National Aeronautics and
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April 15, 2019

Reply to Attn of: EP-19-006

To: RECORD

From: EP5/Electrical Power Systems, Technical Discipline Lead, Propulsion and Power

Subject: Report on ZBook Barrel Connector

This memorandum serves to document the test results for mating and demating the barrel type power connector on the ZBook Laptop Computer.

It has been written in response to Chit 017065 which addresses the situation of the crew not utilizing an upstream inhibit when demating or mating the ZBook barrel connector.

As detailed in the test report attached to memo EP-19-002, testing has been performed to determine if molten metal is created when a ZBook barrel type power connector is mated or demated under worst case normal ZBook currents and voltage. This connector corresponds with the P1 connector on SEG33125099-301 and SEG33125099-302.

Measurements on a ground ZBook laptop (HP ZBook 15 G2) and AC adapter (HP 90W Slim Combo Adapter (H6Y84AA) HP Part No.:696960-001) during connection and disconnection showed that the 19.5Vdc (Direct current Volts) 4.62A (Amperes) values quoted in Chit 17065 correctly envelope the behavior of the ZBook at the barrel connector interface under different operating conditions. This behavior was enveloped by testing with 20V and 5A (herein referred to as worst case normal conditions), as well as higher voltages and currents.

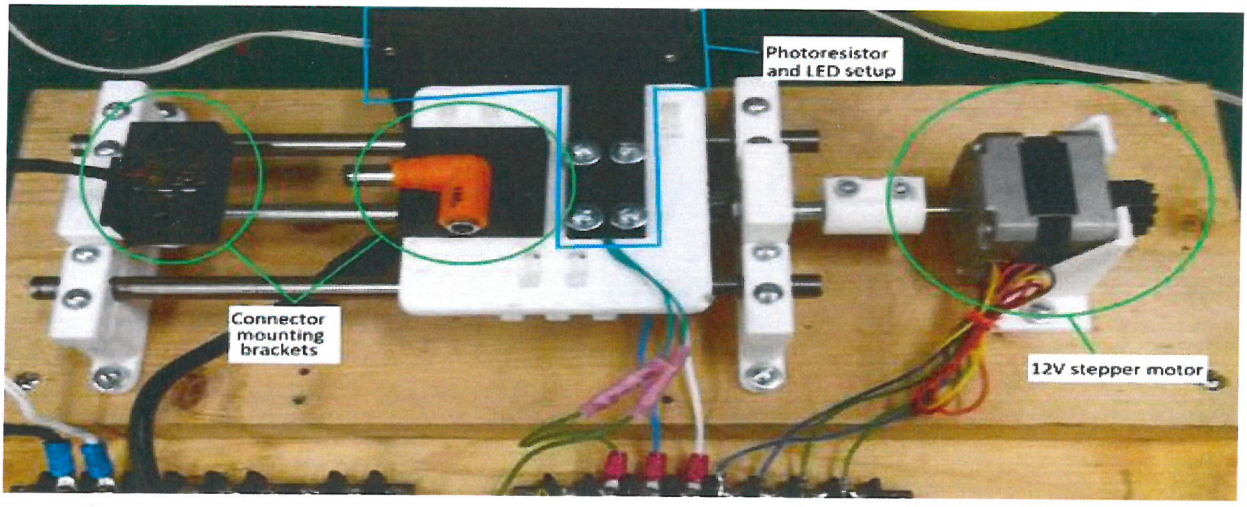


Figure 1: Photograph of test setup

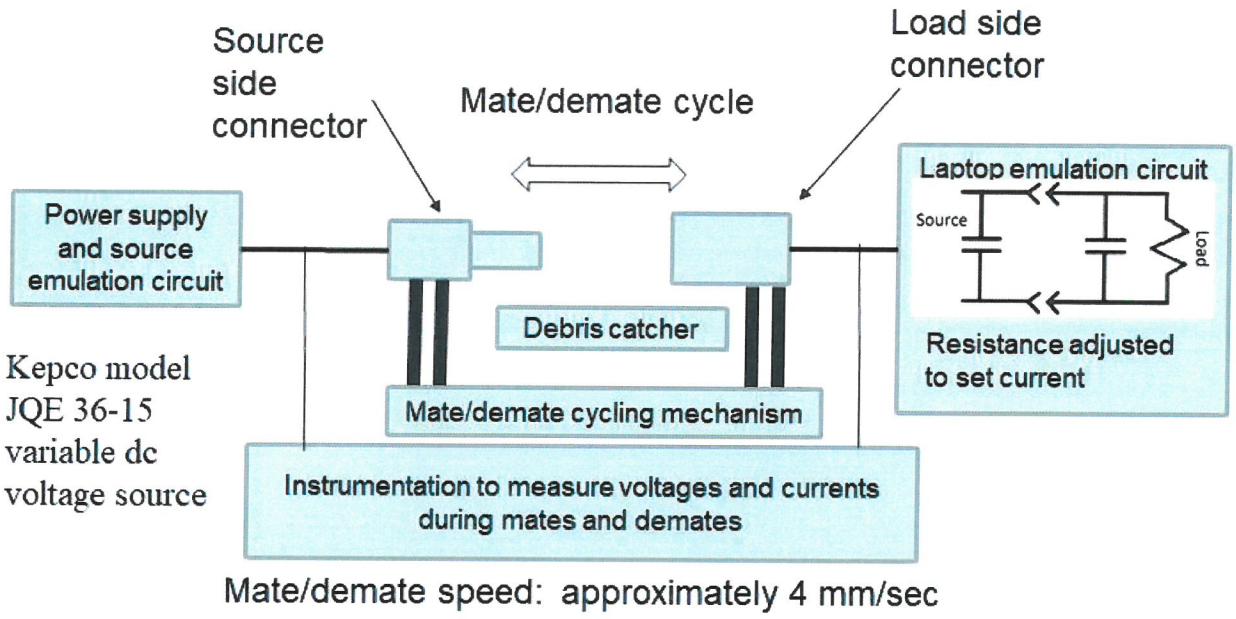


Figure 2: block diagram of test setup

Testing consisted of mating and demating ZBook barrel connectors (from commercial adapter kits) and ZBook barrel sockets (from ZBook replacement hardware) 10 times at a speed of 4 mm per second connected to a lab power supply set to 20V on the socket side, and a load resistor set for 5A (4 ohms) on the barrel connector side. The test setup is shown in figures one and two, and is described in more detail in the test report (Method section).

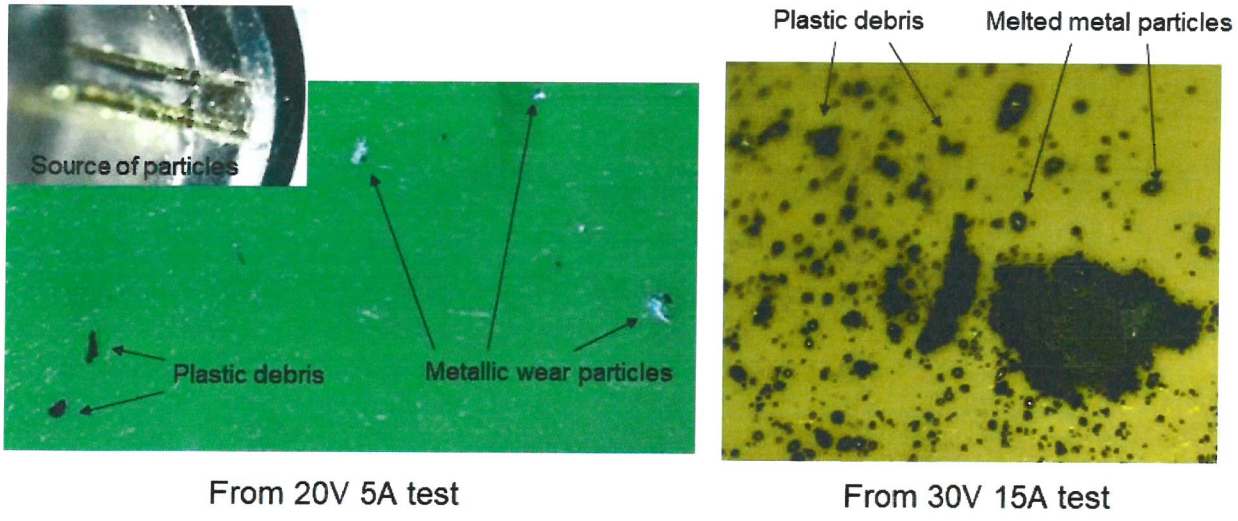


Figure 3: Examples of debris

Testing at 20Vdc and 5A showed no signs of molten metal, therefore, testing was performed at higher voltage and currents to determine the conditions that would cause molten metal generation during electrical arcing (shown in figure three), and also gave an idea of the margin

between the 20V 5A condition and the conditions that generate molten metal. This is summarized in figure four.

