

CellBlock FCS Recommended Procedures for In-flight Lithium-ion Battery Fires

INTRODUCTION

CellBlock FCS' singular goal is the safety of passengers and crew during a thermal runaway of a lithium battery. This safety product and the following procedure's focus is on reducing, mitigating or eliminating the hazards of a thermal runaway, which can include exposure to heat, flames, smoke and the inhalation of toxic fumes. In accordance with FAA's SAFO 18003 regarding the expeditious limitation of the production of smoke, fumes, and odor, and the passenger's and crews exposure to them; CellBlock technology is more effective than water as the primary response as an extinguishing agent for battery or device fires. Until the development of this technology water was the primary extinguishing agent. Water on such fires creates additional smoke, hydrogen gas, and steam with dissolved toxins and oxides of metal. Furthermore, CellBlock concurs with FAA's InFO 17021, and does **NOT** suggest or recommend moving an on-fire battery or device. Movement of an ignited device exposes crew and passengers to serious injury from sudden explosions and fire; ejection of cells; and projectiles of melted metal and plastics. There are cases however, where the destructive potential for fires in sensitive or inaccessible areas may require that the device to be moved as a preventative measure. These areas include the flight deck and the overhead bins, among others. Proper crew training to assess such conditions is essential.

CellBlock suggests the use of the equipment provided inside the kit to protect the crew member/ firefighter in every possible scenario. The protective gloves are required and the use of LIBIK Fire Blanket(s) is strongly recommended, as these serve as a personal shield. The mask and goggles provided in the LIBIK kit are designed for quick and efficient use in certain situations, but they are not intended to replace a PBE if one is available.

CellBlock notes that, while Halon has proven effective in extinguishing an open flame, it is not as effective in addressing the reaction process that occurs in a thermal runaway. However, in recognizing that every situation will present a unique set of challenges, Halon may be optionally used in certain difficult-to-access areas, such as the overhead bin, so that the firefighter can extinguish the initial flame prior to applying the contents of the LIBIK kit.

The following procedures should be considered recommendations and are provided as guidance only. It is the responsibility of the individual airline to perform a Safety Management System (SMS) risk assessment and author their own safety procedures and protocols.

With these principles in mind, CellBlock suggests the procedures listed in this document when handling thermal runaways in-flight.

DISCLAIMER

The information contained in these procedures is for general information purposes only. The information is provided by CellBlock FCS, and while CellBlock FCS endeavors to keep the information up-to-date and accurate, CellBlock FCS makes no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to these procedures for any purpose. In no event will CellBlock FCS be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from the usage of these procedures.

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Definitions of Abbreviations:

PC-LIBIK	Passenger Cabin Lithium-Ion Battery Incident Kit
FD-LIBIK	Flight Deck Lithium-Ion Battery Incident Kit
EDE	Electronic Device Extinguisher
PED	Personal Electronic Device
FA	Flight Attendant
FA1	Flight Attendant First Responder
FA2	Flight Attendant Secondary Responder (Assistant)
OHB	Overhead Bin
PBE	Protective Breathing Equipment
EFB	Electronic Flight Bag
PNF	Pilot Not Flying

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1. BOARDING PROCEDURE

As part of the boarding/safety announcement to the passengers, the flight attendants will make the following announcement:

“For your safety, if your portable electronic device appears to be getting hotter than usual or starts emitting smoke or an unusual odor, please contact a Flight Attendant immediately.”

2. BASIC PASSENGER CABIN PROCEDURES

These recommended procedures address instances of a lithium-ion battery event in the passenger cabin.

FA1 Basic Procedure:

1. Move the passengers as far away as possible from the fire, keeping the aisle clear. If there is a drink cart deployed in the aisle, secure in appropriate galley.
2. Have another FA, if available, notify the flight deck immediately, and then proceed to inform the other passengers, asking them to remain calm and seated.
3. **As the situation unfolds, keep in mind your security protocols in case the PED fire is a diversion for malign intent on the aircraft.**
4. FA2, if available, will bring Halon extinguisher and PC-LIBIK and break seal.
5. Don the mask, goggles and gloves from the LIBIK, or use the onboard PBE, as the situation dictates.

FA2, if available, Basic Procedure:

1. Retrieve the nearest Halon extinguisher
2. Retrieve the Cabin LIBIK Kit located in a clearly marked OHB and bring it to the location of the fire.
3. Break the seal on the PC-LIBIK and remove the mask, goggles, gloves, and the fire blanket and provide to FA1. PED-Pad pillows should be the only remaining item in the bag unless needed to fight the fire.
4. Be ready to assist FA1 with the situation by handing PED-Pad fire-suppression pillows and Fire Blanket from the LIBIK as needed.

