NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		490FM05		
BATTERY, ITEM 490 ---------- SV767789-12 (1) OR BATTERY, ITEM 490 ---------- SV819600-01 (1)	2/1R	Loss of output, high internal resistance. Loose battery terminal, cell degradation.	END ITEM: Drop in battery voltage output. GFE INTERFACE: Reduction in electrical power supplied to EMU. Premature depletion of battery power. MISSION: Terminate EVA. Loss of use of one EMU. CREW/VEHICLE: None for single failure. Possible loss of crewman with loss of SOP. TIME TO EFFECT /ACTIONS: Seconds. If EVA, turn off the battery by switching to the SCU power, open the purge valve to activate the SOP. If IV use spare battery. TIME AVAILABLE: Minutes. TIME REQUIRED: Seconds.	A. Design - The battery cells are interconnected to each other through silver plated copper straps mated to the .16 dia., silver plated carbon steel terminals on the battery. The buss bar cross-section is .031" x .38". These straps are connected to the battery interface connector through #20 AWG copper stranded wire. The connector sockets are attached to the wire by crimping. After assembly, all the above cabling and jumper straps are encapsulated in potting to provide protection from the environment and maintain tight connections. B. Test - Component Acceptance Test - The relief valve assembly is leakage tested per AT-E-490RV for P/N SV767789-12 and AT-E-490RV-1 for SV819600-00. The valve is fixtured so that any leakage will enter a vent tube, which has its end under water. The valve is pressurized with nitrogen at 9 - 16.5 PSIG for P/N SV767789-12 and at 29.5 +/- 0.5 psig for P/N SV819600-00. The end of the vent tube is observed. Leakage is defined as any bubbles escaping from the vent tube within a five minute period. The battery is leakage tested per AT-EMU-490 for P/N SV767789-12 and per AT-EMU-490-1 for P/N SV819600-00. All the cells are pressurized with 40.0 +/- 1.0 psig of nitrogen. A leak detecting solution is used to check for leaks around the vent ports of the battery. The individual cells are leakage and proof pressure tested per SVHS 7820. The cells are completely submerged in water and pressurized, by nitrogen through the activating plug, to 60 psid. There shall be no bubbles in five minutes in the restrained condition and no structural deformation. Loaded circuit voltage is checked at section 20.0 of BAT-001 (Battery Procedure for Activation of EMU-MMU Batteries). A high internal resistance would show as a low voltage (spec. 15.7 volts minimum). Certification Test - P/N SV767789-12 The item completed the 15 year structural vibration and shock certification requirement during 10/83. P/N SV819600-00 The item completed structural vibration and shock requirement by test during 9/98. The item has completed all certification requirements. C. Inspection - Connector mounting screws are torqued into battery container per HS2212 with all torques being recorded by a certified operator. Continuity checks performed as follows: Between cells after initial assembly and bonding together. Between connector and +/- battery terminals after connector is wired. Between connector and +/- battery terminals just prior to curing cells after assembly into battery container. Between connector and +/- battery terminals after all assembly is completed. D. Failure History - P/N SV767789-12 B-EMU-490-A009 (11/8/90) - Battery S/N 1146 failed minimum discharge requirement during two formation discharge cycles. No failure investigation per NASA

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			REDUNDANCY SCREENS:	direction.
			A-PASS	H-EMU-490-C027 (9/14/93) - Battery S/N 1256 leaked internally during
			B-PASS	certification testing due to a crack in the intercell wall between cells 4 and
			C-PASS	5. EC3569 epoxy was evident on the fracture surface clearly showing the crack was mostly through the wall when the cover was bonded in place. Therefore, crack was caused by mishandling the case prior to bonding. No corrective action taken. B-EMU-490-A025 (01/13/97) - Battery S/N 1311 failed minimum discharge requirement during formation. Investigation found the battery electrolyte amount to be below HS specification requirements. EC 182135-070 and CCBD H6729 will change documentation to require 72 GM minimum electrolyte per battery cell. P/N SV819600-00 None. H-EMU-490-C029 (4/24/00) - Open circuit voltage fell below minimum spec after successfully completing 30 of 33 required charge/discharge cycles during cert testing. Cellophane is susceptible to damage from environmental conditions. Cellophane used in battery was stored unprotected in a bright fluorescent storage area. Cellophane shelf life reduced to 6 months. Supplier (BST) to create a new handling procedure (Ref. G6605R6) for storage of materials. H-EMU-490--001 (12/8/00) Battery failed to meet voltage requirement during first formation cycle. Investigation revealed cracks in cell case walls of cells 1 and 2 due to solvent breaching ultrasonic weld during cell manufacturing process. In-process test added to detect poor ultrasonic welds prior to solvent application. E. Ground Turnaround - Tested per FEMU-R-001, Battery Activation or Preflight Recharge. F. Operational Use - Crew Response - PreEVA: Troubleshoot problem, perform in-suit battery swap using spare battery. Continue prep. EVA/PostEVA: When CWS data confirms loss of voltage and comm/fan are degraded, terminate EVA. Training - Standard EMU training covers this 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 power. 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

Prepared by: _____
HS - Project Engineering

_____
HS - Reliability

_____
HS - Engineering Manager

Approved by: _____ 5/24/02
NASA ~~SFA~~/SSM
ES5

_____ 5/21/02
NASA ~~EMU~~/SSM

_____ 5/30/02
NASA ~~S & MA~~

_____ 5-30-02
NASA ~~MOD~~

_____ 6/04/02
NASA ~~Crew~~

_____ 6/3/02
NASA ~~Program~~ Manager