

PAGE: 1

PRINT DATE: 05/27/94

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE

NUMBER: 05-6-2010B -X

SUBSYSTEM NAME: ELECTRICAL POWER DISTRIBUTION & CONTROL

REVISION: 7 05/26/94

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: AFT PCA 4, 5, 6	VO70-765280
SRU	: FUSE, HIGH CURRENT	ME451-0016-2150

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

FUSE F3, 150 AMP, HIGH CURRENT - LOCATED IN AFT PCA 5

REFERENCE DESIGNATORS: 55V76A135F3

QUANTITY OF LIKE ITEMS: 1

ONE

FUNCTION:

CONDUCTS ORBITER MAIN BUS B CURRENT AND PROVIDES OVERCURRENT PROTECTION FROM AFT POWER CONTROLLER ASSEMBLY (APCA) 5 TO APCA 2.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE
NUMBER: 05-6-2010B - 01

REVISION# 7 05/26/94

SUBSYSTEM NAME: ELECTRICAL POWER DISTRIBUTION & CONTROL

LRU: AFT PCA 4, 5, 6

ITEM NAME: FUSE, HIGH CURRENT

CRITICALITY OF THIS
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) PASS
C) PASS

PASS/FAIL RATIONALE:

A)

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

B)

B SCREEN PASSES BECAUSE FUSE FAIL OPEN IS DETECTABLE DURING FLIGHT FROM
AVAILABLE MEASUREMENT INDICATION.

C)

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

- FAILURE EFFECTS -

(A) SUBSYSTEM:

INABILITY TO CONDUCT ORBITER MAIN BUS B POWER FROM APCA5 TO APCA2. LOSS
OF ONE OF TWO POWER PATHS TO LO2 OVERBOARD BLEED VALVE CLOSE SOLENOID.
DEGRADATION OF REDUNDANCY AGAINST INADVERTENT DEACTUATION OF CLOSE
SOLENOID.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF POWER REDUNDANCY TO LOADS ON MAIN BUS B IN APCA2.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE
NUMBER: 05-6-2010B - 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 RPC 24 FOR THE 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 RPC 24 FOR THE 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.

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE
NUMBER: 05-6-2010B - 01

(E) FUNCTIONAL CRITICALITY EFFECTS (CONTINUED)

(REFERENCE CRITICAL FMEA: 05-6J-2092-01)

-DISPOSITION RATIONALE-

(A) DESIGN:
REFER TO APPENDIX D, ITEM NO. 3 - FUSE, HIGH CURRENT

(B) TEST:
REFER TO APPENDIX D, ITEM NO. 3 - FUSE, HIGH CURRENT

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

(C) INSPECTION:
REFER TO APPENDIX D, ITEM NO. 3 - FUSE, HIGH CURRENT

(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 :

Kil. Preston 6/7/94
T. Kimura 6/2/94
J. Gulsby 6/7/94
For Frank Adams 4-11-95
1-11-95
For Frank Adams