

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE

NUMBER: M5-6MB-2176-G -X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

REVISION: 9 04/16/96

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : H2/O2 CONTROL BOXES	V070-764470
SRU : CONTROLLER, REMOTE POWER	MC450-0017-1100
SRU : CONTROLLER, REMOTE POWER	MC450-0017-2100
SRU : CONTROLLER, REMOTE POWER	MC450-0017-3100

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

CONTROLLER, REMOTE POWER (RPC), 10A (TWO IN SERIES PER HEATER CIRCUIT) -
LO2 TANKS 1 THRU 9 HEATER CIRCUITS

REFERENCE DESIGNATORS:

- 40V76A141RPC5
- 40V76A141RPC6
- 40V76A141RPC7
- 40V76A141RPC8
- 40V76A141RPC9
- 40V76A141RPC10
- 40V76A141RPC11
- 40V76A141RPC12
- 40V76A142RPC5
- 40V76A142RPC6
- 40V76A142RPC7
- 40V76A142RPC8
- 40V76A142RPC9
- 40V76A142RPC10
- 40V76A142RPC11
- 40V76A142RPC12
- 40V76A143RPC5
- 40V76A143RPC6
- 40V76A143RPC7
- 40V76A143RPC8
- 40V76A143RPC9
- 40V76A143RPC10
- 40V76A143RPC11
- 40V76A143RPC12
- 40V76A144RPC5

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40V76A144RPC6
40V76A144RPC7
40V76A144RPC8
40V76A144RPC9
40V76A144RPC10
40V76A144RPC11
40V76A144RPC12
40V76A217RPC5
40V76A217RPC6
40V76A217RPC7
40V76A217RPC8
40V76A217RPC9
40V76A217RPC10
40V76A217RPC11
40V76A217RPC12
40V76A218A1RPC5
40V76A218A1RPC6
40V76A218A1RPC7
40V76A218A1RPC8
40V76A218A1RPC9
40V76A218A1RPC10
40V76A218A1RPC11
40V76A218A1RPC12
40V76A218A2RPC5
40V76A218A2RPC6
40V76A218A2RPC7
40V76A218A2RPC8
40V76A218A2RPC9
40V76A218A2RPC10
40V76A218A2RPC11
40V76A218A2RPC12
40V76A218A3RPC5
40V76A218A3RPC6
40V76A218A3RPC7
40V76A218A3RPC8
40V76A218A3RPC9
40V76A218A3RPC10
40V76A218A3RPC11
40V76A218A3RPC12
40V76A218A4RPC5
40V76A218A4RPC6
40V76A218A4RPC7
40V76A218A4RPC8
40V76A218A4RPC9
40V76A218A4RPC10
40V76A218A4RPC11
40V76A218A4RPC12

QUANTITY OF LIKE ITEMS:

TWO EACH OF 4 HEATER CIRCUITS IN EACH H2/O2 CONTROL BOX

**FAILURE MODES EFFECTS ANALYSIS (FMEA) --GIL HARDWARE
NUMBER: M5-6MB-2176-G-X**

FUNCTION:

TWO SERIES RPC'S CONDUCT AND SWITCH CURRENT TO EACH ONE OF FOUR HEATERS FOR EACH OF LO2 TANKS 1 THRU 8. THE SEPARATELY CONTROLLED SERIES RPC'S PRECLUDE THE POSSIBILITY OF A SINGLE FAILURE POINT WHICH WOULD ALLOW CONTINUOUS ENERGIZING OF A TANK HEATER.

FAILURE MODES EFFECTS ANALYSIS FMEA - CIL FAILURE MODE

NUMBER: M5-5MB-2176-G-02

REVISION#: 9 04/16/96

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

LRU: H2/O2 CONTROL BOXES

CRITICALITY OF THIS

ITEM NAME: CONTROLLER, REMOTE POWER

FAILURE MODE: 1R3

FAILURE MODE:

INADVERTENT OUTPUT, FAILS "ON", FAILS TO TURN "OFF"

MISSION PHASE:

PL	PRE-LAUNCH
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 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)

B)

REDUNDANCY SCREEN "B" FAILS BECAUSE OF INABILITY TO DETECT FIRST FAILURE
(FAILED RPC).

C)

- FAILURE EFFECTS -**(A) SUBSYSTEM:**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE
NUMBER: M5-6MB-2176-G-02**

LOSS OF SERIES REDUNDANCY TO CONTROL POWER TO THE AFFECTED TANK HEATER.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF INTERFACE REDUNDANCY. THE NONCONDUCTING SERIES RPC WILL PREVENT THE HEATER FROM BEING ENERGIZED INADVERTENTLY. A SECOND SIMILAR FAILURE IN THE REDUNDANT RPC WOULD ALLOW A CONTINUOUSLY ENERGIZED HEATER AND RESULT IN EARLY DEPLETION OF LO2 AND POSSIBLE DAMAGE TO THE AFFECTED TANK. TIME TO EFFECT IS APPROXIMATELY 9 HOURS ONCE THE AFFECTED LO2 TANK HAS REACHED A RESIDUAL LEVEL OF 9 PERCENT. SHUTDOWN OF THE RELATED MAIN DC BUS PRECLUDES THE CONTINUOUS HEATING OF THE AFFECTED HEATER.

(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) FIRST RPC FAILS SHORT, 2) SECOND SERIES RPC FAILS SHORT - LO2 TANK HEATER FAILED "ON", 3) PLUGGED RELIEF PORT, . . .

(FOR LO2 TANKS 6 THRU 9) STEPS 1 THRU 3 ABOVE, AND 4) 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 B, ITEM NO. 2 - REMOTE POWER CONTROLLER

(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.

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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.

GROUND TURNAROUND TEST
 RPC SERIES REDUNDANCY IS VERIFIED.

(TANKS 1-5) DURING ORBITER MAINTENANCE DOWN PERIOD (OMPD).

(TANKS 6-9) DURING PALLET LO2 TANK HEATER LPS AUTO TEST PERFORMED PRIOR TO FIRST EDO FLIGHT, AFTER LRU REPLACEMENT, OR PRIOR TO NEXT EDO FLIGHT IF TIME BETWEEN CHECKOUT EXCEEDS 36 MONTHS.

(C) INSPECTION:

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

(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 B IS NO LONGER BEING KEPT UP-TO-DATE.

(E) OPERATIONAL USE:

PER FLIGHT RULE 8-581F A CRYO HEATER THAT CONTINUES TO BE POWERED AFTER PLACING ITS CORRESPONDING SWITCH IN THE "OFF" POSITION WILL BE DEACTIVATED BY PERFORMING THE FOLLOWING (CIL): 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. THIS IS AN UNDESIRABLE PROCEDURE AND MAY/WILL HAVE AFFECTS ON ADDITIONAL ORBITER SYSTEMS.

- APPROVALS -

PAE MANAGER	: P. STENGER-NGUYEN	: <u><i>P. Stenger-Nguyen</i></u>
PRODUCT ASSURANCE ENGR	: J. NGUYEN	: <u><i>J. Nguyen</i></u>
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EDITORIALLY APPROVED	: JSC	: <u><i>J. Stenger</i></u>
TECHNICAL APPROVAL	: VIA APPROVAL FORM	: 96-CIL-012_M5-6MB