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PRINT DATE: 05/27/94

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE**  
NUMBER: 05-6-2291C -X

SUBSYSTEM NAME: ELECTRICAL POWER DISTRIBUTION & CONTROL  
REVISION: 7 05/26/94

	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
LRU	: AFT PCA 4, 5, 6	VO70-765280
SRU	: FUSE	ME451-0009-1019

**PART DATA**

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
FUSE F10, 7.5 AMP, CARTRIDGE TYPE - LOCATED ON AFT PCA 6

**REFERENCE DESIGNATORS:** 56V76A136F10

**QUANTITY OF LIKE ITEMS:** 1  
ONE

**FUNCTION:**  
CONDUCTS ESSENTIAL BUS 3AB CURRENT AND PROVIDES OVERCURRENT PROTECTION FROM AFT POWER CONTROLLER ASSEMBLY (APCA) 6 TO AFT LOAD CONTROLLER ASSEMBLY (ALCA) 3.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE  
NUMBER: 05-6-2291C - 01**

REVISION# 7 05/26/94

SUBSYSTEM NAME: ELECTRICAL POWER DISTRIBUTION & CONTROL

LRU: AFT PCA 4, 5, 6

CRITICALITY OF THIS

ITEM NAME: FUSE

FAILURE MODE: 1R2

**FAILURE MODE:**  
FAILS OPEN, FAILS TO CONDUCT

**MISSION PHASE:**

PL PRELAUNCH  
LO LIFT-OFF

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:** 102 COLUMBIA  
103 DISCOVERY  
104 ATLANTIS  
105 ENDEAVOUR

**CAUSE:**  
STRUCTURAL FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK,  
PROCESSING ANOMALY, THERMAL STRESS

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

**REDUNDANCY SCREEN** A) PASS  
B) FAIL  
C) PASS

**PASS/FAIL RATIONALE:**

A)  
"A" SCREEN PASSES BECAUSE FUSE FAIL OPEN IS DETECTABLE DURING GROUND  
TURNAROUND TEST

B)  
"B" SCREEN FAILS BECAUSE CIRCUIT PATH IS NOT MONITORED

C)  
"C" SCREEN PASSES BECAUSE REDUNDANT FUSES ARE PHYSICALLY ISOLATED FROM  
EACH OTHER

**• FAILURE EFFECTS •**

**(A) SUBSYSTEM:**  
INABILITY TO CONDUCT ESSENTIAL BUS 3A8 POWER FROM APCA 6

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

LOSS OF ONE OF TWO POWER PATHS TO LO2 OVERBOARD BLEED VALVE CLOSE  
SOLENOID. DEGRADATION OF REDUNDANCY AGAINST INADVERTENT DEACTUATION  
OF CLOSE SOLENOID.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE  
NUMBER: 05-6-2291C - 01****(C) MISSION:**

NO EFFECT - FIRST FAILURE

**(D) CREW, VEHICLE, AND ELEMENT(S):**

NO EFFECT - FIRST FAILURE

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

POSSIBLE LOSS OF CREW/VEHICLE AFTER TWO FAILURES:

**CASE I: 1R/2, 1 SUCCESS PATH AFTER FIRST FAILURE.****TIME FRAME - PRELAUNCH**

- 1) FUSE FAILS OPEN RESULTING IN LOSS OF OUTPUT OF THE TYPE I HDC FOR THE LO2 OVERBOARD BLEED VALVE CLOSE COMMAND B CIRCUIT.
- 2) PARALLEL POWER PATH FAILS "OFF" (HDC, RPC, DIODE) CAUSING LO2 OVERBOARD BLEED VALVE (PV19) TO OPEN.

FAILURES WILL RESULT IN CONTINUED BLEED FLOW RESULTING IN LOSS OF LO2 OVERBOARD WITH FAILURE OF BLEED DISCONNECT (PD13) TO CLOSE. BLEED DISCONNECT IS NOT CERTIFIED FOR CLOSURE UNDER FLOW CONDITIONS AND CANNOT BE CONSIDERED A REDUNDANT INHIBIT AGAINST OVERBOARD FLOW. POSSIBLE RUPTURE OF DISCONNECT HOUSING AND/OR DOWNSTREAM BLEED SYSTEM DUE TO WATER HAMMER. RESULTS IN LOSS OF APPROXIMATELY 3000 LBS OF PROPELLANT WHICH IS INSUFFICIENT TO CAUSE PREMATURE SSME SHUTDOWN.

