

CIL  
 EMU CRITICAL ITEMS LIST

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12/24/94 SUPERSEDES 12/24/93

ANALYST:

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
DCM ELECTRONICS, ITEM 350 ----- SV792291-27 (1)	2/2	350PH15 Battery voltage sense circuit output drifts low.  CAUSE: Electrical component failure, broken connections, open circuit.	END ITEM: Battery voltage displayed is lower than actual.  GFE INTERFACE: False warning and indication that the battery has failed.  MISSION: Terminate EVA. Loss of use of one EMU.  CREW/VEHICLE: None.	A. Design - Semiconductor failure is minimized through the use of high reliability components. Established reliability capacitors (Level B) and resistors (Level R) are used and are qualified to the requirements of their respective MIL specs and thermal shocked per condition B of MIL-STD-202 Method 107. The transistors and diodes are qualified to the requirements of MIL-S-19500 and receive the burn-in of JANTXV level parts per the applicable methods, 1036, 1039, and 1040, of MIL-STD-750. The electronic components are operating within the power derating requirements of SVBS 7804. The printed circuit boards are polyimide per MIL-P-134949 Type 6I and manufacturing and soldering is per NSFC-STD-156 and NRB5300. 4 (3A-1). The board assemblies are hard mounted to the DCM case to provide a thermal transfer path between the board heat sinks and the case to direct heat away from the electronic components. The board assemblies are also conformal coated per MIL-A-46146 (Dow Corning RM 3140) for environmental protection. All wiring used in the DCM is M22759/11 (teflon insulated). Soldering is per NRB5300. 4 (3A-1) and wire crimping is per SVBS 4909 (based on MSC-SPEC-Q-1A). All wires are strain relieved. Electrical connectors are environmentally sealed to prevent damage due to contamination and humidity.  B. Test - In-Process Test - The DCM electronics assembly is tested during initial build-up; at the board assembly level, after the PC boards have been interwired, after installation of the boards and wiring, and after installation of the front cover. These tests consist of continuity through the switches and wiring, voltage checks, functional check of all current limiters, and full operation of the DCM electronics. The tests insure proper operation of all electronic components.  PDA Test - Vibration testing per SEMU-6D-015 followed by continuity and full functional testing verifies the integrity of the solder joints and crimp connections in the DCM. The random vibration level for this test is 6.6 gms for a duration of 1 minute per axis for each of the three orthogonal axes. (JSE Spec SP-T-0023)

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	2/2	350FH15;		<p>Thermal Vacuum testing followed by full functional electrical testing per SEMU-40-015 also verifies the health of the solder joints as well as the acceptability of the components. The BCM is placed in a vacuum chamber at <math>1 \times 10^{-3}</math> torr. The BCM case temperature is cycled 3 times from 70 to 130 degree F. At the end of the third cycle, the temperature is held at between 130 and 135 degrees F for a minimum of four hours. The BCM display must remain on throughout the test. This verifies proper transfer of heat from the electronics to the BCM case to prevent overheating of components.</p> <p>Certification Test -          The Liquid Crystal Display version of the BCM electronics assembly (Item 350, SV792291-7), as part of the full BCM Item 300 (items 350 and 385 combined), was successfully subjected to levels of vibration and shock equivalent to those experienced over a fifteen (15) year life.</p> <p>Random Flight Vibration 1.625 grams 48 min/axis          Sinusoidal Flight 1 grms. 5-35 Hz ea.          Vibration axis          Design Shock 6.5 grms. 11 ms/peak</p> <p>The LED display version of the BCM Electronics Assembly (Item 350, SV792291-5) was subjected to certification of EMI which occurred in September of 1985. The testing verified the basic integrity and flight worthiness of the redesigned BCM configuration (Item 300, SV792294). The item 350 completed Qualification Vibration (7.6 GRMS, 6 minutes per axis) as a separate item, and structural vibration (1.625 GRMS, 48 minutes per axis), and shock testing as part of the full BCM Item 300 (Item 350 combined with Item 385). The BCM/300 also completed the four hour thermal vacuum certification at 135 degree F and storage temperature testing at 35 degree F. No class I EC's have been incorporated into this version of the BCM since certification was completed.</p> <p>C. Inspection -          100% inspection of all soldering (PC boards and wiring) by Hamilton Standard QA and DCAS QA.          All board assemblies are inspected for damage and contamination.</p>

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	2/2	350FN19:		<p>All wiring is inspected for damage, nicks in the insulation, wear, and strain relief. The DCN is internally inspected after installation of the circuit boards and wiring to insure no damage has occurred during Assembly.</p> <p>D. Failure History - None.</p> <p>E. Ground Turnaround - This failure would be detected during Ground Turnaround per FEMU-R-001, vacuum chamber run, DCN display verification, Possible false battery failure message.</p> <p>F. Operational Use - Crew Response - Pre/PostEVA: Perform battery swap for spare EMU battery. Continue EVA operations. EVA: Continue EVA. Rely on monitoring of audible command, for RPM. Training - No training specifically covers this failure mode. Operational Considerations - For single failure, no constraints. EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Flight rules define go/no go criteria related to battery power. Real Time Data System allows ground monitoring of EMU systems.</p>