

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
BATTERY, ITEM 490 ----- SV819600-01 (1)	2/1RA	490FM03Z Relief Valve Fails Open Defective Q seal, contamination, poppet spring fails.	END ITEM: Continuous electrolyte flow through the relief valve. GFE INTERFACE: If relief valve fails open, the electrolyte would sublimate to vacuum and battery power would be lost. MISSION: Terminate EVA with loss of battery power. CREW/VEHICLE: None for single failure. Possible loss of crewmember with loss of SOP. TIME TO EFFECT /ACTIONS: Seconds.	A. Design - The valve seal is a quad "Q" seal made from ethylene propylene. It is installed in the poppet head and seals against the valve housing. The sealing surface has a 32 micro-inch finish for smoothness. Contamination is prevented from entering the valve by a 304 CRES sintered wire 0.030" mesh screen installed directly over each relief valve. The screens are held in place by Teflon caps. The valve poppet spring is made from 17-7 PH stainless steel with a yield strength of 155.00 ksi. At the maximum operating pressure of 40 psig., the spring is stressed to 103.517 ksi. The spring has a yield strength safety factor of 1.5. B. Test - The relief valve is tested for reseal per AT-E-490-RV-1. Reseat of assemblies is 31 psid minimum. PDA Test - Data is transferred from the Acceptance Test. Certification Test - A relief valve was cycled through crack, flow, and reseal for 148 cycles in June 1999. All reseal pressures recorded were above the minimum required specification of 28 psig. The item has completed all certification requirements. C. Inspection - The relief valves are tested and adjusted during vendor manufacturing to verify that the valves reseal at the specified 31 psid minimum. D. Failure History - B-EMU-490-A027 (2/23/01) Relief valves failed reseal requirements of 28 - 28.1 psig with 0 cc/min flow during crack and reset screening. The cause was due for the most part to the shift in the valve set point, which was the result of the spring movement and partly to stiction of the Quad seals. BRV (battery relief valve) was redesigned to eliminate set point shift and stabilize the spring by adding a shim. S/AD SV819600/2 drawing was also revised to update note 8 to include 5 cc as minimum crack flow rate and as a maximum reseal flow rate. H-EMU-490--002 (1/23/01) Battery relief valve failed visual inspection when the Hysol used to retain the calibration nut became partially debonded. This problem was caused by poor mixing of the Hysol leading to the improper cure for Hysol. In addition, Krytox was found on the nut surface and poppet thread. This lubricant material prevented adhesion of Hysol. Battery relief valve was redesigned to eliminate Hysol and incorporate a new primary calibration nut retention feature and add a secondary nut retention feature. E. Ground Turnaround - None. Due to battery design, no ground turnaround test is possible. F. Operational Use - Crew Response - PreEVA/PostEVA: Swap out EMU battery. EVA: When loss of battery power detected, terminate EVA to standby on SCU.

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490FM03Z

Training: Standard EMU training covers this failure mode.

Operational Considerations -
Flight rule A15.1.2-2 of "Space Shuttle Operational Flight Rules", NSTS-12820 defines go/no go criteria related to EMU battery. Generic EVA Checklist, JSC-48023, procedures Section 3 (EMU Checkout) and 4 (EVA prep) verify hardware integrity and systems operational status prior to EVA. Real Time Data System allows ground monitoring of EMU systems.

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-490 BATTERY
CRITICAL ITEM LIST (CIL)
EMU CONTRACT NO. NAS 9-97150

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