Embedded Battery Safety

Battery Handling and Safety

Handle the battery or top case assembly with battery by the edges, with two hands at all times.

Do not lift or hold the battery or top case assembly with battery using the cable or connector.

Never puncture, press, twist, torque, strike, or squeeze the actual battery or its cell packs.

Inspect the battery for dents, scratches or other possible defects. Refer to the Visual Battery Inspection section of this training module.

Always replace a dropped battery or top case assembly with battery. They may have an abnormal charge current or voltage that can possibly lead to thermal issues.

Never expose batteries, exposed cells or top case assemblies with battery to liquid.

Keep batteries, top case assemblies with battery and computers away from heat and open flames. Store them in a cool dry place.

When the bottom case is removed and when the battery or top case assembly with battery is separate from the computer, keep the protective battery service cover on the battery at all times.

When replacing a battery or top case assembly with battery, use the battery cover as directed by the product’s service guide. Tip: The cover can be reused after the bottom case is reattached to the computer for another repair if it is free of dust, dirt, or damage.

Always ship or transport batteries or top case assemblies with batteries in its original packaging. It should be bagged and properly packed in the original packaging as shown in the Returning Packaging section of this training course. Be sure required IATA Caution and Packing List labels are attached to the packaging.

Notice anything unusual?

If something unusual is noticed, such as an odor, discoloration, deformity, or is overheating, disconnect and stop using the battery. Follow safety guidelines as outlined in this training course.

Designated workstations used to service portable computers should meet the following criteria:

- Non-flammable and ESD safe workbench
- Adequate ventilation
- Unobstructed access to a portable fire extinguisher (CO2 or dry chemical rated ABC or equivalent) located within 20 feet travel distance of the workstation.

**Equipment checklist:**

- Lab apron
- Nitrile/latex gloves
- Thermal resistant gloves
- Safety glasses or goggles
- Fire safety box (recommended)

**Materials checklist:**

- Baking soda or sand
- Tongs
- Sealable disposal bags (large enough to fit a top case with battery)

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**Keep combustible materials away**

Be sure to keep paper and other combustible materials at least 4 feet away from the workstation.

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**Additional safety procedures**

Check with local management on additional protocols and procedures regarding workstation setup and safety.

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**Acceptable Conditions (OK to continue use)**

Minor dents (up to 8 dents if 0.4 mm deep or less; up to 5 if 1.5 mm deep or less; up to 3 if 2.0 mm deep or less)
Minor cell pack deformity (up to 2.0 mm total area)

**Unacceptable Conditions (Stop using and replace)**

Scratches

Swollen or wrinkled cell pack

**IMPORTANT**

Only properly trained and equipped emergency responders should handle the situations in the next four sections:

Hot Batteries
Swollen Batteries
Leakage Event
Thermal Event
Embedded Battery Safety

Scenario: Hot Batteries

When a battery’s temperature rises above safe operating temperature, it can be potentially hazardous.

Response

- Clear work bench of any materials or debris.
- Put on thermal gloves, safety goggles or glasses, and apron.
- In the case of an external short circuit, unplug the computer’s power adapter. The battery should immediately start to cool.
- Using tongs to hold the battery or top case with battery, place it in the fire safety box for at least 2 hours. (If the battery or top case with battery is not easily removed, place the entire system in the fire box.
- Dispose of batteries according to Apple disposal procedures and local regulatory requirements.

If the hot cell persists

If the battery or top case with battery doesn’t cool significantly after 2 hour there is an increased likelihood of a thermal event. Refer to the thermal event section of this module for additional guidance.
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Scenario: Swollen Batteries

Damage or overheating of a soft cell battery may cause it to swell with gasses. These gasses may be flammable and can pose a health risk.

Caution
Do not puncture, crush or attempt to flatten a swollen battery.

Response
- Put on chemical resistant gloves, lab apron, and safety goggles or glasses.
- Prepare an absorbing agent (baking soda) in case it is needed.
- Prepare a disposal bag.
- Clear work bench of any materials or debris.
- Unplug the computer's power adapter. If the battery or top case with battery is hot, it should immediately start to cool.
- When the battery or top case with battery is cool, use tongs to place the battery in the disposal bag and put it in the fire safety box.
- Dispose of batteries according to Apple disposal procedures and local regulatory requirements.
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Scenario: Leakage Event

In the event of a leaking battery, keep everyone at a safe distance. Do not touch or walk through any spilled electrolyte.

Response

Caution

Immediately eliminate any ignition source or debris near or around the battery.

- Clear work bench of any materials or debris
- Put on nitrile/latex gloves, lab apron, and safety goggles or glasses.
- Apply an absorbent agent (baking soda) to the spilled electrolyte.
- Use tongs to pick up the battery.
- Place it in a disposal bag with any contaminated absorbent material.
- Put the disposal bag in the fire safety box.
- Use baking soda to clean the area of the spill. (Commercially available liquid acid neutralizer can also be used).
- Wipe down the spill area with your regular cleaning solution.
- Dispose of batteries according to Apple disposal procedures and local regulatory requirements.
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Scenario: Thermal Event

In the unlikely event that a battery is involved in a thermal event, the primary concern is personal safety.

Never use water to suppress a battery fire!
Only use a portable fire extinguisher (CO2 or dry chemical rated ABC or equivalent).

Caution!
When properly trained emergency responders cannot extinguish a fire within 10 seconds, immediately call 911 or the local emergency service. Vacate the area in accordance with normal evacuation procedures for your location.

Response (Once the thermal event is contained)
Proceed with the following steps:

- Put on chemical resistant gloves, lab apron, and safety goggles or glasses.
- Use tongs to place the battery in a disposal bag.
- Place the disposal bag and its contents into a fire safety box for a minimum 2 hours.
- If employees are injured or were exposed as a result of the thermal event, notify your company's Environmental Health and Safety (EHS) department.
- Dispose of batteries according to Apple disposal procedures and local regulatory requirements.
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First Aid Response

In case of exposure to smoke, fumes, or electrolyte from a leaking battery or cell, follow these general first aid procedures.

Inhalation

- Move victim to fresh air.
- Call 911 or other emergency medical service.
- Take appropriate first aid/CPR actions as necessary (only if you have been properly trained to do so).

Skin or eye contact

- Remove and isolate contaminated clothing and shoes.
- Call 911 or emergency medical service.
- In case of contact with internal battery materials or fluids, immediately flush skin or eyes with running water for at least 20 minutes.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.
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Disposal Procedures

Under normal circumstances, all batteries should be sent back to Apple for proper disposal.

When to dispose a battery or top case with battery
Do not ship batteries or top case assemblies (containing batteries) that were:

- Damaged
- Exhibited excessive heat
- Leaked electrolyte
- Currently or previously swollen
- Dispose of batteries with these conditions locally in accordance with local, state and federal laws.

How to dispose a battery or top case assembly with battery
Dispose of the spent battery according to local environmental laws and guidelines

At Carnegie Mellon, place a request for hazardous waste pick-up at the following link:

http://www.cmu.edu/ehs/chemical/waste/index.html