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Lithium ion battery assemblies

Hazards and controls

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The fire hazards of lithium ion batteries

Lithium ion (li-ion) batteries, due to their small size, capacity to hold a charge, and recharging capacity, have become the go-to power source for personal electronics and mobility solutions.

Failures of these batteries have been a source of concern for a long time. The first ones used in consumer items (laptop computers and mobile telephones) were smaller. Energetic failures like thermal runaway, while not inconsequential, generally did not lead to large property losses.

As the battery packs increase in size and capacity, energetic failures of these assemblies become powerful sources of ignition and fires. The chemistry of these batteries also makes them difficult fires to control with standard firefighting methods. These larger battery packs are found in personal mobility devices (e-bicycles, scooters, “hoverboards,” etc.) and large handheld power tools.

In the first 11 months of 2022, New York City experienced 200 significant fires attributed to failures of these units.[1]

In general, energetic failures are due to one or a combination of the following:

1. Poor design/Manufacturing defects
2. Mechanical abuse
3. Electrical abuse
4. Thermal abuse

Poor design/Manufacturing defects

Modern lithium ion battery packs incorporate multiple safety features to prevent many situations that can typically lead to energetic failures. They also are tested to prevent those with defects from being distributed to the public. These features and tests are required to receive certification from one of the major safety testing laboratories such as Underwriters Laboratories (UL). Battery packs that do not sport a UL or similar label should not be used, and disposed of safely. (More on disposal later.)

Mechanical abuse

Mechanical abuse can be accidental or intentional. Accidental abuse may come from the assembly being struck by an object, struck against an object, or dropped. While these units are packaged in a way to take some abuse, damage to the exterior packaging may result in damage to the individual units themselves.

These assemblies are packages of multiple individual cells. Damage to even a single cell that leads to thermal runaway can lead to failures to adjacent cells, resulting in a cascading failure and severe fire hazard.

Intentional abuse may come from attempts to repair or tinker with the battery packs. While not the only example, one of the most recent large fires in New York City was apparently the result of an unauthorized repair operation in a residential high-rise building.[2] Repair of these assemblies by anyone other than a trained, authorized entity is frowned upon. If there is no option to repair an assembly, it should be disposed of per the manufacturer's instructions.

Electrical abuse

Electrical abuse generally occurs when one of these units is overcharged, or over-depleted. Modern units have safeguards to prevent both, and this type of abuse is generally due to using inappropriate charging techniques or unauthorized tinkering.

Thermal abuse

As these assemblies are being charged, or in use, they can generate heat. If the heat cannot be dissipated as designed, the units can reach a point of heat-initiated thermal runaway. In general, these units are designed to dissipate heat through vents or other means.

Reducing the fire hazards of lithium ion batteries

Standard loss-control techniques for reducing hazards start with **removing the hazard completely.** However, the utility and ubiquitous nature of these assemblies make this unreasonable. The following steps can be made to reduce the hazard these units pose.

☐ **Look for the label**

Make sure the units on-site have passed the requirements of a recognized testing authority. UL and others have a robust labeling protocol to identify components that have passed their rigorous design and testing parameters.

☐ **Do not use damaged units**

Regularly inspect and remove from service all components that have been physically damaged or exhibit symptoms of failure, such as swelling or significant loss of capacity.

☐ **No unauthorized repairs or use**

Do not attempt to repair or modify a battery pack. Damaged packs should only be repaired by an authorized, experienced service provider.

Do not attempt to use the batteries in assemblies they are not designed for. Tinkering or hacking may bypass the built-in safeguards and lead to premature failure.

☐ **Do not overcharge or over-deplete**

The battery packs should only be charged using the appropriate (and UL or otherwise listed) charging device. Batteries should not be used in equipment they are not designed for, to prevent over-depletion.

☐ **Watch for overheating**

Do not allow vents and other heat dissipation structures to be blocked or rendered ineffective. Keep an eye on the units when charging, and do not allow the units to be charged unattended. Sometimes an overheating pack may produce an odor, so keeping alert for unusual smells is important.

In general, lithium ion battery assemblies, like any tool, can provide safe utility and/or be maintained to provide safe operation.

If you have any questions regarding this subject, or any loss control topic, please feel free to contact the Loss Control Experts at Munich Re Specialty Insurance.

Contact us

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