FA1 and FA2 proceed to fight the fire depending on the situation as described in the following lithium-ion battery fire scenarios:

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Once the device is inside the LIBIK bag DO NOT RE-OPEN. The LIBIK bag should then be placed away from passengers (e.g. in a locked lavatory) and monitored for the remainder of the flight. The LIBIK should remain accessible to a crew member should further action be required.

Update the flight deck of the status.

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3. PC-LIBIK PROCEDURE - Small PED in the Passenger Cabin, Visible

These recommended procedures address small devices such as phones, tablets, or battery packs that are visible and easily accessible (on the floor, a tray table, or passenger seat).

FA1 and FA2, if available, follow your Basic Passenger Cabin Procedures as previously described.
[PAGE 4] Proceed to fight the fire depending on the situation as described below.

Device is on fire:

1. FA2, if available, provide FA1 with PED-Pad pillows and Fire Blankets.
2. FA1 maintains the blanket as a shield between themselves and the device while placing a PED-Pad pillow directly on the source of the fire.
3. FA1 then place the LIBIK Fire Blanket over the PED-Pad pillow and the device.
4. FA2, if available, prepare the LIBIK bag to receive the device.
5. When the device is completely extinguished, FA1 continue to use gloves and Fire Blanket to place the device in LIBIK bag; seal the LIBIK bag.

Device is overheating or smoking:

1. FA2, if available, provides FA1 with Fire Blankets and prepare the LIBIK bag to receive the device.
2. FA1 approach the device using the blanket as a shield and place blanket directly over it.
3. FA1 use gloves and Fire Blanket to gather the device and to aid in placing the device inside the LIBIK; seal the LIBIK bag.

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4. PC-LIBIK PROCEDURE - Laptop in the Passenger Cabin, Visible

These recommended procedures address laptops that are visible and easily accessible (on the floor, a tray table, or passenger seat).

FA1 and FA2, if available, follow your Basic Passenger Cabin Procedures as previously described.
[PAGE 4] Proceed to fight the fire depending on the situation as described below.

Laptop is on fire:

1. FA2, if available, provide FA1 with PED-Pad pillows and Fire Blankets.
2. If the laptop is closed, FA1 approach the device using the LIBIK Fire Blanket as a shield and place blanket directly over it. If the laptop is open, FA1 approach the device using the Fire Blanket as a shield; use the blanket to close the laptop; place blanket directly over the device.
3. FA1 briefly lift blanket. Place a PED-Pad pillow over the device nearest the source of the flames. Reapply blanket.
4. FA2 prepare the LIBIK bag to receive the device.
5. When the device is completely extinguished, FA1 continue to use gloves and Fire Blanket to place the device in LIBIK bag; seal the LIBIK bag.

Laptop is overheating or smoking:

1. FA2, if available, provides FA1 with Fire Blankets and prepares the LIBIK bag to receive the device.
2. If the laptop is closed, FA1 approach the device using the Fire Blanket as a shield and place blanket directly over it. If the laptop is open, FA1 approach the device using the Fire Blanket as a shield; use the blanket to close the laptop; place blanket directly over the device.
3. FA1 use gloves and Fire Blanket to gather the device and to aid in placing the device inside the LIBIK; seal the LIBIK bag.

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5. PC-LIBIK PROCEDURE - Device in the OHB, Loose/Exposed

These recommended procedures address devices in the overhead bin that are loose and exposed. LIBIK Fire Blankets and PED-Pad fire-suppression pillows can augment any safety procedure by providing a means to suppress a fire without excess toxic fumes and vapors, such those released with the use of water.

FA1 and FA2, if available, follow your Basic Passenger Cabin Procedures as previously described.
[PAGE 4] Proceed to fight the fire depending on the situation as described below.

1. FA1 will be responsible for assessing conditions to determine the location of the fire. **Exercise extreme caution when touching the closed OHB as you determine the temperature and presence of fire.**
2. If the OHB is melted shut, use the LIBIK prybar* to open, or ask FA2, if available, to retrieve the crash ax to pry open.
3. Open the overhead bin slowly to reduce the possibility of a flash fire.

Device is on fire:

1. If surrounding luggage is on fire, use Halon to extinguish flames.
2. FA1 and FA2, if available, remove uncharred baggage.
3. If the device continues in thermal runaway and there is sufficient space, FA1 apply a PED-Pad pillow to the top of the device, while using the blanket as a shield; place Fire Blanket over pillow and allow to extinguish. If space does not allow the application of a PED-Pad, continue to extinguish with Halon.
4. FA2, if available, prepares the LIBIK bag to receive the device.
5. Once the device is completely extinguished, FA1 use gloves and Fire Blanket to place the device in LIBIK bag; seal the LIBIK bag.

