Lithium-Ion Risk Prevention System

Questions & Answers

General Questions

What type of gaseous fire protection system could be employed for Lithium-Ion battery protection?

There are two principal hazards, the first being the released flammable off-gases and the other being the combustible materials within the hazard area including Lithium-Ion battery electrolyte. In applications where the off-gases can build (and not be vented externally of the hazard area), an inerting system could be employed. For the other hazards a conventional gas suppression system design could be used.

FM Global data sheet 5-33 mentions full extraction when off-gas is detected, what is our response/suggestion?

Johnson Controls' suggestion is that off-gases should be dispersed or extracted if possible as the primary response at the off-gas alarm condition. However, Johnson Controls also realizes that in some systems the extraction may not be possible. In these cases at the moment of off-gas alarm, Johnson Controls recommends discharging the inerting system at the Methane inerting concentration.

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Does dry powder work for extinguishment with Lithium-Ion batteries or only with lithium type batteries?
Dry powder agents, such as the ANSUL Lith-X agent, have not been tested on Lithium-Ion fires and should not be designed to protect Lithium-Ion fires in fixed systems.

What does the 'Patent Pending' mean and what are the patents on?
Johnson Controls has applied for patent coverage on several aspects of the Lithium-Ion Risk Prevention system. The patents are in the review process by the global patent organization, so no further details can be shared at this time. Once the patents are granted to Johnson Controls additional details can be shared.

Applications Questions

What type of batteries does the Lithium-Ion Risk Prevention System work with?
The Lithium-Ion Risk Prevention System is targeted to operate with commercial Lithium-Ion batteries. The technology is capable of catching the off-gas production for cells from multiple manufacturers. It should also be noted that Lithium-Ion batteries are different than lead acid and also metal Lithium primary cell batteries. Those two battery types are protected differently to Lithium-Ion batteries.

What applications is the Lithium-Ion Risk Prevention System designed for?
The Lithium-Ion Risk Prevention System has been designed for Lithium-Ion batteries installed in fixed racking systems within buildings or conex box enclosures. These are typically stand-alone Energy Storage Systems (ESS) or systems for backup energy in industrial applications such as data centers or cellular telecoms sites.

Can we use this technology on vehicle charging areas?
Our initial product launch is around fixed energy storage system applications where batteries and racks are used. Other applications can be reviewed such as forklift or motor vehicle charging areas, as those applications are outside the scope of the current technology and would require a deeper engineering/application review.

Lithium-Ion Risk Prevention System Questions

Do the off-gas sensors and controller comply with any particular gas detector standard like EN 60079-29?
No, the products are not a gas detector. These are monitors that don't quantify gas like traditional gas detectors, but rather it is a presence alert. Since these off-gas materials are only present in a battery failure then the quantity is irrelevant and we need to be alerted if minute quantities are in the atmosphere to get the fastest detection signals.

What is the lifetime of the sensors?
The sensors have a lifetime of 10 years. The sensor technology is based on a detection element which has acute sensitivity to Lithium-Ion battery off-gases. This sensing element is extremely robust and with the housing and filter membrane on the sensing element, it provides a long life if inspected and maintained in accordance with the product manual.

Do cables need to be run in conduit? If not, what is the recommended cable attachments and spacing? (NFPA 2001 says initiating circuits should be in raceways).
The wiring for the sensor wires does need to be fastened and secured. The system design standards and local electrical standards need to be followed for the circuits. Johnson Controls recommends the cabling be placed in cable trays or within conduit suited for routing and protection of the cables.

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How does the Lithium-Ion Risk Prevention System interface with the control panel? Is a conventional control panel adequate or is an addressable panel required/recommended?
The interfacing does require an addressable panel. The interface with the other panels is addressed within the product manual. Wiring diagrams and schematics are part of the manual and product training programs.

Inerting System Questions

What is the necessary inerting concentration of each agent?
The DNV-GL Report 2019-1025 Rev 4, identifies Methane as one of the gases emitted by Lithium-Ion batteries. Based on this, if a system is being designed to inert, the suggestion is to use the published inerting design concentrations for Methane.

Where do the inerting concentrations come from?
NFPA 2001, ISO 14520 or other national design standards.

Are these inerting concentrations safe for personnel?
Inerting concentrations provided for Methane may be close to or exceed the agent NOAEL. The appropriate system response and safety protocols must be taken per local regulations.

How long do we need to hold this inerting concentration for?
Normally, for gaseous fire protection systems, the duration of 10 minutes would be recommended, but Johnson Controls suggests that the timeframe be assessed based on the availability of other resources to deal with the incident.

Are inerting concentrations available for both SAPPHIRE and INERGEN?
3M has indicated that Novec 1230 can be used for inerting. NFPA 2001 provides inerting concentrations for Novec 1230 and INERGEN for various gases, including Methane.

Suppression System Questions

One item that seems apparent is that a 'standard' clean agent system (designed per NFPA 2001, for example using 4.7% concentration for Novec 1230 or ISO 14520 / EN 15004 using 5.6% concentration), may not be adequate to extinguish a fire involving Lithium-Ion batteries.
Our system using the off-gas detection is aimed to prevent the Lithium-Ion battery fires before thermal runaway. The suppression system is not employed to extinguish a thermal runaway battery fire. The suppression system is to protect the items within the room that could combust (including if a battery were to leak electrolyte materials). The design concentration for a suppression system, must be designed using the highest Class B fuel (typically the specific electrolyte material). The Class C (NFPA 2001) or High Hazard (ISO 14520 / EN 15004) design concentrations are based on an electrical hazard and are not high enough for a flammable liquid fire.

Where are these concentrations coming from for the suppression application?
The design concentrations must be established according to the highest hazard in the protected space in accordance with the methods outlined in NFPA 2001, ISO 14520, EN 15004 or other national standards. This highest hazard is often the battery electrolyte material. The material may need to be tested or information supplied by the manufacturer of the material to determine the appropriate design concentration.