IF THE LO2 BLEED VALVE FAILS TO CLOSE BEFORE T-0 THE LO2 BLEED DISCONNECT WOULD BE CLOSING WITH AN OXYGEN FLOW OF 4.1 LBS/SEC. THIRTY-TWO PERCENT OF THIS FLOW WILL BE VAPOR. THE LO2 BLEED DISCONNECT IS NOT CERTIFIED FOR CLOSURE UNDER FLOW. HOWEVER, THE CLOSURE IS AT ONE "G" ACCELERATION RATE (T-0 UMBILICAL SEPARATION RATE) WHICH LIMITS THE IMPACT ENERGY ON THE VESPEL SEAL TO A LEVEL WHICH IS BELOW THE LO2/VESPEL IGNITION LEVEL (NOT PREVIOUSLY TESTED WITH THIS CONDITION). THE WATER HAMMER TOWARDS EFFECT GENERATED DURING THIS CLOSURE HAS BEEN CALCULATED TO BE APPROXIMATELY 60 PSIG. SYSTEM PROOF PRESSURE LEVEL IS 286 PSIG.

POSSIBLE AFT COMPARTMENT OVERPRESSURIZATION. FIRE/EXPLOSIVE HAZARD BOTH INTERIOR AND EXTERIOR TO THE VEHICLE. NO LCC EXISTS FOR VERIFICATION OF VALVE POSITION PRIOR TO T-0. POSSIBLE LOSS OF CREW/VEHICLE.

**CASE II: 1R/3, 2 SUCCESS PATHS AFTER FIRST FAILURE.****TIME FRAME - ASCENT**

- 1) FUSE FAILS OPEN RESULTING IN LOSS OF OUTPUT OF THE TYPE I HDC FOR THE LO2 OVERBOARD BLEED VALVE CLOSE COMMAND B CIRCUIT.
- 2) PARALLEL POWER PATH FAILS "OFF" (HDC, RPC, DIODE) CAUSING LO2 OVERBOARD BLEED VALVE (PV19) TO OPEN.
- 3) BLEED DISCONNECT (PD13) FAILS TO CLOSE/REMAIN CLOSED.

RESULTS IN LOSS OF APPROXIMATELY 3000 LBS OF PROPELLANT WHICH IS NOT ENOUGH TO CAUSE PREMATURE SSME SHUTDOWN. POSSIBLE FIRE/EXPLOSION HAZARD IN FLIGHT. POSSIBLE LOSS OF CREW/VEHICLE.

(REFERENCE CRITICAL FMEA: 05-6J-2091-01)

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE  
NUMBER: 05-6-2291C - 01

**-DISPOSITION RATIONALE-**

**(A) DESIGN:**

REFER TO APPENDIX D, ITEM NO. 2 - FUSE, AXIAL LEAD/CARTRIDGE

**(B) TEST:**

REFER TO APPENDIX D, ITEM NO. 2 - FUSE, AXIAL LEAD/CARTRIDGE

**GROUND TURNAROUND TEST**

ANY GROUND TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**

REFER TO APPENDIX D, ITEM NO. 2 - FUSE, AXIAL LEAD/CARTRIDGE

**(D) FAILURE HISTORY:**

FAILURE HISTORY IS TRACKED IN THE PRACA SYSTEM.

**(E) OPERATIONAL USE:**

NONE

**• APPROVALS •**

PAE MANAGER	:	K. PRESTON
PRODUCT ASSURANCE ENGR	:	T. KIMURA
DESIGN ENGINEERING	:	J. GULSBY
NASA SSMA	:	
NASA SUBSYSTEM MANAGER	:	

*K. L. Preston 6/7/94*  
*T. Kimura 6/2/94*  
*J. Gulsby 6/7/94*  
*Product Assurance 9-11-95*  
*4-11-95*  
 FOR FRAM ACQUIS