, to develop considered and relevant design criteria, to deliver an effective fabric/textile. The result is a product that can be used in any situation where a textile can be used to form a protective barrier.

What should the design criteria for a lithium fire textile be?

The fire industry already has some excellent fabrics and standards for fire resistant textiles and fabrics, and we have adopted/adapted these standards to our fire blankets. This approach helps our customers understand the performance criteria and capability of the products and allows performance benchmarking between various fabrics on the market to compare cost v benefits, and secure value for money.

The criteria are:

Heat resistance

The key attribute is an ability to withstand the heat and fire load generated by a car fire (including electric vehicles). The fabric should at least meet a performance standard for Fire Resistant (FR) fabrics. - why re-invent the wheel?

Abrasion resistance

This ability helps to keep the material's original structure and look, extending the life of a product. The blanket should be suitable for multi fire use up to at least 5 fires, and small rips/tears should be easily (and cost effectively) repaired (using a repair kit), to prolong the life of the product and secure value for money.

Shock/explosion resistance

The fabric should offer protection against explosion, flying debris or shrapnel. Fabric selection should consider fabric density, potential impact conditions, projectile mass, projectile geometry, and striking velocity.

Non-conductive, and water/weather resistant

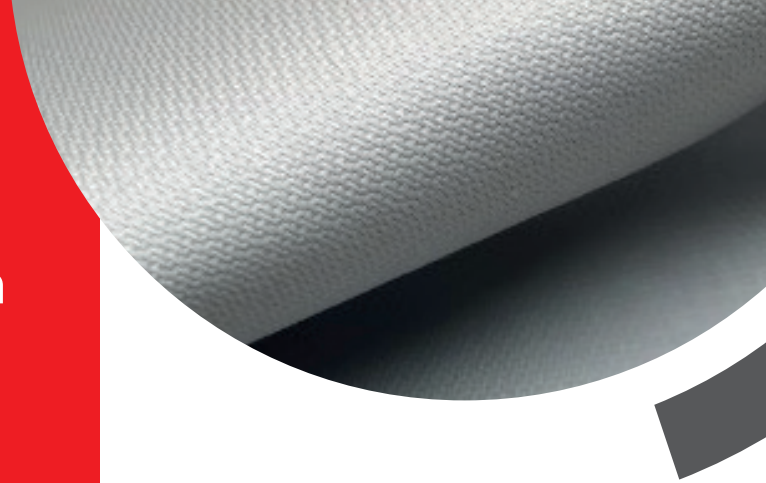
A blanket could be left outside in all weathers, and after use it should be easily cleaned and decontaminated. It should also be possible to repair the blanket to support multiple use and value for money.

What standards does the textile material meet?

Our core material meets the following standards (applicable in the UK).

EN10301-B-S1-do (Fire classification of construction products)	**BS476 Past 6 & 7 Class 1** (Fire propagation and surface spread of flame tests)	**FMVSS 302** (Flammability of interior motor vehicles materials)	**BSEN 20811** (Hydrostatic pressure test)	**FMVSS 302** (Oil repellency / hydrocarbon resistance test)
The EN-standard is based on a test for the actual material's response to fire, smoke development and droplets while burning. FireShell products are B-S1-dO	The test measures the distance & time a flame will spread across a surface. Results range from: the worst, Class 4 – i.e., longest distance and fastest of flame spread, to the best, Class 1 – i.e., least distance and slowest of flame spread. FireShell products are Class 1.	The US National Highway Traffic Safety Administration (NHTSA) have a test method, known as FMVSS No. 302, to establish a maximum burn rate for interior materials, and to determine the burn resistance capabilities of materials used in the occupant compartments of motor vehicles. **FireShell products meet the standard FMVSS 302.**	This test determines the resistance of fabrics to penetration by water primarily intended for dense fabrics such as tarpaulins and tentings. This ensures the blanket achieves excellent resistance to water penetration.	The US National Highway Traffic Safety Administration (NHTSA) have a test method, known as FMVSS No. 302, to establish a maximum burn rate for interior materials, and to determine the burn resistance capabilities of materials used in the occupant compartments of motor vehicles. **FireShell products meet the standard FMVSS 302.**

These standards are not an exhaustive list, but they illustrate the thinking, rationale and quality that underpins our approach to delivering/procuring a high-performance, high-quality product, that will protect first responders, and minimise fire spread/fire damage. Information on how to safely use our products is available on our website.



Will a textile fully extinguish a lithium battery fire?

It depends on the size of the battery and the extent of fire. A fire blanket isolates a fire, reduces smoke damage, minimises exposure to the highly toxic vapours emitted by a battery in thermal runaway, and significantly reduces the overall fire load. It buys time to escape to safety or seek further advice. Very little training is required.

Thermal runaway is an inconvenient phenomenon of lithium batteries, and we are confident that the quality of our fabric means it will absorb a great deal of the vapour cloud explosion of a thermal event.

However, the relative newness of the technology, the low volume of incident data, and the absence of any manufacturer data about thermal runaway, means that it is impossible to guarantee any blanket will entirely contain a thermal runaway explosion - there are just too many unknowns and variables. What can be guaranteed is that a fire blanket will help create a safe distance, a blanket absorbs most of the explosive power, and is a safer /less harmful/less disruptive/less contaminating strategy than any other option currently available.

Conclusion

As with all emerging industries, fire blankets all look similar. This leaflet explains why **we are confident our approach is best in class** and is an **excellent first attack tool** to support us all to safely live with lithium in the future. Our customers include urban and independent Fire and Rescue Agencies who are looking at a waterless and more environmentally sustainable firefighting solution to dealing with car fires, battery fires, skip fires or any fire where smothering can be used as an initial attack intervention.

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JGS

Customers

Despite being a very new company, we already have a strong customer base which includes:

- **Large car parks** - fires in car parks, even in the open air, can quickly develop into a very serious incident. A fire at Southwest Florida International Airport originally involved only 20 cars in the grassy rental car overflow area, but by the time it was extinguished, the fire had destroyed more than 3,500 rental cars.
- **Urban and rural fire and rescue agencies.**
- **Private fire and rescue agencies** (airports, festivals, and arenas)
- **Shopping centres** - especially for car parks and pop-up car displays inside the venue.
- **Waste sites** - especially important in End of Life Vehicle dismantling (ELV)