

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE****NUMBER: 05-6J-2198 -X****SUBSYSTEM NAME:** EPD&C - MAIN PROPULSION SYSTEM**REVISION:** 1 07/11/00

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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 R4	V070-730278
SRU	:LH2 PREVALVE TOGGLE SWITCH	ME452-0102-7354, -8354

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

TOGGLE SWITCH, 3 POLE/3 POSITION, CENTER LEVER LOCK, LH2 PREVALVES 1, 2, AND 3  
MANUAL CONTROL POWER.

**REFERENCE DESIGNATORS:** 32V73A4S14  
32V73A4S15  
32V73A4S16

**QUANTITY OF LIKE ITEMS:** 3  
1 PER PREVALVE 1, 2, AND 3

**FUNCTION:**

PROVIDES MANUAL CONTROL OF LH2 PREVALVE. SOFTWARE CONTROLS NORMAL  
PREVALVE FUNCTIONS.

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

**NUMBER: 05-6J-2198-01**

**REVISION#:** 1 11/14/2000

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

**LRU:** PANEL R4

**CRITICALITY OF THIS**

**ITEM NAME:** LH2 PREVALVE TOGGLE SWITCH (PV4,5,6)

**FAILURE MODE:** 1R2

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**FAILURE MODE:**

FAILS TO TRANSFER TO CLOSE POSITION

**MISSION PHASE:**

PL PRE-LAUNCH  
LO LIFT-OFF

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**

102 COLUMBIA  
103 DISCOVERY  
104 ATLANTIS  
105 ENDEAVOUR

**CAUSE:**

PIECE PART STRUCTURAL FAILURE, CONTAMINATION, MECHANICAL SHOCK, VIBRATION, THERMAL STRESS

**CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES**

AOA ABORT ONCE AROUND  
ATO ABORT TO ORBIT  
PAD PAD ABORT  
RTLS RETURN TO LAUNCH SITE  
TAL TRANS-ATLANTIC LANDING

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**REDUNDANCY SCREEN**

A) PASS  
B) PASS  
C) PASS

**PASS/FAIL RATIONALE:**

A)

B)

C)

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

NO EFFECT. SWITCH IS NOT NOMINALLY USED DURING FLIGHT.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL FAILURE MODE  
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CRIT 1/1 FOR ANY ABORT WITH SSME SHUTDOWN WITH UNCONTAINED DAMAGE (ASSUMES ENGINE IS DAMAGED ONLY TO THE EXTENT THAT ISOLATION OF THE DAMAGE WILL SAFE THE SYSTEM) - FOR PAD ABORTS A PARTIALLY OPEN MAIN FUEL VALVE. FAILURE OF SWITCH TO TRANSFER TO CLOSE RESULTS IN FAILURE TO CLOSE PREVALVE.

PREVALVE WOULD FAIL TO ISOLATE THE AFFECTED ENGINE. RESULTS IN LH2/GH2 LEAKAGE IN AFT FUSELAGE LEADING TO OVERPRESS, FIRE/EXPLOSION HAZARD, AND POSSIBLE LOSS OF CRITICAL ADJACENT COMPONENTS DUE TO CRYOGENIC EXPOSURE. MAIN FUEL VALVE LEAKAGE AFTER A PAD ABORT RESULTS IN HAZARDOUS OVERBOARD LEAKAGE OF LH2. POSSIBLE LOSS OF CREW/VEHICLE.

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

LOSS OF CAPABILITY TO CLOSE LH2 PREVALVE.

**(C) MISSION:**

SAME AS A.

**(D) CREW, VEHICLE, AND ELEMENT(S):**

SAME AS B.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

1R/2 2 SUCCESS PATHS. TIME FRAME – ANY SSME SHUTDOWN

- 1) ENGINE SHUTDOWN WITH UNCONTAINED DAMAGE (ASSUMES ENGINE IS DAMAGED ONLY TO THE EXTENT THAT ISOLATION OF THE DAMAGE WILL SAFE THE SYSTEM) - FOR PAD ABORTS A PARTIALLY OPEN MAIN FUEL VALVE.
- 2) FAILURE OF SWITCH TO TRANSFER TO CLOSE RESULTS IN FAILURE TO CLOSE PREVALVE.

PREVALVE WOULD FAIL TO ISOLATE THE AFFECTED ENGINE. RESULTS IN LH2/GH2 LEAKAGE IN AFT FUSELAGE LEADING TO OVERPRESS, FIRE/EXPLOSION HAZARD, AND POSSIBLE LOSS OF CRITICAL ADJACENT COMPONENTS DUE TO CRYOGENIC EXPOSURE. MAIN FUEL VALVE LEAKAGE AFTER A PAD ABORT RESULTS IN HAZARDOUS OVERBOARD LEAKAGE OF LH2. POSSIBLE LOSS OF CREW/VEHICLE.

REF. CIL 03-1-0402-04.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**

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

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**(B) TEST:**

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

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 EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

**(E) OPERATIONAL USE:**

FLIGHT - NO CREW ACTION CAN BE TAKEN.

GROUND: GROUND OPERATIONS SAFING PROCEDURES CONTAIN SAFING SEQUENCE OF EVENTS FOR MAJOR LEAKS IN THE HYDROGEN SYSTEM.

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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
D&C SUBSYSTEM MGR.	: LAITH COTTA	:/S/ LAITH COTTA
MOD	: JEFFREY L. MUSLER	:/S/ JEFFREY L. MUSLER
USA SAM	: MICHAEL SNYDER	:/S/ MICHAEL SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: BILL PRINCE	:/S/ BILL PRINCE