NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		151FM14		
ELECTRICAL POWER HARNESS, ITEM 151 --- SV789151-4 (1) Or --- SV824051-1 (1)	3/2RB	Electrical open or short, primary DCM electrical power to SSER. Cable chafing against connector shell or shield. Improper connector strain relief. Faulty connection between connector and lead wires, insulation breakdown, conductor severed, contact resistance.	END ITEM: Open circuit or short to ground in primary DCM electrical power to SSER. GFE INTERFACE: Loss of one of two redundant DCM power supplies to SSER. MISSION: None for single failure. Terminate EVA with loss of second power supply. CREW/VEHICLE: None. TIME TO EFFECT /ACTIONS: Seconds. TIME AVAILABLE: Days. TIME REQUIRED: Days. REDUNDANCY SCREENS: A-PASS B-FAIL C-PASS	A. Design - SV789151-4 Open and short circuits in any of the circuits in the Item 151 harness are minimized by the following: a. Conductors are hard potted in Stycast 2651 in the area that they interface with the metal backshells to minimize their movement and chance of shorting to the backshell. b. The conductors are strain relieved at the connector/harness interface with a molded rubber backshell. This minimizes the effects of cable tension on the individual conductors. c. Conductors are sheathed within a woven Nomex outer layer. This holds the cables together to share any loading. d. Each connector/adapter ring interface is locked in place to prevent rotation by a mechanical and adhesive lock. e. #22 and #24 AWG Teflon insulated wires provide electrical and mechanical properties to prevent wire breakage and to help prevent shorting. f. Wire crimping per SVSH4909 (based on MSFC-Spec-Q-1A). SV824051-1 Open and short circuits in any of the circuits in the item 151 harness are minimized by the following: Connectors of all metal construction with smooth internal edges (0.010" min. corner radius) on backshell housings to prevent cable chafing are used. Each connector/backshell interface is locked in place by a mechanical lock to prevent rotation. Each connector/cable interface is strain relieved by the use of a connector backshell strain relief nut, collet, and pressure sensitive tape as required to secure the electrical cable. The #22 and #24 Teflon insulated wires and connector provide electrical conduction and insulation properties. Connector pins are operating at 56.7% of derated temperature and 7% of derated voltage and the wire at 32.2% of derated current. Connector pins are insulated by a polyphenylene sulfide insert. A woven Halar sheath is assembled over the cable wire bundles to provide load sharing and protection from abrasion and impact. Wire crimping is performed per NHB5300.4 (3H). B. Test - Component Acceptance Test - SV789151-4 The harness is acceptance tested per the following tests of AT-EMU-151 to ensure there are no workmanship problems which would cause open or short circuits. Pull Test (9 pounds) - This test subjects each connector/harness interface to a specific pull test designed to exceed any stress encountered in actual use. The insulation resistance between each conductor and the ground circuit is measured during the test to ensure there is no shorting. The test is followed by a circuit check of each conductor path to ensure there are no open circuits. Continuity Test - The resistance of each circuit is measured to ensure there are no open circuits or high resistance paths. Insulation Resistance/Dielectric Strength Testing - The harness is tested for short circuits or low resistance paths between each conductor to the shield circuit(s) and between each conductor to each other conductor by insulation resistance and dielectric strength measurements at 200 VDC and 200 VAC respectively.

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SV824051-1
The 151 harness is subjected to acceptance testing per AT-E-151-1 prior to final acceptance to ensure there are no workmanship problems that could cause an open or short circuit. Each connector/harness interface is subjected to a 9 - 10 pound pull test. The insulation resistance between each conductor and ground circuit is measured during this test to ensure there are not intermittent shorts and to verify the integrity of the harness strain relief. A continuity test is performed to measure the resistance of each circuit to ensure there are not open circuits or high resistance paths. The insulation resistance and dielectric strength between each conductor and the shield ground is measured to ensure there are no shorts.

PDA Test -
An open or short circuit in the power line to the primary/secondary hardlines or primary/alternate aradio DC/DC power supplies can be detected during the Audio Test portion of PLSS PDA Testing per Para. 6.0 of SEMU-60-010.

