

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE  
 NUMBER: M5-6MB-2203-G -X

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

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PART DATA

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PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : H2/O2 CONTROL BOXES	V070-704470
SRU : CONTROLLER, HYBRID DRIVER	MC477-0261-0002

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EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
 CONTROLLER, HYBRID DRIVER (HDC), TYPE 1 - HEATER "A" AND "B" CONTROL, LO2  
 TANKS 1 THRU 9

REFERENCE DESIGNATORS:

- 40V76A141AR12
- 40V76A141AR14
- 40V76A141AR19
- 40V76A141AR21
- 40V76A142AR12
- 40V76A142AR14
- 40V76A142AR19
- 40V76A142AR21
- 40V76A143AR12
- 40V76A143AR14
- 40V76A143AR19
- 40V76A143AR21
- 40V76A144AR12
- 40V76A144AR14
- 40V76A144AR19
- 40V76A144AR21
- 40V76A217AR12
- 40V76A217AR14
- 40V76A217AR19
- 40V76A217AR21
- 40V76A218A1AR12
- 40V76A218A1AR14
- 40V76A218A1AR19
- 40V76A218A1AR21
- 40V76A218A2AR12
- 40V76A218A2AR14
- 40V76A218A2AR19
- 40V76A218A2AR21
- 40V76A218A3AR12

**FAILURE MODES EFFECTS ANALYSIS (FMEA) --CIL HARDWARE**

**NUMBER: M5-6MB-2203-G-X**

40V76A218A3AR14  
40V76A218A3AR19  
40V76A218A3AR21  
40V76A218A4AR12  
40V76A218A4AR14  
40V76A218A4AR19  
40V76A218A4AR21

**QUANTITY OF LIKE ITEMS:**

**FOUR PER LO2 TANK HEATER SYSTEM**

**FUNCTION:**

**PROVIDES CONTROL OF RPC'S SUPPLYING POWER TO LO2 TANK HEATERS.**

**FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE**

**NUMBER: M5-6MB-2203-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, HYBRID DRIVER**

**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

<b>VEHICLE/PAYLOAD/KIT EFFECTIVITY:</b>	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 DUE TO SERIES REDUNDANT HDC MASKING THE FAILED HDC.**

**C)**

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE  
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DEGRADATION OF REDUNDANCY AGAINST CONTINUOUS POWERING OF AFFECTED LO2 TANK HEATER.

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

LOSS OF INTERFACE REDUNDANCY - FIRST FAILURE OF HDC SIGNALS ONE OF TWO SERIES RPC'S. NO EFFECT. FAILURE OF SECOND HDC COMPLETES LOGIC TO SECOND SERIES RPC TO CONTINUOUSLY POWER "ON" ONE HEATER IN EACH OF TWO ASSEMBLIES. THIS COULD RESULT IN EARLY DEPLETION AND POSSIBLE DAMAGE TO AFFECTED LO2 TANK. TIME TO EFFECT IS APPROXIMATELY 9 HOURS ONCE THE AFFECTED TANK HAS REACHED A LEVEL OF 9 PERCENT.

**(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 IS DUE TO THE FOLLOWING SCENARIO:

(FOR LO2 TANKS 1 THRU 5) 1) FIRST HDC SHORTS (DRIVES ONE SET OF TWO SERIES RPC'S, 2) SECOND HDC SHORTS (DRIVES OTHER SET OF SERIES RPC'S - 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.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

REFER TO APPENDIX B, ITEM NO. 1 - HYBRID DRIVER

**(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.

## FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE

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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 CIRCUIT IS FUNCTIONALLY VERIFIED DURING DRIVER SERIES REDUNDANCY TEST (LO2 TANK HEATER LPS AUTO TEST),

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

(TANKS 6-9) 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. 1 - HYBRID DRIVER

**(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 9-581F 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): AN H2 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 AND MAY/WILL HAVE AFFECTS ON ADDITIONAL ORBITER SYSTEMS.

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- APPROVALS -

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EDITORIALLY APPROVED	: JSC	<u>J. Stacey</u>
TECHNICAL APPROVAL	: VIA APPROVAL FORM :	96-CIL-012 M5-6MB