

# CellBlock®

## Fire Containment Systems

### Certificate of Test

---

<b>Project:</b>	CellSafe Lithium Battery Recall Kit	<b>Date:</b>	March 15, 2019
		<b>Document No.:</b>	CBRPT013
		<b>Project Manager:</b>	Dylan Vandemark
		<b>Date of Testing:</b>	March 15, 2019

---

**Description:** Lithium-Ion Thermal Runaway Containment Study Within Fiberboard Boxes

**Details:** TEST 13: 15" x 8" x 4" Folded Mailer with closure tape, B-flute with 2.0lbs of CellBlockEX within heat sensitive textile pillow lined with fire resistant textile.

**Purpose:** This test was conducted to demonstrate and document the capability of CellBlockEX® to contain a thermal event involving lithium ion cells and batteries (UN 3480) within a fiberboard box.

**Test Sample Identification:** TENERGY 18650 9.6 Wh, 15 count @ 100% SOC (144 total Wh), installed in 1x15 tight arrangement inside of box between CellBlock® extinguishing pillows. These cells are the same as used by the FAA William J. Hughes Technical Center and represent one of the most volatile cells commercially available.

**Test Equipment:** FireRod heater cartridge, 110 DC Power Supply, Type-K Thermocouples

**Procedure:** Single cell ignition by heating at a rate of 2°C/sec to vent and thermal runaway or 200°C. Record temperature every 1 second on the ignition cell, adjacent cell, middle cell, aft cell, box top, box bottom, and box left; record photographs and video.

---

The results and any data provided by CellBlock in any format ("Data") apply only to the sample(s) tested and shall not be considered indicative of the qualities of apparently identical or similar samples. This certificate does not indicate successful or unsuccessful completion of a test or qualification program. CellBlock disclaims all warranties, express or implied, and liability for the performance of the tested sample(s) and use of any Data.

---

---

**Project:** CellSafe Lithium Battery Recall Kit

**Date:** March 15, 2019  
**Document No.:** CBRPT013  
**Project Manager:** Dylan Vandemark  
**Date of Testing:** March 15, 2019

---

**Results:** An initiation cell was heated until it experienced rapid disassembly (thermal event). The initiation cell exposed adjacent cells to heat, fire and ejected contents. The cells were assembled in close proximity to each other, but the CellBlockEX material was effective in preventing propagation of all remaining test cells (cells 2 through 15). The heat generated from the initiated thermal event melted the heat sensitive textile material as intended, dispersing CellBlockEX loose-fill. While initially there was significant smoke that exited the seams of the box, once the CellBlockEX material was released it absorbed significant quantities of the smoke as can be viewed in the video recordings. The test was performed with a quantity of CellBlockEX consistent with a ratio of 1.98 cubic inches per Watt hour (Wh) of cells, which is below the recommended quantity of 3-5 cubic inches per Wh (in/Wh) of CellBlockEX. The maximum internal temperature recorded was 722.18°C. The maximum adjacent cell temperature recorded was 120.33°C. The maximum external temperature recorded was 26.62°C on the box bottom. The result was positive in that:

- There was no hazardous flame or hazardous fragments that exited the package.
- No outer package charring was observed.
- The thermal runaway was suppressed and fully contained
- The CellBlockEX absorbed the gas from the thermal event
- Propagation was prevented.
- No damage or leaking electrolyte was observed from adjacent cells.

**Prepared by:**

  
Sarah Grasso  
Assistant

**Reviewed by:**

  
Dylan Vandemark  
VP of Product Development

**List of Attachments:**

Attachment 1: Test Photos  
Attachment 2: Thermocouple Data

---

The results and any data provided by CellBlock in any format ("Data") apply only to the sample(s) tested and shall not be considered indicative of the qualities of apparently identical or similar samples. This certificate does not indicate successful or unsuccessful completion of a test or qualification program. CellBlock disclaims all warranties, express or implied, and liability for the performance of the tested sample(s) and use of any Data.

