

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE  
NUMBER: 04-1A-0101 -X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION: FUEL CELL  
REVISION: 3 03/27/96

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PART DATA

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	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: FUEL CELL POWERPLANT IFC	MC464-0115-3020 807100
LRU	: FUEL CELL POWERPLANT IFC	MC464-0115-3021 808100
LRU	: FUEL CELL POWERPLANT IFC	MC464-0115-3030 814100
LRU	: FUEL CELL POWERPLANT. IFC	MC464-0115-3031 815100

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EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
FCP NO. 1, 2, 3

REFERENCE DESIGNATORS: 40V45A100  
40V45A200  
40V45A300

QUANTITY OF LIKE ITEMS:  
TWO-RH  
ONE-LH

FUNCTION:  
THREE POWER SOURCES FOR MAIN ELECTRICAL POWER.



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**NUMBER: 04-1A-0101- 10**

LOSS OF VISIBILITY INTO POSSIBLE CROSSOVER FAILURE MODE (REF. CIL 04-1A-0101-9).

**(B) INTERFACING SUBSYSTEM(S):**  
NO EFFECT FOR FIRST FAILURE.

**(C) MISSION:**  
SAME AS (B)

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
NO EFFECT FOR FIRST FAILURE. POSSIBLE LOSS OF CREW/VEHICLE AFTER SECOND FAILURE (UNDETECTED CROSSOVER). IF CPM FAILURE IS DETECTED, CREW CAN PERFORM BUS TIE AND MONITOR FCP PERFORMANCE.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

THE CELL PERFORMANCE MONITOR (CPM) DESIGN UTILIZES MILITARY STANDARD COMPONENTS SELECTED FROM THE ORBITER PROJECT PARTS LIST (OPPL) OF HIGH RELIABILITY COMPONENTS OR COMPONENTS WHICH HAVE HAD A SPECIAL REVIEW TO ASSURE HIGH QUALITY AND RELIABILITY. OPERATING STRESSES ARE MAINTAINED AT OR BELOW THE DERATING VALUES PERMITTED BY THE OPPL SPECIFICATION. STRESS EVALUATIONS INCLUDE, WHERE APPLICABLE, VOLTAGE, CURRENT, POWER, AND TEMPERATURE LIMITS.

PRINTED CIRCUIT BOARDS ARE DESIGNED TO MEET THE REQUIREMENTS OF MIL-P-13949. COMPONENTS ARE CONFORMAL COATED TO PROVIDE PROTECTION AGAINST THE SERVICE ENVIRONMENT.

THE DEVICE IS DESIGNED TO TOLERATE TRANSIENT VOLTAGES OCCURRING ON THE POWER LINES AND IS DESIGNED TO OPERATE AT LOW POWER TO MINIMIZE COMPONENT HEAT BUILDUP.

**(B) TEST:**

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AT THE COMPONENT LEVEL, THE CPM ACCEPTANCE TESTING INCLUDES FUNCTIONAL VERIFICATION AS WELL AS BURN IN TESTING, VIBRATION TESTING, AND THERMAL CYCLING.

POWERPLANT LEVEL ACCEPTANCE TESTING PROVIDES ADDITIONAL FUNCTIONAL VERIFICATION.

BUILT-IN TEST CIRCUITRY PROVIDES A PERFORMANCE CALIBRATION EVERY 7.5 MINUTES WHILE THE DEVICE IS OPERATING. THIS IS UTILIZED TO DETERMINE PROPER OPERATION DURING ALL GROUND AND FLIGHT FUEL CELL OPERATIONS.

OMRSD: PREFLIGHT VERIFICATION IS ACCOMPLISHED DURING EVERY GROUND TURNAROUND CYCLE DURING FUEL CELL STARTUP AND FUEL CELL PERFORMANCE ON DC BUS OPERATIONS.

**(C) INSPECTION:**

**RECEIVING INSPECTION**

RECEIVING INSPECTION PERFORMS A VISUAL EXAMINATION OF ALL INCOMING PARTS. MATERIAL LOT SAMPLES ARE FORWARDED TO A TEST LAB FOR CERTIFICATION ANALYSIS.

**CONTAMINATION CONTROL**

QC VERIFIES REQUIRED PROCEDURES AND SHOP PRACTICES ARE UTILIZED FOR CONTAMINATION CONTROL.

**ASSEMBLY/INSTALLATION**

DETAILED INSPECTION IS PERFORMED ON ALL PARTS PRIOR TO NEXT ASSEMBLY. ALL SOLDER CONNECTIONS ARE VISUALLY INSPECTED AT A MINIMUM OF 4X MAGNIFICATION IN ACCORDANCE WITH NHB 5300.4 (3A) BY EACH OPERATOR.

**NONDESTRUCTIVE EVALUATION**

ELECTRICAL CONNECTION CRIMPING AND TENSILE TESTING IS PERFORMED AT VENDOR AND VERIFIED BY SOURCE INSPECTION.

**CRITICAL PROCESSES**

ALL CRITICAL PROCESSES AND CERTIFICATIONS ARE MONITORED AND VERIFIED BY INSPECTION. THE RELEVANT CRITICAL PROCESSES ARE SOLDERING AND ELECTRICAL CONNECTION CRIMPING.

**TESTING**

ALL PARTS OF THE ATP ARE OBSERVED AND VERIFIED BY QC INCLUDING ACCEPTANCE VIBRATION AND ACCEPTANCE THERMAL TESTING.

**HANDLING/PACKAGING**

PROTECTIVE CAPS/COVERS ARE REQUIRED DURING HANDLING, SHIPPING, AND STORAGE AND VERIFIED BY INSPECTION. IN-PROCESS OPERATIONS ARE VERIFIED BY QC TO PROTECT PARTS AND PRECLUDE MISHANDLING. PARTS PACKAGING IS VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS.

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## (D) FAILURE HISTORY:

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATA BASE.

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

## (E) OPERATIONAL USE:

NO CREW ACTION IS REQUIRED IF CPM FAILURE IS UNDETECTED. DETECTION OF FAILED CPM IS DEPENDENT ON GROUND COVERAGE. IF DETECTED, PERFORM BUS TIE AND GROUND WILL MONITOR LOAD SHARING TO DETECT FCP VOLTAGE/CURRENT PERFORMANCE SHIFTS COMPARED TO FCP WITH VALID CPM.

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- APPROVALS -

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PAE MANAGER : D. F. MIKULA  
 PRODUCT ASSURANCE ENGR : L. X. DANG  
 DESIGN ENGINEERING : MUSTIN, LLOYD  
 NASA SSMA :  
 NASA SUBSYSTEM MANAGER :

*D.F. Mikula 29 MAR 96*  
*L. X. Dang 3/29/96*  
*John Anderson 3-28-96*  
*JB On Call 6/1/97*  
*Howard A. Wilcox 6/16/97*