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PRINT DATE: 13.02.87

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE  
NUMBER: M5-6SS-B025-X

SUBSYSTEM NAME: E - DOCKING SYSTEM

REVISION: 0 FEBDEC, 19976

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: POWER SWITCHING UNIT (PSU) RSC-E	MC621-0087-1003 33Y.5114.007

**PART DATA**

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
LINE REPLACEABLE UNIT (LRU) PSU - APDS LOGIC AND POWER CONTROL,  
DISTRIBUTION, AND PROTECTION.

REFERENCE DESIGNATORS: 45V53A2A4

QUANTITY OF LIKE ITEMS: 1  
(ONE)

**FUNCTION:**

THE PSU CONTROLS AND DISTRIBUTES THE APDS LOGIC BUSES. IT PROTECTS AND DISTRIBUTES THE APDS POWER BUSES. LOGIC AND MAIN POWER IS RECEIVED FROM THE ORBITER THROUGH CONNECTOR X3 AND RETURNED THROUGH CONNECTOR X4. THE LOGIC POWER BUSES ARE +WIA +WIB +WIB AND THE POWER BUSES ARE +CIW1 AND +CIW2. THE PSU PROVIDES THE FOLLOWING OUTPUTS:

**OUTPUT FUNCTIONS:**

- 1) POWER BUS +CIW1: RING MOTOR M4, PACU MOTORS M6 & M6, FIXERS 1 & 2, AND HI-ENERGY (AND LOW-ENERGY FOR THE "SOFT" DOCKING MECHANISM) DAMPERS 1 & 2.
- 2) POWER BUS +CIW2: RING MOTOR M5, PACU MOTORS M7 & M9, FIXERS 3, 4, & 5, AND HI-ENERGY (AND LOW-ENERGY FOR THE "SOFT" DOCKING MECHANISM) DAMPER 3.
- 3) LOGIC POWER BUSES +WIA +WIB +WIB ARE PROTECTED BY PANEL A8A3 CIRCUIT BREAKERS AND PROVIDE POWER PROVIDED UNFUSED TO THE LACU, PACU-1, PACU-2, DSCU, AND THE DMCU.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE**

**NUMBER: M5-SS-B025-02**

**REVISION# 0 FEBDEC, 1997**

**SUBSYSTEM NAME: E - DOCKING SYSTEM**

**LRU: M0621-0087-1009**

**ITEM NAME: POWER SWITCHING UNIT**

**CRITICALITY OF THIS**

**FAILURE MODE: 1R3**

**FAILURE MODE:**

**LOSS OF ONE OF THREE LOGIC BUSES: +11A +11E +11B**

**MISSION PHASE:**

**OO .ON-ORBIT**

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**

**103 DISCOVERY**

**104 ATLANTIS**

**105 ENDEAVOUR**

**CAUSE:**

**MULTIPLE INTERNAL COMPONENT FAILURES**

**CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO**

**CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO**

**REDUNDANCY SCREEN**

**A) PASS**

**B) N/A**

**C) FAILS**

**PASS/FAIL RATIONALE:**

**A)**

**B)**

**N/A - AT LEAST TWO REMAINING PATHS ARE DETECTABLE IN FLIGHT.**

**C)**

**REDUNDANT FUNCTIONS ROUTED THROUGH THE SAME CONNECTOR.**

**METHOD OF FAULT DETECTION:**

**NONE**

**MASTER MEAS. LIST NUMBERS:**

**NONE**

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**

**DEGRADATION OF CAPABILITY TO PROVIDE LOGIC BUS POWER TO AVIONICS LRUs.**

**(B) INTERFACING SUBSYSTEM(S):**

**LOSS OF CAPABILITY TO OPEN ONE OF THREE CAPTURE LATCHES. DEGRADED LOGIC BUS REDUNDANCY.**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE  
NUMBER: M5-SS-B025-02**

**(C) MISSION:**  
NO EFFECT.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
FIRST FAILURE - NO EFFECT.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**  
WORST CASE, SHUTTLE MECHANISM CONTROL: POSSIBLE LOSS OF CREW OR VEHICLE  
AFTER TWO FAILURES.  
FIRST FAILURE (LOSS OF ONE OF THREE LOGIC BUSES) - NO EFFECT.  
SECOND FAILURE (LOSS OF ONE OF TWO ASSOCIATED BUSES) - DISABLES CAPABILITY  
TO RETRACT THE RING AND OPEN THE CAPTURE LATCHES.

**DESIGN CRITICALITY (PRIOR TO OPERATIONAL DOWNGRADE, DESCRIBED IN F): 1R2**

**(F) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:**  
CRITICALITY DOWNGRADED FROM 1R2 TO 1R3 DUE TO ADDITIONAL FAULT TOLERANCE  
PROVIDED BY WORKAROUNDS ALLOWED PER CR S050107W.

AFTER THE SECOND FAILURE, THE CREW WOULD PERFORM IFM TO DRIVE THE  
CAPTURE LATCHES OPEN. IF UNABLE TO PERFORM THE IFM (THIRD FAILURE) THEN  
CREW WOULD PERFORM THE IFM TO RETRACT RING SO THAT THEY CAN MANUALLY  
OPEN THE CAPTURE LATCHES. IF UNABLE TO RETRACT THE DOCKING RING (FOURTH  
FAILURE) THEN PERFORM EVA TO REMOVE 96 BOLTS TO CIRCUMVENT THE WORST  
CASE "DESIGN CRITICALITY" EFFECT. IF UNABLE TO PERFORM EVA (FIFTH FAILURE),  
POSSIBLE LOSS OF CREW/VEHICLE DUE TO LOSS OF ALL UNDOCKING CAPABILITY.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
REFER TO APPENDIX X4, ENERGIA HARDWARE.

**(B) TEST:**  
REFER TO APPENDIX X4, ENERGIA HARDWARE.

PSU BUS CIRCUIT OPERATION IS VERIFIED DURING GROUND CHECKOUT. ANY TESTING  
IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**  
REFER TO APPENDIX X4, ENERGIA HARDWARE.

**(D) FAILURE HISTORY:**  
REFER TO APPENDIX X4, ENERGIA HARDWARE.

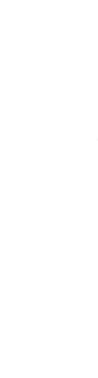
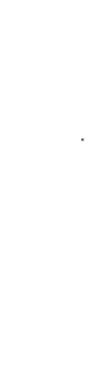
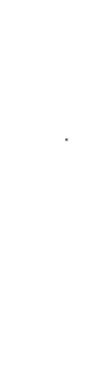
**(E) OPERATIONAL USE:**  
AFTER SECOND FAILURE, IN-FLIGHT MAINTENANCE PROCEDURES DEVELOPED TO DRIVE  
THE CAPTURE LATCH MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN  
THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: M5-6SS-8025-02

AFTER THIRD FAILURE, IN-FLIGHT MAINTENANCE PROCEDURES DEVELOPED TO DRIVE THE RING MOTORS DIRECTLY FROM THE FEED-THROUGH CONNECTORS IN THE EXTERNAL AIRLOCK, USING THE ORBITER BREAKOUT BOX.

- APPROVALS -

PRODUCT ASSURANCE ENGR	:	M. NIKOLAYEVA	:	
DESIGN ENGINEER	:	B. VAKULIN	:	
NASA SSMA	:		:	
NASA SUBSYSTEM MANAGER	:		:	
JSC MGD	:		:	
NASA EPDC SSMA	:		:	
NASA EPDC SUBSYSTEM MANAGER :			:	