

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE****NUMBER: 05-6J-2111 -X****SUBSYSTEM NAME:** EPD&C - MAIN PROPULSION SYSTEM**REVISION:** 1 07/24/00

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**PART DATA**

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|     | <b>PART NAME</b>   | <b>PART NUMBER</b>     |
|-----|--------------------|------------------------|
|     | <b>VENDOR NAME</b> | <b>VENDOR NUMBER</b>   |
| LRU | : PANEL R2         | V070-730277            |
| SRU | : SWITCH, TOGGLE   | ME452-0102-7203, -8203 |

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

SWITCH, TOGGLE (TWO POLES, THREE POSITIONS), HELIUM SUPPLY ISOLATION VALVE B (LV 2/4/6).

**REFERENCE DESIGNATORS:** 32V73A2S12  
32V73A2S13  
32V73A2S14

**QUANTITY OF LIKE ITEMS:** 3**FUNCTION:**

PROVIDES MANUAL CONTROL OF POWER TO HELIUM SUPPLY ISOLATION VALVE B.

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

**NUMBER: 05-6J-2111-03**

**REVISION#:** 1 07/24/00

**SUBSYSTEM NAME:** EPD&C - MAIN PROPULSION SYSTEM

**LRU:** PANEL R2

**CRITICALITY OF THIS**

**ITEM NAME:** SSME GHE ISO VLV B TOGGLE SWITCH (LV2, 4, 6)

**FAILURE MODE:** 1R2

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**FAILURE MODE:**

SWITCH OPEN CONTACTS SHORT-TO-GROUND

**MISSION PHASE:** LO LIFT-OFF

|   |     |           |
|---|-----|-----------|
| <b>VEHICLE/PAYLOAD/KIT EFFECTIVITY:</b> | 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

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|                          |         |
|--------------------------|---------|
| <b>REDUNDANCY SCREEN</b> | A) PASS |
|                          | B) FAIL |
|                          | C) PASS |

**PASS/FAIL RATIONALE:**

A)

B)

FAILS B SCREEN BECAUSE DUAL SWITCH POLES MASK SWITCH SCAN INDICATION

C)

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

NO EFFECT FIRST FAILURE. LOSS OF REDUNDANT OPEN COMMAND TO SSME ISOLATION VALVE B.

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

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SAME AS A.

**(C) MISSION:**  
SAME AS A.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
SAME AS A.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

CASE 1: (CLOSE CONTACTS)

1R/2 2 SUCCESS PATHS. TIME FRAME - ENGINE OPERATION.

- 1) HELIUM LEAK DOWNSTREAM OF ISOLATION VALVE
- 2) EITHER SWITCH CLOSE CONTACT SHORTS-TO-GROUND, RESULTS IN INABILITY TO ISOLATE LEAKING HELIUM AND RESULTS IN PREMATURE SSME SHUTDOWN.

RESULTS IN NON-ISOLATABLE LEAKAGE FROM THE ENGINE HELIUM SUPPLY. POSSIBLE OVERPRESSURIZATION OF AFT COMPARTMENT SINCE ISOLATION OF THE LINE CANNOT BE ACHIEVED WITHIN AVAILABLE RESPONSE TIME. POSSIBLE LOSS OF CREW/VEHICLE.

CASE 2: (OPEN CONTACTS)

1R/3 4 SUCCESS PATHS. TIME FRAME - ENGINE OPERATION.

- 1) EITHER SWITCH OPEN CONTACT SHORTS-TO-GROUND.
- 2) SERIES SWITCH BLOCKING DIODE SHORTS.
- 3) LOSS OF PARALLEL SOLENOID POWER PATH. RESULTS IN LOSS OF POWER TO SSME ISOLATION VALVE B.
- 4) SSME ISOLATION VALVE A FAILS OFF.

FAILURES WILL RESULT IN LOSS OF HELIUM REQUIRED TO PERFORM CONTINUOUS PURGING OF HIGH PRESSURE OXIDIZER TURBOPUMP INTERMEDIATE SEAL CAVITY. THIS CAVITY IS BETWEEN TWO SEALS, ONE OF WHICH CONTAINS THE HOT, FUEL-RICH GAS IN OXIDIZER TURBINE AND THE OTHER CONTAINS THE LIQUID OXYGEN IN OXIDIZER TURBOPUMP. LEAKAGE THROUGH ONE OR BOTH SEALS COULD RESULT IN A CATASTROPHIC EXPLOSION IF ALLOWED TO ACCUMULATE. CONTINUOUS OVERBOARD PURGE OF THIS AREA PREVENTS THIS ACCUMULATION FROM OCCURRING. POSSIBLE LOSS OF CREW/VEHICLE.

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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.

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

**(C) INSPECTION:**

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

**(D) FAILURE HISTORY:**

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

CURRENT DATA ON TEST FAILURE, FLIGHT FAILURE, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

**(E) OPERATIONAL USE:**

NO CREW ACTION CAN BE TAKEN.

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**- APPROVALS -**

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|----------------------|------------------------|--------------------------|
| S&R ENGINEERING      | : W.P. MUSTY           | :/S/ W.P. MUSTY          |
| S&R ENGINEERING ITM  | : P. A. STENGER-NGUYEN | :/S/ P.A. STENGER-NGUYEN |
| DESIGN ENGINEERING   | : ANDY RIZVI           | :/S/ ANDY RIZVI          |
| MPS SUBSYSTEM MGR.   | : TIM REITH            | :/S/ TIM REITH           |
| EPD&C SUBSYSTEM MGR. | : RICHARD PHAN         | :/S/ RICHARD PHAN        |
| MOD                  | : JEFF MUSLER          | :/S/ JEFF MUSLER         |
| USA SAM              | : MIKE SNYDER          | :/S/ MIKE SNYDER         |
| USA ORBITER ELEMENT  | : SUZANNE LITTLE       | :/S/ SUZANNE LITTLE      |
| NASA SR&QA           | : BILL PRINCE          | :/S/ BILL PRINCE         |