Device is overheating or smoking:

1. FA2, if available, provides FA1 with Fire Blankets and prepare the LIBIK bag to receive the device.
2. FA1 approach the device using the Fire Blanket as a shield and place blanket directly over it.
3. FA1 use gloves and Fire Blanket to gather the device and to aid in placing the device inside the LIBIK; seal the LIBIK bag.

*Optional equipment.

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6. PC-LIBIK PROCEDURE - Device in the OHB, Hidden

These recommended procedures address devices in the overhead bin that are hidden in luggage.

LIBIK Fire Blankets and PED-Pad fire-suppression pillows can augment safety procedure by providing a means to suppress a fire without excess toxic fumes and vapors, such those released with the use of water.

FA1 and FA2, if available, follow your Basic Passenger Cabin Procedures as previously described.

[PAGE 4] Proceed to fight the fire depending on the situation as described below.

1. FA1 will be responsible for assessing conditions to determine the location of the fire. **Exercise extreme caution when touching the closed OHB as you determine the temperature and presence of fire.**
2. If the OHB is melted shut, use the LIBIK prybar* or the crash ax to pry open.
3. Open the overhead bin slowly to reduce the possibility of a flash fire.

Device is on fire:

1. 1FA1 use Halon to extinguish all flames.
2. FA2, if available, if there is an additional LIBIK Fire Blanket onboard, prepare the blanket by placing on the floor, black felt side up. This is the side without the logos.
3. Using a Fire Blanket as a shield, FA1 carefully remove suspect bag from OHB and place on Fire Blanket (floor).
4. FA1 carefully open baggage compartments and dump contents onto the fire blanket.
5. FA1 and FA2, if available, locate the device and place a PED-Pad over it and allow to extinguish.
6. FA2, if available, prepares the LIBIK bag to receive the device.
7. Once the device is completely extinguished, FA1 use gloves and Fire Blanket to place the device in LIBIK bag; seal the LIBIK bag.

Device is overheating or smoking:

1. FA2, if available, provides FA1 with Fire Blankets and prepare the LIBIK bag to receive the device.
2. FA1 using the Fire Blanket as a shield carefully approach the suspect baggage and remove from OHB.
3. FA1 carefully open the baggage to locate the device. Use gloves and Fire Blanket to aid in removing the device from the baggage.
4. FA1 use gloves and Fire Blanket to gather the device and to aid in placing the device inside the LIBIK; seal the LIBIK bag.

NOTE: If other contents of luggage continue to smolder from a non-lithium source such as clothing, water or halon may be used in this instance to extinguish the secondary fire.

*Optional equipment.

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7. PC-LIBIK PROCEDURE - Device in a hard-to-reach location

These recommended procedures address devices that are in hard to reach locations, such as between the seats or in seat back pockets. LIBIK Fire Blankets and PED-Pad fire-suppression pillows can augment any safety procedure by providing a means to suppress a fire without excess toxic fumes and vapors, such as those released with the use of water.

1. FA1 and FA2, if available, follow your Basic Passenger Cabin Procedures as previously described. [PAGE 4] Proceed to fight the fire depending on the situation as described below.

Device is in the seat back pocket and is on fire:

1. If the device fire is spreading onto the tray table and fabrics, FA1 use Halon to extinguish the initial flames.
2. FA1 using gloves and a Fire Blanket as a shield, place a PED-Pad into the backseat pocket directly against or atop the device. Leave to extinguish.
3. FA2, if available, prepares the LIBIK bag to receive the device.
4. When the device is completely extinguished, FA1 use gloves and blanket to place the device in LIBIK bag; seal the LIBIK bag.

Device is in the seat back pocket and is overheating or smoking:

1. FA2, if available, provides FA1 with Fire Blankets and prepare the LIBIK bag to receive the device.
2. FA1 approach the device using the Fire Blanket as a shield. Grab the device with the blanket and place into the LIBIK; seal the LIBIK bag.

Device is between seats and is on fire:

1. If the device fire is spreading onto seats and fabrics, FA1 use Halon to extinguish the initial flames.
2. FA1 place PED-Pad directly against or above the device fire; cover with blanket if able. Leave to extinguish.
3. FA2, if available, prepares the LIBIK bag to receive the device.
4. When the device is completely extinguished, FA1 use gloves and Fire Blanket to place the device in LIBIK bag; seal the LIBIK bag.

