

Mobile Computer Cradle Care and Maintenance

Overview

This document explains why cleaning may be required for mobile computer cradles and provides an overview of areas that need to be cleaned. Also outlined are examples of damage and/or performance loss that may develop from poor cradle care and maintenance.

What to Look For and Why to Clean a Cradle

General cradle maintenance will prolong proper function for daily use. It is common knowledge that keeping cradles away from high vibration, debris and contaminants, liquids, as well as extreme temperatures is ideal, but this is often not possible in many use cases.

To combat these environmental hazards, proper cleaning on a regular basis is recommended to maintain normal cradle functionality. For information on proper cradle cleaning practices, please refer to the Zebra document “Best Practices for Cleaning Mobile Computers.”

EFFECTS OF DEBRIS, CONTAMINANTS, AND LIQUIDS

Debris, contaminants, and liquids can decrease cradle performance in the following ways:

- Degrade electrical connectivity of mating connectors.
- Typically abrasive and will wear plating, as well as housings (cosmetically).
- Can build up on and in latching mechanisms, making them stick or move in a rough manner.
- When combined with moisture, may lead to some level of electrical shorting.
- Exposure to liquids and to salty air can accelerate corrosion of contacts.

EFFECTS OF TEMPERATURE EXTREMES

Extremely hot or cold temperatures can affect cradle performance as follows:

- Excessive heat and cold will change the fit between the device and the cradle and may reduce performance. Also, Li-ion batteries cannot charge without damage at extreme temperatures.
- Some products are designed with safety circuits built into them that will suspend battery charging when the environmental temperature is too high or too low. This circuit typically causes the charge indicator light to appear red and blinking.
- The charging function will generate additional heat inside mobile devices and batteries, so it is important to have enough air flow around a cradle(s) to prevent a significant temperature rise that will cause the suspension of charging.
- Cycling between cold and hot will result in condensation that can potentially mix with debris and/or contaminants, and can create many issues, including some level of electrical shorting.

EFFECTS OF VIBRATION

Vibration can also affect cradle performance in the following ways:

- Vibration will accelerate plastic mating surface wear and may loosen hardware, the effect of which is often decreased performance.
- A high-vibration environment may also cause intermittent electrical connections between the device and the cradle.
- Sustained levels of high vibration are likely to reduce the product life by contact pin/spring fatigue, which can cause premature failure.

Practices to Avoid

The following list describes poor maintenance practices that should be avoided, so as to minimize performance issues and damage to cradles and devices:

- Cable routing that enables side loads (forces or movements perpendicular to the mated connection) that are frequent, or of significantly high levels, resulting in connectors breaking off the PCB inside the cradle, or failure of the connector body itself.
- Failure to not fully insert the mobile device into the cradle often results in constant stress on the side cradle cup latches, which in turn causes them to crack over time.
- Charging suspends when the cradles and devices are located in an environment with insufficient air flow or cooling to keep the units below the upper charge temperature limit.
- Cradle contacts damaged with chemical-containing elements, such as chlorine. Chlorine and other elements are highly corrosive to connector metals.
- Excessive plugging and unplugging of the cradle cables, resulting in wearing out of the connector contact.
- Spillage of sugary liquids on the pogo pins/contacts often results in stuck pins and no charging after the liquid dries up.

Examples of Damage Resulting from Poor Maintenance

The charger shown in Figure 1 was affected by a chemical containing a “Cl” element (shown in Figure 2). This chemical caused the corrosion of the 1st pin.

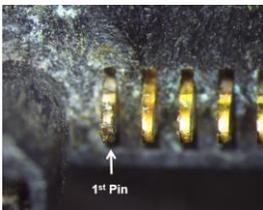
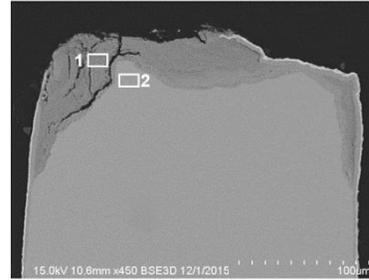


Figure 1: Pin Corrosion from Chemical



Through EDS analysis, Cl, Cu, and Sn were detected from the corrosive region, Cu and Sn could be attributed to matrix material (bronze), and Cl may be related to foreign matter.

	Cl	Cu	Sn	a.t.%
1	1.2%	88.0%	10.7%	100 %
2	0%	95.3%	4.6%	100 %

Figure 2: Chlorine/Chloride Detected From Corrosive Region

The cradles and devices shown in Figure 3 were positioned with insufficient air flow and cooling to keep the units below the maximum charge temperature. The charging was automatically turned off to protect the battery.



Figure 3: Insufficient Air Flow and Cooling

Figure 4 illustrates how a side cradle cup latch can crack due to the mobile device imposing constant stress on the latch over a period of time.



Figure 4: Cracked Side Cradle Cup Latch

Dos and Don'ts of Cradle Maintenance

DOS

- ✓ Do perform the cleaning process regularly.
- ✓ Do position the cradle(s) in a location where there is sufficient "cool" airflow to prevent overheating.
- ✓ Do position the cradle(s) with enough space around them so the associated cables and connections are not loaded with a side-load force.
- ✓ Do fully insert the mobile device into the cradle.

DON'TS

- ✗ Do not expose the cradle to any type of liquid.

Note: The cleaning process should involve applying liquids to a cloth or cotton swab, and not directly to the cradle or contact area.

- ✗ Do not put significant side-load force on connectors; especially USB connectors.
- ✗ Do not place cradle in an unclean environment.