**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE**
**NUMBER:M8-1SS-E044 -X**

**SUBSYSTEM NAME:** ECLSS - EMU POTABLE & WASTE WATER SYSTEM
**REVISION:** 0 04/08/97

**PART DATA**

| | PART NAME<br>VENDOR NAME | PART NUMBER<br>VENDOR NUMBER |
|---|---|---|
| LRU | :VALVE, SOLENOID LATCHING<br>VALCOR ENGINEERING CORP | ME284-0518-1023<br>V70500-59-1 |

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**
ECLSS PANEL EMU WASTE WATER RETURN SOLENOID LATCHING (CONTROL) VALVE

**QUANTITY OF LIKE ITEMS:** 2
TWO

**FUNCTION:**
ALLOWS FLOW OF WASTE WATER FROM AFFECTED EMU WHEN VALVE IS LATCHED IN THE OPEN POSITION. WHEN VALVE IS LATCHED CLOSED, IT PROVIDES EMU ISOLATION AGAINST A 40 PSIA MAXIMUM WASTE WATER RETURN PRESSURE.

**REFERENCE DOCUMENTS:** VS28-643001

**FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE**
**NUMBER: M8-1SS-E044-01**

**REVISION#:** 0 04/08/97

**SUBSYSTEM NAME:** ECLSS - EMU POTABLE & WASTE WATER SYSTEM
**LRU:** ECLSS PANEL EMU WASTE WATER RETURN VALVE **CRITICALITY OF THIS**
**ITEM NAME:** VALVE, EMU WASTE WATER RETURN **FAILURE MODE:** 1R3

**FAILURE MODE:**
FAILS TO OPEN, RESTRICTED FLOW (CLOGGED)

**MISSION PHASE:** OO ON-ORBIT

**VEHICLE/PAYLOAD/KIT EFFECTIVITY:**
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

**CAUSE:**
CHEMICAL REACTION, CONTAMINATION, MECHANICAL SHOCK, EXCESSIVE VIBRATION, MISHANDLING OR ABUSE, INTERNAL COMPONENT FAILURE

**CRITICALITY 1/1 DURING INTACT ABORT ONLY?** NO

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**REDUNDANCY SCREEN**
A) PASS
B) PASS
C) PASS

**PASS/FAIL RATIONALE:**
A)

B)

C)

**METHOD OF FAULT DETECTION:**
NONE UNTIL EMU IS CONNECTED TO ECLSS PANEL. THEN RESTRICTED FLOW CAN BE DETECTED THROUGH VISUAL OBSERVATION (INCREASED TIME IN SERVICING AFFECTED EMU) AND THROUGH INSTRUMENTATION (DELTA PRESSURE INDICATION BETWEEN EMU GAS AND WATER PRESSURE READINGS).

**MASTER MEAS. LIST NUMBERS:** V64X0505E
V64X0525E

**CORRECTING ACTION:** MANUAL

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**CORRECTING ACTION DESCRIPTION:**
CREW COULD UTILIZE REDUNDANT WASTE WATER RETURN PATH TO SERVICE ALL EMU'S. IN THE EVENT A SIMILAR FAILURE OCCURS ON THE REDUNDANT PATH, THE ORBITER/ISS COULD BE MANEUVERED SUCH THAT THE EVA CREWMEMBERS ARE NOT EXPOSED TO THE SUN.

**REMARKS/RECOMMENDATIONS:**
WITHIN THE ECLSS PANEL DUAL WASTE WATER RETURN PATHS ARE PROVIDED TO SERVICE THE EMU'S. FAILURE WOULD NOT BE DETECTED UNTIL AN EMU IS ATTACHED TO THE WASTE WATER TRANSFER PORT. WORST CASE SCENARIO IS WHEN RESTRICTED WASTE WATER FLOW OCCURS FOLLOWING INITIAL EVA. THERE ARE FOUR EMU'S AVAILABLE TO PERFORM AN EVA. A PLANNED EVA REQUIRES THE USE OF A MINIMUM OF THREE EMU'S (FOR THREE EVA CREWMEMBERS) WHILE A CONTINGENCY EVA REQUIRES A MINIMUM OF TWO EMU'S (FOR TWO EVA CREWMEMBERS).