Device is between seats and is overheating or smoking:

1. FA2, if available, provide FA1 with Fire Blankets and prepare the LIBIK bag to receive the device.
2. FA1 approach the device using the Fire Blanket as a shield. Grab the device with the blanket and place into the LIBIK; seal the LIBIK bag.

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8. FD-LIBIK PROCEDURE - Secured EFB

This recommended procedure address a lithium-ion battery event on the flight deck of a secured EFB in close proximity to a pilot.

The pilot affected where the PED is smoking/on fire will become the Pilot Not Flying (PNF) (Pilot Monitoring) and that pilot will assume the duties of fighting the fire. Keep in mind that existing security procedures must be followed.

EFB is on fire:

1. PNF reach for the Flight Deck LIBIK bag located behind the captain's seat.
2. Break the seal; open the bag and don the gloves.
3. Place a PED-Pad fire-suppression pillow over the device and drape Fire Blanket over the top of the pillow. Allow extinguishing agent to extinguish the fire.
4. Once the device is completely extinguished, use the gloves to carefully remove the EFB from its bracket and place inside the FD-LIBIK bag; seal the bag.
5. Notify the cabin crew to retrieve the FD-LIBIK. Instruct them to follow their security procedures.
6. Once the device is inside the FD-LIBIK bag
7. DO NOT RE-OPEN. Instruct cabin crew to place the FD-LIBIK bag in an aft lavatory and monitor throughout the flight.

EFB is overheating or smoking:

1. PNF reach for the Flight Deck LIBIK bag located behind the captain's seat.
2. Break the seal; open the bag and don the gloves.
3. Carefully remove the EFB from its bracket and place inside the FD-LIBIK bag; seal the bag.
4. Notify the cabin crew to retrieve the FD-LIBIK. Instruct them to follow their security procedures.
5. Once the device is inside the FD-LIBIK bag DO NOT RE-OPEN. Instruct cabin crew to place the FD-LIBIK bag in an aft lavatory and monitor throughout the flight.

*If unable to apply PED-Pad pillow, a Halon fire extinguisher may be used to put out the initial flames.

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9. FD-LIBIK PROCEDURE - Pilot's PED

This recommended procedure address a lithium-ion battery event on the flight deck of a small PED, such as a tablet, phone or charging device.

The pilot affected where the PED is smoking/on fire will become the Pilot Not Flying (PNF) (Pilot Monitoring) and that pilot will assume the duties of fighting the fire. Keep in mind that existing security procedures must be followed.

PED is on fire:

1. PNF reach for the Flight Deck LIBIK bag located behind the captain's seat.
2. Break the seal; open the bag and don the gloves.
3. Remove a PED-Pad fire suppression pillow from the FD-LIBIK and place over the device*. Place Fire Blanket over the pillow. Allow extinguishing agent to extinguish the fire.
4. Once the device is completely extinguished, use the gloves and Fire Blanket to place the device inside the FD-LIBIK bag; seal the bag
5. Notify the cabin crew to retrieve the FD-LIBIK. Instruct them to follow their security procedures.
6. Once the device is inside the FD-LIBIK bag DO NOT RE-OPEN. Instruct cabin crew to place the FD-LIBIK bag inside an aft lavatory and monitor throughout the flight.

PED is overheating or smoking:

1. PNF reach for the Flight Deck LIBIK bag located behind the captain's seat.
2. Break the seal; open the bag and don the gloves.
3. Carefully place device inside the FD-LIBIK bag and seal the bag.
4. Notify the cabin crew to retrieve the FD-LIBIK. Instruct them to follow their security procedures.
5. Once the device is inside the FD-LIBIK bag DO NOT RE-OPEN. Instruct cabin crew to place the FD-LIBIK bag in an aft lavatory and monitor throughout the flight.

* If the device is not safely accessible, Halon may be use to extinguish the initial flame.

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10. FOLLOW-UP PROCEDURES FOR ALL INCIDENTS

If CellBlockEX loose-fill is dispersed in the cabin or flight deck during a lithium-ion battery fire incident, the granulate may be cleaned up with a vacuum and disposed of in a trash receptacle. The granules are non-toxic and present no environmental risk. No environmental cleanup is required.

CellBlock FCS offers a discounted unit replacement of any LIBIK that has been exposed to a thermal runaway. To obtain a discounted replacement kit, complete the warranty form and return to:

Cellblock FCS
234 Northeast Road, Unit #5
Standish, Maine
USA 04084
1-800-440-4119
info@cellblockfcs.com

Please note that an incident report and documentation of disposal are required. User is responsible for all shipping costs.