

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

NUMBER: M5-SMB-2027-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	: PANEL R1A2	V070-730276
LRU	: PANEL A15	V070-730372
LRU	: PANEL A11A1	V070-730732
SRU	: SWITCH, TOGGLE, 3P3P	ME452-0102-7306

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

SWITCH, TOGGLE, 3P3P, MAINTAINED ON - LH2 TANKS 1 THRU 9 HEATER "A" AND "B" CONTROL

REFERENCE DESIGNATORS:

- 32V73A1A2S11
- 32V73A1A2S12
- 32V73A1A2S19
- 32V73A1A2S20
- 32V73A1A2S24
- 32V73A1A2S25
- 36V73A11A1S4
- 36V73A11A1S5
- 36V73A15S7
- 36V73A15S8
- 36V73A15S16
- 36V73A15S17
- 36V73A15S21
- 36V73A15S22
- 36V73A15S26
- 36V73A15S27
- 36V73A15S31
- 36V73A15S32

**QUANTITY OF LIKE ITEMS:**

TWO PER LH2 TANK HEATER SYSTEM

**FUNCTION:**

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PROVIDES MANUAL CONTROL OF POWER TO THE LH2 TANK HEATER ELEMENTS "A"  
AND "B" FOR THE "AUTO/OFF/ON" MODES.

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

NUMBER: M5-6MB-2027-G-02

REVISION#: 10 08/09/96

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

LRU: PANEL R1A2

CRITICALITY OF THIS

ITEM NAME: SWITCH, TOGGLE, 3P3P

FAILURE MODE: 1R3

**FAILURE MODE:**

FAILS CLOSED IN "ON" POSITION

**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 STRUCTURAL FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, PROCESSING ANOMALY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN	A) PASS
	B) PASS
	C) PASS

**PASS/FAIL RATIONALE:**

A)

B)

C)

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

POSSIBLE MULTIPLE INTERNAL CONTACT SHORTING PROVIDES INADVERTENT "ON" SIGNAL.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE**  
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**(B) INTERFACING SUBSYSTEM(S):**

POSSIBLE ENERGIZING OF A LH2 TANK HEATER ELEMENT BY THE BRIDGING OF ADJACENT CONTACTS BY A LOOSE ROLLER AND/OR SPRING WITHIN THE SWITCH RESULTING IN EARLY DEPLETION OF LH2 AND POSSIBLE DAMAGE TO THE AFFECTED TANK WHEN THE THERMAL DESIGN IS EXCEEDED. THE MINIMUM TIME REQUIRED FOR TANK RUPTURE TO OCCUR EXCEEDS 35 HOURS STARTING FROM WHEN THE AFFECTED TANK RESIDUAL LEVEL IS REACHED. POWER-DOWN OF THE ASSOCIATED MAIN BUS PRECLUDES THE CONTINUOUS ENERGIZING OF THE AFFECTED HEATERS.

**(C) MISSION:**

POSSIBLE EARLY MISSION TERMINATION - MAY NOT MEET MINIMUM DURATION FLIGHT.

**(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 LH2 TANKS 1, 2 & 4) 1) SWITCH FAILS CLOSED IN THE "ON" POSITION RESULTING IN CONTINUOUS ENERGIZATION OF TANK HEATER, AND 2) RELIEF PORT PLUGGED, . . .

(FOR LH2 TANKS 3 & 5, 1R3 CRITICALITY) STEPS 1 AND 2 ABOVE, AND 3) SECOND RELIEF PORT PLUGGED, . . .

(FOR LH2 TANKS 6 THRU 9, 1R3 CRITICALITY) 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.

**DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1R2**

**(F) RATIONALE FOR CRITICALITY DOWNGRADE:**

THIS CIL HAS BEEN DOWNGRADED FROM 1R2 TO 1R3 DUE TO THE CREW WORKAROUNDS DESCRIBED IN THE SECTION (E)\*OPERATIONAL USE\* OF THE DISPOSITION RATIONALE. UPON FAILURE OF THE SWITCH, THE CREW WILL REMOVE POWER FROM THE AFFECTED TANK HEATER BY DROPPING A MAIN BUS OR REMOVING THE ASSOCIATED FUSES. POSSIBLE LOSS OF CREW/VEHICLE IF THE TIME FOR CORRECTIVE ACTION (CREW WORKAROUNDS) EXCEEDS THE TIME TO EFFECT (TANK OVERPRESSURE DUE TO PLUGGED RELIEF PORT).

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**-DISPOSITION RATIONALE-**

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

**(B) TEST:**  
REFER TO APPENDIX A, ITEM NO. 1 - TOGGLE SWITCH

SWITCH IS VERIFIED INFLIGHT DURING LH2 TANK HEATER CABIN SWITCH TEST.  
PERFORM GROUND TURNAROUND TEST.

(TANKS 1-5) WHEN VALID VERIFICATION IS UNOBTAINABLE IN FLIGHT.

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

**(E) OPERATIONAL USE:**  
CREW WILL VERIFY MANIFOLD ISOLATION VALVES ARE OPEN AFTER FIRST FAILURE.

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**- APPROVALS -**

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EDITORIALLY APPROVED : RI  
EDITORIALLY APPROVED : JSC  
TECHNICAL APPROVAL : VIA JSC

*Boyd G. Hannon 5/12/96*  
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:96-CIL-012