Consensus Paper

Canada/Health Canada, Mexico/PROFECO, United States/CPSC
Early Consultation Initiative

Trilateral Investigation into the Safety Hazards Associated with AC and USB Chargers (also called Adapters)

Introduction

The U.S. Consumer Product Safety Commission (CPSC), Health Canada (HC) and Mexico's Consumer Protection Federal Agency (PROFECO), hereby called the parties, joined in a tri-lateral initiative to investigate the incidents and potential safety hazards associated with alternating current (AC) and universal serial bus (USB) chargers. AC chargers are typically used to power portable personal computers. USB chargers are a 5-volt direct current (DC) voltage power supply that can be used to charge smart phones, e-readers, tablet personal computers, and many other devices.

Some incidents reported to the parties have resulted in skin burns from contact with hot, sometimes melting or deforming surfaces on battery packs, smart phones, other electronic devices, or the charger itself. There have also been reported incidents of fires and explosions that initiated within the charger or in one of the cords attached to the charger. Additional incident reports described 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.

These incidents were found to be more prevalent in chargers that were not evaluated and certified by a third party testing facility. Therefore, during the engineering examination, special emphasis was placed on selecting and evaluating those that were not certified and which were available for sale in one of the three countries. Considering these product types are sold in the three markets, the parties tested the samples using a common test procedure. The test procedure included select tests from the applicable voluntary safety standards and additional tests deemed important by the three parties. Not all tests were conducted on the AC chargers as some were applicable only to USB chargers. This consensus paper

addresses the conclusions from all of the parties after testing of the samples and provides a proposal on how to move forward.

Product Testing

The U.S. CPSC conducted testing on AC Chargers, Health Canada conducted testing on USB Chargers and Mexico's PROFECO conducted testing on both AC and USB Chargers.

Analysis of Tests Results

AC Chargers: An analysis of the test results shows that 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; and flammability of the plastic enclosure.

Additionally, during the early stages of testing, some failures resulted in activating ground fault circuit interruption (GFCI) breakers. However, when the same model was connected to a non-GFCI protected breaker, the non-GFCI breaker did not trip. Instead, the samples 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. Where high-voltage dielectric breakdown testing produced a fault, the failure indicated the units posed an increased risk of electric shock compared to units of this type that passed the electric strength test contained in the applicable voluntary standard.

USB Chargers: Every uncertified USB charger model tested experienced a failure of multiple tests. A majority of the failures resulted during one of more of the following tests: electric strength; termination of conductors; tension/compression; and flammability.

The parties are of the opinion that non-certified USB chargers can present a fire and electric shock hazard, which may result in a burn or electric shock injury. The non-certified USB chargers tested also pose an indirect fire risk, as they can overheat and ignite nearby flammable materials. Through the testing conducted, all non-certified USB chargers failed to meet the safety requirements meant to address hazards such as fire and electric shock.

Many of the non-certified USB chargers tested contained only the CE label as a third party safety mark. The parties consider products containing only a CE mark as not known to be compliant with any safety standards, because the CE mark requirements are such that they equate to only an assertion of voluntary compliance to a safety standard. From the testing results, units with only the CE mark performed equally as poor as units which contained no certification mark of any kind, failing the electrical, mechanical and flammability testing.

More detailed test results are provided within the reports provided by all 3 parties.

Conclusions

Many of the tests used during this project are included in voluntary standards and are required for certification. Third party certification is not mandatory in all jurisdictions. The parties feel that those tests adequately cover some hazards associated with both AC and USB chargers.

The parties, however, also agree that there are still some unaddressed hazards associated with these products. The parties identified the following additional tests, which when complied with, will increase the safety of these products:

- **Electrical Output at Rated Load:** The test measured voltage within 5 V +/- 5% of rated voltage and current within +/- 10% of the rated current. A USB charger may damage the device under charge or overheat itself if it provides voltage and current outside of the prescribed limits. Overvoltage and overcurrent are especially dangerous for lithium ion batteries contained in devices, as it can cause the batteries to experience thermal runaway, creating a fire and explosion hazard.

- **Evaluation of potential shock or fire hazard after completing Mechanical Modified Compression/Tension 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 Compression/Tension Test.

- **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.

- **Tension/Compression Test:** 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, causing arcing 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.

Each party remains free to take action or encourage others to act according to its own domestic procedures, but will strive to maintain lines of communication with the other governments to maximize the potential for aligned approaches going forward.