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PRINT DATE: 02/24/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE

NUMBER: 05-6J-2092 -X

SUBSYSTEM NAME: EPD&C MAIN PROPULSION SYSTEM

REVISION: 1 02/06/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: AFT PCA 2	V070-765320
LRU	: AFT PCA 3	V070-765330
SRU	: CONTROLLER, REMOTE POWER	MC450-0017-1030
SRU	: CONTROLLER, REMOTE POWER	MC450-0017-2030
SRU	: CONTROLLER, REMOTE POWER	MC450-0017-3030
SRU	: CONTROLLER, REMOTE POWER	MC450-0017-4030

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

CONTROLLER, REMOTE POWER (RPC) 3 AMP, LO2 OVERBOARD BLEED VALVE CLOSE SOLENOID (LV76).

REFERENCE DESIGNATORS: 55V76A132RPC24  
56V76A133RPC23

QUANTITY OF LIKE ITEMS: 2  
TWO

FUNCTION:

CONDUCTS MAIN BUS POWER TO CLOSE SOLENOID OF LO2 OVERBOARD BLEED VALVE CLOSE SOLENOID. RPC IS IN SERIES WITH A DIODE AND A HDC.

- APPROVALS -

PRODUCT ASSURANCE MGR : K. L. PRESTON  
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 NASA EPD&C SUBSYS MGR :  
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 NASA EPD&C SSMA :  
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*K.L. Preston 9/14/95*  
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*J. Peck 9/14/95*  
*John Banister 3-19-96*  
 N/A  
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SHUTTLE CRITICAL ITEMS LIST - ORBITER

5/5

SUBSYSTEM : EPD&C - MAIN PROP. FMEA NO 05-6J -2092 -1 REV 04/26/88  
 DEP 513

ASSEMBLY : AFT PCA - 2, 3 CRIT. FUNC: 1R  
 P/N RI : MC450-0D17-1030/2030 CRIT. HDW: -2

P/N VENDOR: VEHICLE 102 103 104  
 EFFECTIVITY: X X X  
 QUANTITY : 2 PHASE(S): PL X LO X CO DO LS  
 : TWO

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

PREPARED BY: DES J. BROWN APPROVED BY: DES [Signature] APPROVED BY (NASA):  
 REL P DEFENSOR REL Michael Ch... EPDC SSM [Signature]  
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ITEM:

CONTROLLER, REMOTE POWER (RPC) 3 AMP, LO2 OVERBOARD BLEED VALVE CLOSE SOLENOID (LV76).

FUNCTION:

CONDUCTS MAIN BUS POWER TO CLOSE SOLENOID OF LO2 OVERBOARD BLEED VALVE CLOSE SOLENOID. RPC IS IN SERIES WITH A DIODE AND A HDC. 55V76A132RPC24, 56V76A133RPC23.

FAILURE MODE:

LOSS OF OUTPUT, FAILS TO CONDUCT, FAILS TO TURN "ON".

CAUSE(S):

PIECE PART FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PROCESSING ANOMALY, THERMAL STRESS.

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE (E) FUNCTIONAL CRITICALITY

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

(B,C,D) NO EFFECT - FIRST FAILURE.

## SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : EPD&amp;C \* MAIN PROP.

FMEA NO 05-6J -2092 - -1

REV: 04/26/88  
5/5  
DEP-5-12(E) CASE I: 1R/2, 1 SUCCESS PATH AFTER FIRST FAILURE.  
TIME FRAME - PRELAUNCH.

- 1) RPC FAILS "OFF".
- 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.

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) RPC FAILS "OFF".
- 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.

## DISPOSITION &amp; RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A-D) FOR DISPOSITION AND RATIONALE

REFER TO APPENDIX B, ITEM NO. 2 - REMOTE POWER CONTROLLER.

(B) -GROUND TURNAROUND TEST

COMPLETE ELECTRICAL VERIFICATION V4LABO.200C EVERY FLIGHT.

(E) OPERATIONAL USE

NO CREW ACTION CAN BE TAKEN.

INSERT

DEP 5-12

INSERT FOR CIL 05-6J-2092-1  
EFFECTS SECTION (E)

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.