PRINT DATE: 04/17/96

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: M5-6MB-2029-G -X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC
REVISION: 9 04/16/96

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: PANEL R1A2	V070-730276
LRU	: PANEL A15	V070-730372
LRU	: PANEL A11A1	V070-730732
SRU	: SWITCH, TOGGLE, 3P3P	ME452-0102-7306

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SWITCH, TOGGLE, 3P3P, MAINTAINED ON - LO2 TANKS 1 THRU 9 HEATER "A" AND "B" CONTROL

REFERENCE DESIGNATORS:
32V73A1A2S8
32V73A1A2S9
32V73A1A2S13
32V73A1A2S14
32V73A1A2S21
32V73A1A2S22
36V73A11A1S1
36V73A11A1S2
36V76A15S4
36V76A15S5
36V76A15S13
36V76A15S14
36V76A15S18
36V76A15S19
36V76A15S23
36V76A15S24
36V76A15S28
36V76A15S29

QUANTITY OF LIKE ITEMS:
TWO PER LO2 TANK HEATER SYSTEM

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FUNCTION:
PROVIDES MANUAL CONTROL OF POWER TO THE LO2 TANK HEATER ELEMENTS "A" AND "B" FOR THE "AUTO/OFF/ON" MODES.

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FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE
NUMBER: M5-6MB-2029-G- 03

REVISION#: 9 04/16/96

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC
LRU: PANEL R1A2
ITEM NAME: SWITCH, TOGGLE, 3P3P

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS CLOSED IN THE "AUTO" POSITION

MISSION PHASE:
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT
LS LANDING/SAFING

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

CAUSE:
PIECE PART STRUCTURAL FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PROCESSING ANOMALY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:
A)

B)
REDUNDANCY SCREEN "B" FAILS SINCE SWITCH IS NORMALLY IN "AUTO" POSITION AND FAILURE CANNOT BE DETECTED UNTIL SWITCH IS OPERATED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
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DEGRADATION OF REDUNDANCY AGAINST CONTINUOUS POWERING OF TANK HEATERS.

(B) INTERFACING SUBSYSTEM(S):
LOSS OF ABILITY TO COMMAND THE AFFECTED LO2 TANK HEATER TO "MANUAL" MODE OR TO THE "OFF" STATE.

(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 DUE TO THE FOLLOWING SCENARIO:

(FOR LO2 TANKS 1 THRU 5) 1) SWITCH FAILS CLOSED IN THE "AUTO" POSITION - NO EFFECT, 2) ASSOCIATED OUTPUT HDC IN THE "AUTO" MODE CONTROL CIRCUIT FAILS "ON" - AFFECTED LO2 TANK HEATER FAILS "ON", 3) CLD FAILS TO TRIP IN TEST MODE, AND 4) RELIEF PORT PLUGGED, . . .

(FOR LOW TANKS 6 THRU 9) STEPS 1 THRU 4 ABOVE, AND 5) PALLET MDCA MOTORIZED SWITCH WHICH SUPPLIES DC POWER TO THE PALLET FAILS CLOSED, . .

RESULTING IN OVERPRESSURE AND POSSIBLE TANK RUPTURE.

-DISPOSITION RATIONALE-

(A) DESIGN:
REFER TO APPENDIX A, ITEM NO. 1 - TOGGLE SWITCH

(B) TEST:
GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD. THE OMRSD DATA PROVIDED BELOW IS NO LONGER BEING KEPT UP-TO-DATE. IF THERE IS ANY DISCREPANCY BETWEEN THE GROUND TESTING DATA PROVIDED BELOW AND THE OMRSD, THE OMRSD IS THE MORE ACCURATE SOURCE OF THE DATA.

SWITCH OPERATION IS VERIFIED IN FLIGHT DURING LO2 TANK HEATER CABIN SWITCH AUTO TEST. PERFORM GROUND TURNAROUND TEST.

(TANKS 1-5) WHEN VALID VERIFICATION IS UNOBTAINABLE IN FLIGHT OR AFTER LRU REPLACEMENT.

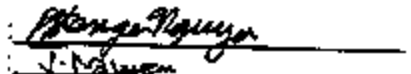
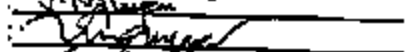
(TANKS 6-9) PRIOR TO FIRST EDO FLIGHT OR WHEN VALID VERIFICATION IS UNOBTAINABLE IN FLIGHT.

(C) INSPECTION:
REFER TO APPENDIX A, ITEM NO. 1 - TOGGLE SWITCH

(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. THE FAILURE HISTORY DATA PROVIDED IN APPENDIX A IS NO LONGER BEING KEPT UP-TO-DATE.

(E) OPERATIONAL USE:
PER FLIGHT RULE B-581F A CRYO HEATER THAT CONTINUES TO BE POWERED AFTER PLACING ITS CORRESPONDING SWITCH IN THE "OFF" POSITION WILL BE DEACTIVATED BY PERFORMING ONE OF THE FOLLOWING (CIL):
1. AN ATTEMPT WILL BE MADE TO DEACTIVATE AN O2 HEATER BY PERFORMING A CURRENT LEVEL DETECTOR TEST. IF REQUIRED, THE HEATER CAN STILL BE USED MANUALLY BY OPERATION OF THE CURRENT LEVEL DETECTOR SWITCH (TEST/RESET FOR HEATER OFF/ON).
2. AN O2 HEATER WILL BE DEACTIVATED BY DROPPING THE MAIN BUS THAT POWERS THE HEATER. THE MAIN BUS WILL BE BROUGHT UP FOR ENTRY IF THE TANK QUANTITY ALLOWS CONTINUOUS HEATER OPERATION WITHOUT VIOLATING HEATER TEMPERATURE LIMITS.
3. THE CREW CAN PERFORM THE PROCEDURE "CRYO TANK HEATER FUSE REMOVAL" LOCATED IN THE INFLIGHT MAINTENANCE (IFM) CHECKLIST. THE PROCEDURE WILL OPEN THE AFFECTED PANEL (R1, A11 OR A15) AND REMOVE THE TWO AFFECTED FUSES THAT ALLOW CONTROL BUS POWER TO THE DOWNSTREAM RPC'S IN THAT HEATER CIRCUIT. TAKING THE HEATER SWITCH TO OFF AND TRIPPING THE ASSOCIATED CURRENT LEVEL DETECTORS WILL BE PERFORMED PRIOR TO DROPPING MAIN BUS OR CONTROL BUS POWER. EITHER PROCEDURE 2 OR 3 WILL BE GIVEN THE SAME PRIORITY IN TROUBLESHOOTING - I.E. BOTH ARE UNDESIRABLE AND MAY/WILL HAVE AFFECTS ON ADDITIONAL ORBITER SYSTEMS.

- APPROVALS -

PAE MANAGER	: P. STENGER-NGUYEN	
PRODUCT ASSURANCE ENGR	: J. NGUYEN	
DESIGN ENGINEERING	: T. D. NGUYEN	
EDITORIALLY APPROVED	: JSC	

PRINT DATE: 04/22/96

FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL FAILURE MODE
NUMBER: M5-6MB-2029-G- 03

TECHNICAL APPROVAL : VIA APPROVAL FORM : 96-CIL-012_M5-6MB