## - FAILURE EFFECTS -

**(A) SUBSYSTEM:**
NO EFFECT UNTIL EMU IS CONNECTED FOLLOWING AN EVA. THEN INABILITY TO TRANSFER WASTE WATER FROM A SINGLE PORT.

**(B) INTERFACING SUBSYSTEM(S):**
FIRST FAILURE MAY INCREASE TIME REQUIRED TO COMPLETE EVA SINCE ALL EMU'S WILL BE SERVICED FROM ONLY ONE WASTE WATER RETURN PATH. INABILITY TO REMOVE WASTE WATER FROM ALL EMU'S FOLLOWING SIMILAR FAILURE OF LATCHING VALVE ON REDUNDANT WASTE WATER RETURN PATH.

**(C) MISSION:**
NO EFFECT FIRST FAILURE. SIMILAR FAILURE OF LATCHING VALVE ON REDUNDANT WASTE WATER RETURN PATH, COULD LIMIT USE OF AFFECTED EMU'S IN PERFORMING A SECOND PLANNED EVA.

**(D) CREW, VEHICLE, AND ELEMENT(S):**
NO EFFECT ON FIRST FAILURE. INABILITY TO UTILIZE EMU'S, WHEN REQUIRED, FOLLOWING SIMILAR FAILURE OF SECOND VALVE COULD RESULT IN LOSS OF EVA CAPABILITY. POTENTIAL LOSS OF CREW AND VEHICLE IN THE EVENT A CONTINGENCY EVA IS REQUIRED TO CORRECT A POTENTIAL CRIT 1 CONDITION.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**
FIRST FAILURE (VALVE IN FIRST PATH FAILS TO OPEN OR CLOGS) - INABILITY TO REMOVE WASTE WATER FROM EMU ON AFFECTED PATH. INCREASED TIME IN SERVICING ALL EMU'S FROM A SINGLE PORT.

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SECOND FAILURE (VALVE IN SECOND PATH FAILS TO OPEN OR CLOGS) - WORST CASE IF SECOND FAILURE OCCURS FOLLOWING AN INITIAL EVA. THEN LOSS OF CAPABILITY TO REMOVE WASTE WATER FROM THE EMU'S WOULD PRECLUDE SUBSEQUENT EVA CAPABILITIES. POTENTIAL LOSS OF CONTINGENCY EVA OPERATIONS. - CRITICALITY 1R3 CONDITION.

**DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)):** 1R3

**(F) RATIONALE FOR CRITICALITY DOWNGRADE:**
WORKAROUND TO MANUEVER ORBITER/ISS SUCH THAT EVA CREWMEMBERS ARE NOT EXPOSED TO THE SUN DOES NOT CHANGE CRITICALITY OF THIS FAILURE MODE. CRITICALITY REMAINS AT 1R3.

**- TIME FRAME -**

**TIME FROM FAILURE TO CRITICAL EFFECT:** DAYS

**TIME FROM FAILURE OCCURRENCE TO DETECTION:** SECONDS

**TIME FROM DETECTION TO COMPLETED CORRECTING ACTION:** HOURS

**IS TIME REQUIRED TO IMPLEMENT CORRECTING ACTION LESS THAN TIME TO EFFECT?**
YES

**RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:**
CREW HAS AMPLE TIME TO UTILIZE REDUNDANT POTABLE WATER RETURN PATH TO SERVICE ALL EMU'S OR MANEUVER ORBITER/ISS SUCH THAT EVA CREWMEMBERS ARE NOT EXPOSED TO THE SUN BEFORE LOSS OF EMU WASTE WATER REMOVAL BECOMES CATASTROPHIC.

**HAZARD REPORT NUMBER(S):** FF-09

**HAZARD(S) DESCRIPTION:**
INABILITY TO SAFELY PERFORM EVA.

**- APPROVALS -**

| | | | |
|---|---|---|---|
| SS & PAE | : | M. W. GUENTHER | : |
| DESIGN ENGINEER | : | S. CASTILLO | : |