U.S. CONSUMER PRODUCT SAFETY COMMISSION | PROFECO PROCURADURÍA FEDERAL DEL CONSUMIDOR | Health Canada | Santé Canada

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Ms. Deborah R. Prince
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Mr. Bradley J. Schmidt
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Underwriters Laboratories Inc.

Re: Request for inclusion of requirements in safety standards to address hazards associated with AC and USB Chargers

Dear Ms. Prince and Mr. Schmidt,

This letter requests that standards development organizations include, in applicable standards, certain additional performance requirements that regulators from Mexico, Canada and the United States[1], hereafter called the parties, consider important in preventing hazards caused by universal serial bus (USB) chargers (also called "adapters") and alternating current (AC) chargers.

[1] These comments are those of the CPSC staff, and have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

Background

AC chargers are typically used to power portable personal computers. USB chargers are usually a 5-volt direct current (DC) voltage power supplies that can be used to charge smart phones, e-readers, tablet personal computers, and many other devices.

Some reported incidents include:

- burns from contact with hot surfaces on electronic devices, or the charger itself;
- fires and explosions that initiated within the charger or in one of the cords attached to the charger;
- electric shock injuries from user contact with an exposed energized conductor when the charger housing is breached by melting or when the housing breaks apart;
- inappropriate charging, resulting in lithium ion battery fires.

The parties consider these incidents to be more prevalent when an AC charger or USB charger has not been evaluated and certified by a third party testing facility (the charger was “uncertified”).

The U.S. Consumer Product Safety Commission (CPSC) staff, Health Canada (HC) and Mexico’s Consumer Protection Federal Agency (PROFECO) conducted a joint project to analyze incidents and investigate potential safety hazards associated with AC and USB chargers.

Products were evaluated using select tests from the applicable safety standards and additional tests deemed important by the three parties based on an analysis of incidents received. Products were tested in the jurisdiction in which they were sold.

AC Chargers

Every AC charger model tested experienced a failure of at least one test. A majority of the failures resulted during one or more of the following three tests:

- the surface temperature of the unit during normal operation under rated load;
- electric strength;

- flammability of the plastic enclosure.

Additionally,

- some AC charger failures resulted in activating ground fault circuit interruption (GFCI) breakers;
- when non-GFCI breakers were used, some chargers arced internally and then became inoperable;
- during numerous test cycles, the temperatures measured at thermal equilibrium of the plastic enclosure under normal load presented a potential burn hazard;
- high-voltage dielectric breakdown testing indicates the units pose an increased risk of electric shock compared to units of this type that passed the electric strength test in the applicable voluntary standard.

AC chargers that experienced failures:

- present a fire and electric shock hazard, which can result in a burn or electric shock injury;
- pose an indirect fire hazard, because they can overheat and ignite nearby flammable materials; or
- do not meet the safety requirements that are meant to address hazards like fire and electric shock.

USB Chargers

Every uncertified USB charger model tested experienced a failure of multiple tests. A majority of the failures were attributed to one or more of the following tests:

- electric strength tests;
- termination of conductors;
- tension/compression testing; or
- flammability.

USB chargers that experienced failures:

- present a fire and electric shock hazard, which can result in a burn or electric shock injury;

- pose an indirect fire hazard, because they can overheat and ignite nearby flammable materials; or
- do not meet the safety requirements that are meant to address hazards like fire and electric shock.

Test failure was significantly more prevalent when a USB charger was not certified. USB chargers with only the CE mark performed as poorly as those with no certification mark of any kind, failing electrical, mechanical and flammability testing.

Additional requirements to include in applicable safety standards

Many of the tests performed during this joint project are included in the standards and are required for certification. Those tests adequately protect against some hazards associated with both AC and USB chargers; however, there are still some unaddressed hazards associated with these products.

The parties jointly request that the following additional tests be added to applicable safety standards to help increase the safety of these products:

- **Electrical Output at Rated Load:**
  The test measures voltage within 5 V +/- 5% of rated voltage and current within +/- 10% of the rated current. This test is similar to the test contained in IEC 62680-3.

  A USB charger may damage the device under charge or overheat itself if it provides voltage or current outside of the prescribed limits. Overvoltage and overcurrent are especially dangerous for the lithium ion batteries contained in the product, because they can cause the batteries to experience thermal run-away, creating a fire and explosion hazard.

- **Electrical Output at Rated Load to evaluate functionality of three units after Mechanical Test (Drop Test):** This test repeats the Electrical Output at Rated Load test after completing the mechanical drop testing.

  This test is intended to simulate normal use and abuse by consumers.

- **Tension/Compression Test:**
  For direct plug-in chargers, which includes USB chargers, this test requires that the blades be capable of withstanding a downward force of up to 133.5 N applied within 5 seconds and held for 10 seconds on the front face, top edge of the charger. The test shall be conducted with the charger inserted into a standard duplex test receptacle. The test shall be repeated with the force applied laterally to adequately capture the possible orientations of an installed receptacle. After the test, the charger should not present a potentially hazardous condition. This test is derived from ASTM F963 – 11 Clause 8.9 and 8.10.

  This test evaluates whether the plug blades loosen, disengage, or break under foreseeable-use conditions. Blades that are not secure and that are susceptible to loosening present a possible fire and shock hazard. If the blades move, they may not make proper contact with the electrical outlet, increasing the contact resistance and possibly causing arcing, both of which can create overheating and pose a potential fire hazard. The blade movement may also expose the electrical contacts, creating an electrical shock risk to nearby users. Furthermore, the test evaluates any breaks or cracks in the casing of the unit. Breaks or cracks in the unit can expose internal components, which can create a significant shock hazard to a user.

- **Evaluation of potential shock or fire hazard after completing the Mechanical Tension/Compression Test:**
  This test repeats the dielectric testing (*i.e.*, the electric strength or dielectric strength test in the applicable voluntary standard) after completing the Mechanical Tension/Compression Test.

  This test is intended to simulate normal use and abuse by consumers.

Next steps

Each party wishes to be apprised of progress on including these additional tests in applicable safety standards. Contact the parties if you have any questions or need clarification of this request.

The parties will continue to cooperate on future actions to reduce the risk to the public from electrical products.

Thank you for your efforts to promote safety.

George Borlase
Assistant Executive Director for Hazard Identification and Reduction
U.S. Consumer Product Safety Commission

[redacted]
Rogelio Cerda Perez
Federal Consumer Attorney
Consumer Protection Federal Agency of Mexico

[redacted]
Tolga R Yalkin
Director General, Consumer Product Safety Directorate
Health Canada / Government of Canada

Attachments:
-Consensus Paper
-Report from CPSC
-Report from PROFECO
-Report from Health Canada
-CPSC Incident Data