

CEL
EMU CRITICAL ITEMS LIST

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12/24/94 SLIPERGEDS 12/24/93

ANALYST:

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
DCM ELECTRONICS, ITEM 350 SV792291-27 (1)	2/1RB	350FM22: Electrical short to ground, downstream of the DC/DC converter CAUSE: Electrical short in the wiring or electronic components. Wire chafing or contamination.	END ITEM: Loss of one or more of the component functions interfacing with the DCM electronics. GFE INTERFACE: Increase in the battery power consumption. The current is limited in the DC/DC converter to 1.8 +/- 0.25 amps. Shutdown of the DC/DC converter. Loss of CMS, tones and DCM display. MISSION: None for single failure. Terminate EMU with loss of DCM display, CMS and ability to monitor EMU. Loss of use of one EMU. CREW/VEHICLE: None for single failure. Possible loss of crewman with loss of COC, oxygen or low vent flow.	A. Design - Semiconductor failure is minimized through the use of high reliability components. Established reliability capacitors (Level S) 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 JANTRY level parts per the applicable methods, 103B, 1039, and 1040, of MIL-STD-750. The electronic components are operating within the power derating requirements of SVHS 7804 (derated to at least 75%). The printed circuit boards are polyimide per MIL-P-15949 Type G1 and manufactured per SH-P-0006. Parts mounting and soldering is per MSFC-STD-136 and NH85300, 4 (3A-1). The board assemblies are hand 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 electrical components. The board assemblies are also conformal coated per MIL-A-46146 (00w Corning RTV 3140) for environmental protection. All wiring used in the DCM is M22759/11 (teflon insulated). Soldering is per NH85300, 4 (3A-1) and wire crimping is per SVHS 4909 (based on MSC-SPEC-D-1A). All wires are strain relieved. Electrical connectors are environmentally sealed to prevent damage due to contamination and humidity. B. Test - [In-Process: 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 consists 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 the DCM electronics. PDA: Vibration testing per SEMU-60-015 followed by continuity and full function testing verifies the integrity of the solder joints and crimp connections in the DCM. The random

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2/1RB 350FM22:

vibration level for this test is 6.6 gms for a duration of 1 minute per axis for each of the three orthogonal axes (JSC SPEC SP-T-0023).

Thermal vacuum testing followed by full functional electrical testing per SEMU-60-015 also verifies the solder joints as well as the acceptability of the components. The DCM case temperature is cycled 3 times from 70 to 130 degree f. At the end of the third cycle, the temperature is held between 130 and 135 degree f for a minimum of four hours. The DCM display must remain on throughout the test. This verifies proper transfer of heat from the electronics to the DCM case to prevent overheating of components.

Certification:

The Liquid Crystal Display version of the DCM electronics assembly (Item 350, 8V792291-7), as part of the full DCM item 300 (Items 350 and 385 combined), was successfully subjected to levels of vibration and shock equivalent to those experienced over fifteen (15) year life.

Random Flight Vibration	1.625 gms	48 min/axis
Sinusoidal Flight Vibration	1 gms.	5-35 Hz ea. axis
Design Shock	6.5 gms	11 ms/peak

The LED display version of the DCM electronics assembly (Item 350, 8V792291-5) was subjected to certification testing between June and August of 1986 with the exception of EMI which occurred in September of 1985. The testing verified the integrity and flight worthiness of the redesign DCM configuration. (Item 300, 8V792294). The item 350 completed qualification vibration (7.6 gms, 6 minutes per axis) as a separate item, and structural vibration (1.625 gms, 48 minutes per axis), and shock testing as part of the Full DCM Item 300 (Item 350 combined with Item 385). The DCM/380 also completed the four hour thermal vacuum certification at 135 degree f and storage temperature testing at 35 degree F. No class 1 EC's have been incorporated into this version of the DCM since certification was completed.

C. Inspection -

100% inspection of all soldering (PC boards and wiring) by Hamilton Standard QA and DCAB QA.

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NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
	2/1RB	350FM22:		<p>All board assemblies are inspected for damage and contamination. All wiring is inspected for damage, nicks in the insulation, wear, and strain relief.</p> <p>The DCM 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 for this failure mode. Related Failures: 9-EMU-350-R002 (2-24-86) - During Acceptance testing of the DC/DC Converter current limiter, the DCM shutdown prematurely. The cause was traced to an error in the test rig software. EC 42805-18 was issued to correct this error. In addition, EC4286-599-121 was issued to revise the shutdown timer in the DCM to correct for a marginal design condition which was discovered during the above failure investigation.</p> <p>E. Ground Turnaround - This failure would be detected during test per FEMU-R-001. Transducer and DCM gauge calibration check.</p> <p>F. Operational Use - Crew Response Pre-EVA : When detected during scheduled status checks, discontinue use of EMU. Consider use of third EMU if available. EVA : When detected by ground or during periodic status check, terminate EVA. Special Training - Standard training covers this failure mode. Operational Considerations - EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Flight rules define operational EMU CWS as at least able to monitor a valid status list. Real Time Data System allows ground monitoring of EMU systems.</p>