---



Inside package view pre test



Ignition cell assembly pre test



Inside view with battery assembly and thermocouples pre test



Inside view with pillow enclosing batteries pre test



Outside/top view of box pre test



Outside/bottom view of box pre test



Top/right view pre test



Top/left view pre test



Top/front view post test



Bottom/front view post test



Top/right view post test



Top/left view post test



Open/pillow folded over view post test



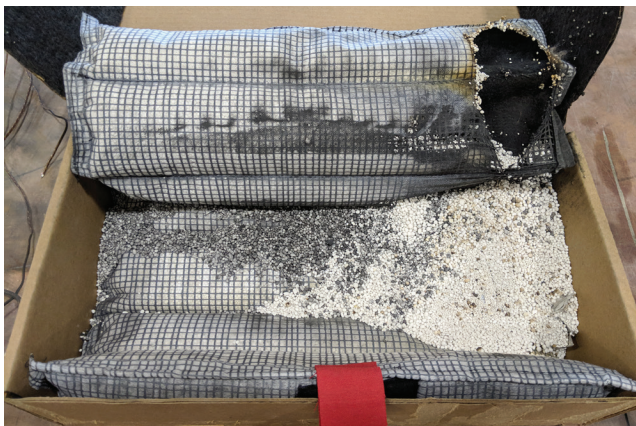
Open view post test



Open closeup view post test



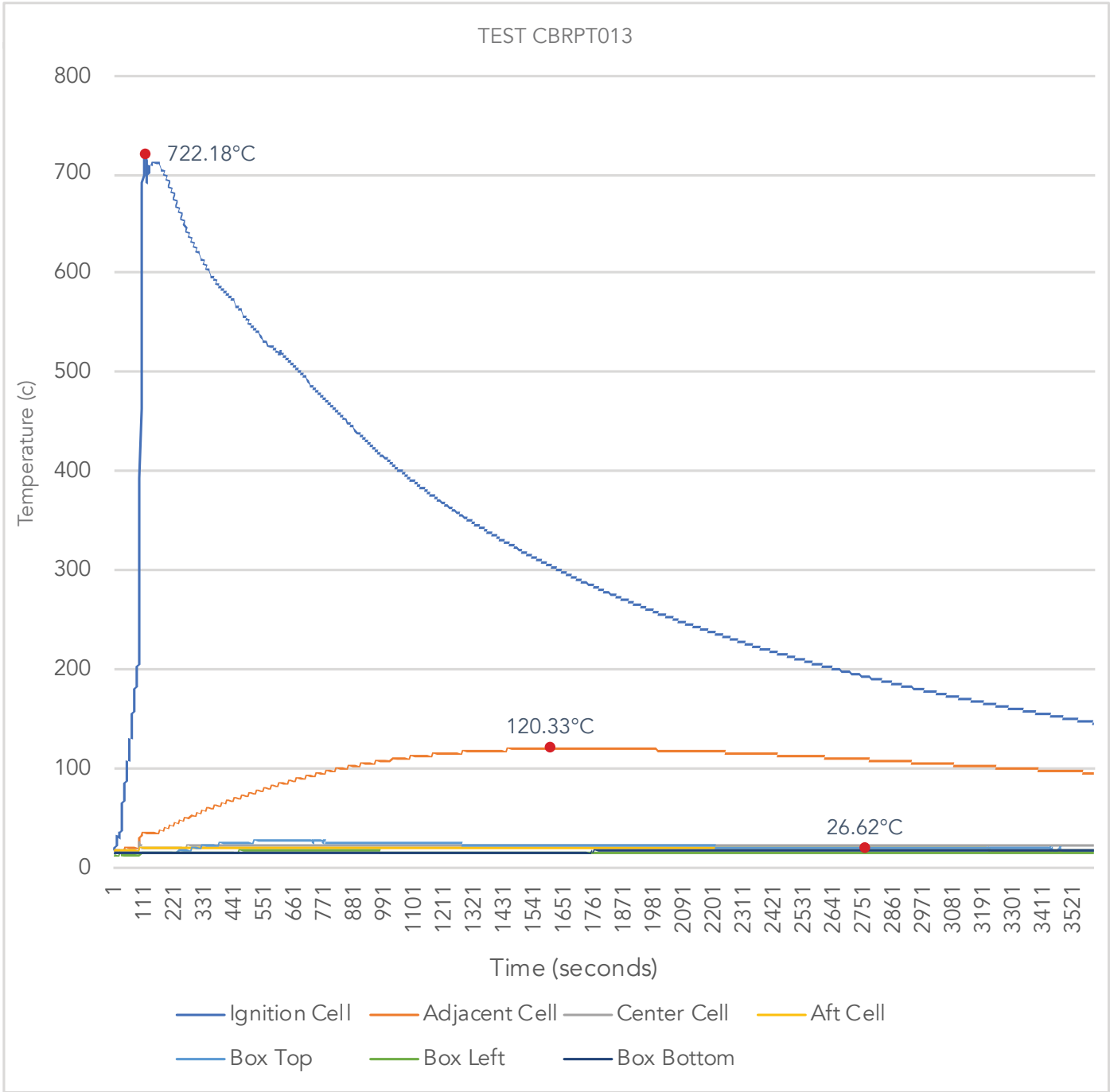
Unpropagated batteries post test - undamaged; no leaking electrolyte observed



Inside view with batteries removed post test



Inside/emptied view post test



**Thermocouple data**

Maximum internal temperature reached 722.18°C at ignition cell.

Maximum adjacent cell temperature reached 120.33°C.

Maximum exterior temperature reached 26.62°C on box bottom.