Certification Test -
SV789151-4
Certified for a useful life of 18 years (ref. EMUM1-0099).

SV824051-1
Certified for a useful life of 15 years (ref. EMU1-13-046).

C. Inspection -
SV789151-4
During harness manufacturing, the following inspections are performed:
a. Visual inspection of conductors prior to potting operations to ensure there are no damaged conductors and that the conductors are routed properly.
b. Visual inspection of the harness prior to and after rubber boot molding process to ensure there are no damaged conductors which could cause an open or short circuit.
c. In-process electrical checkout of the harness before and after potting and molding to ensure there are no open or short circuits.
d. Visual inspection of the conductors prior to application of the outer sheath to ensure there are no damaged conductors that could cause an open or short circuit.
e. Connector contact crimp samples are made prior to and after crimping and subjected to pull testing to ensure the crimping tools are operating properly. This ensures there will not be any high resistance problems at the contacts.

SV824051-1
To ensure that there are no workmanship problems which could cause an open or short circuit in the harness conductors, the following inspections are made:
Contact crimp samples are made prior to start of crimping and at the conclusion of crimping and pull tested to ensure the crimp tooling is operating properly.
Electrical bond test is performed to verify ground path through various points on the harness.
In-process and final electrical checkout of the harness (conductor continuity, dielectric strength, and insulation resistance tests) are performed to ensure there are not open/short circuits.
All crimp terminations are inspected for defects.

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D. Failure History -
SV789151-4
The following RDR's were issued for Item 151 due to open circuits.
H-EMU-151-D001 (7-8-83) Intermittent open due to a broken wire at the P12 connector during acceptance testing. This failure was caused by a workmanship problem. The corrective action was to add a visual inspection prior to molding.

H-EMU-151-D002 (12/14/83) - Intermittent open due to a broken wire at the P3 connector during acceptance testing due to a workmanship problem. The corrective action taken was to issue EC42806-527 which fixes the angular location of the P3 adapter ring slot to insure proper wire exit and EC 42806-527-2 which requires that a pull test be performed to detect opens or shorts.

The following RDR's were issued for Item 151 failures caused by short circuits:
H-EMU-151-D003 (08/27/84) - Short circuit between a P3 connector conductor and adapter ring caused by an improper rework that rotated the connector adapter ring/connector assembly 20 deg. relative to the molded rubber form. This forced the conductors against the adapter ring slot edge and short circuit resulted. EC's 42806-527 and 527-2 have been issued to specify an angular location requirement between the adapter ring slot and the master keyway and to pull test each connector/harness interface.
J-EMU-151--004 and J-EMU-151--005 (6-12-85) - Both failures occurred during an ETA Airlock Power Supply Functional Test. The failures were caused by a short circuit between the EVC power/battery sense (+) line and case ground (connector body). The failure caused the suit return line in the DCM to fuse open. The failure investigation found that a crimp splice within the molded backshell was not sufficiently covered by shrink tubing. The exposed portion of the crimp was allowed to come in contact with the connector body. Class I EC 42806-527-2 created the SV789151-3 harness configuration by adding a connector pull test requirement to the acceptance test requirements. Class I EC 42806-865 created the SV789151-4 harness configuration by eliminating the two crimp splices in the P9 connector, to prevent them from shorting to case.

SV824051-1
None.

E. Ground Turnaround -
None for single failure.

F. Operational Use -
Crew Response -
Pre-EVA/EVA : No response, single failure undetectable by crew or ground.
Post-EVA: N/A
Training -
No training specifically covers this failure mode.
Operational Considerations -
EVA checklist and FDF procedures verify hardware integrity and systems operational status prior to EVA. EMU caution/warning system provides readout on EMU status.

EXTRAVEHICULAR MOBILITY UNIT

SYSTEMS SAFETY REVIEW PANEL REVIEW

FOR THE

I-151 ELECTRICAL POWER HARNESS

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: _____
HS - Project Engineering

_____
HS - Reliability

_____ 4/24/02
HS - Engineering Manager

Approved by: _____
NASA - SSA/SSM

_____
NASA - EMU/SSM

_____
NASA - S & MA

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NASA - MOD

_____
NASA - Crew

_____
NASA - Program Manager