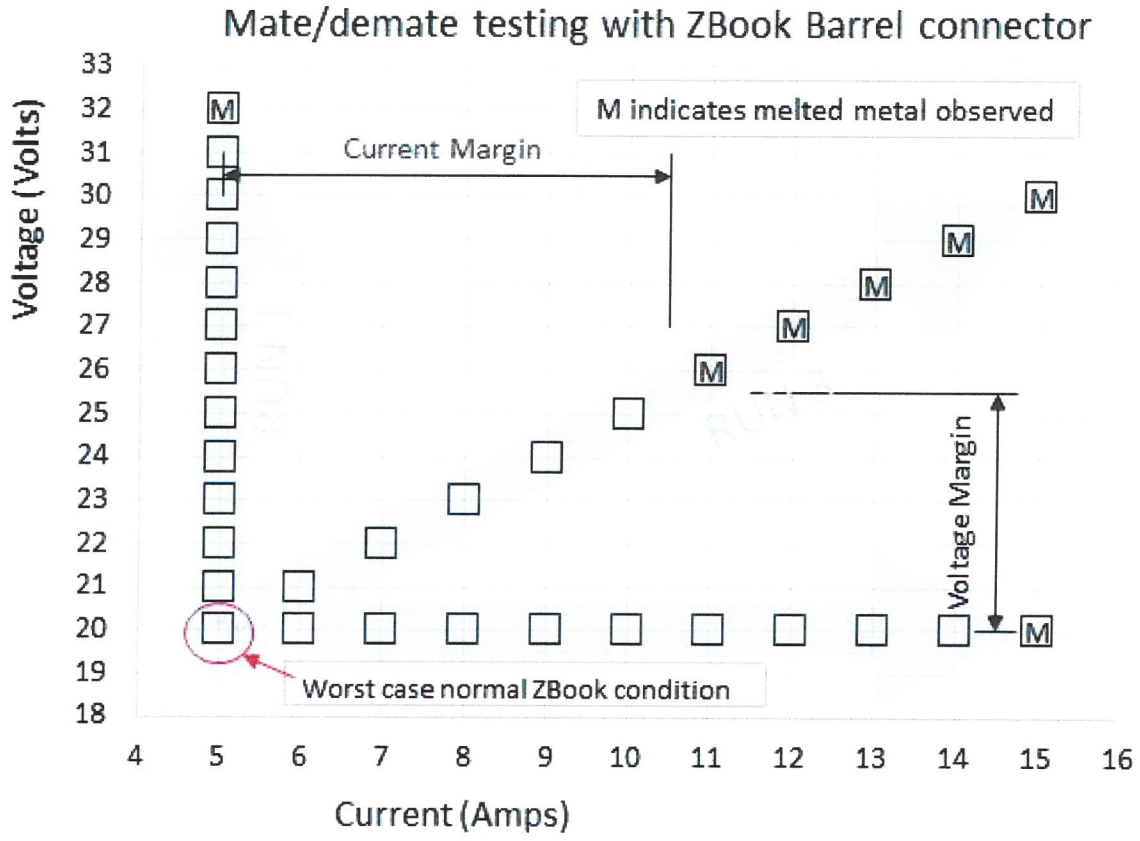


Figure 4

The graph shows that there is a margin of more than 5A (100 percent) on current, and 5V (25 percent) on voltage from the 20V 5A ZBook conditions and the conditions that generate molten metal with the ZBook type barrel connector.

Conclusion:

1. Measurements on the ZBook laptop during mate and demate showed that 20V and 5A are reasonable-worst-case normal conditions.
2. The test was able to induce, capture and detect melted metal particles under higher voltages and currents than the ZBook conditions.
3. The test did not show melted metal particles at 20V 5A conditions, with three different fresh connectors.

4. Margin of more than 5A (100 percent) on current, and 5V (25 percent) on voltage exist between the worst case normal ZBook conditions and the conditions that generate molten metal with the ZBook type barrel connector.
5. Hot mating or demating the barrel power connector to the ZBook laptop under normal conditions does not pose a threat to the crew from molten metal.

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