**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE**
**NUMBER:M8-1SS-E006 -X**

**SUBSYSTEM NAME:** ECLSS - ARPCS

**REVISION:** 2 04/08/97

**PART DATA**

| | **PART NAME**<br>**VENDOR NAME** | **PART NUMBER**<br>**VENDOR NUMBER** |
|---|---|---|
| LRU | :CAP, PRESSURE<br>CARELTON TECHNOLOGIES | MC250-0004-0010<br>2763-2001-7 |

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**
EXTERNAL AIRLOCK AFT HATCH EQUALIZATION VALVE PRESSURE CAP

**QUANTITY OF LIKE ITEMS:** 2
TWO

**FUNCTION:**
CAPS ONTO EQUALIZATION VALVE TO PROVIDE SECONDARY PROTECTION FOR INTERNAL LEAKAGE ACROSS EXTERNAL AIRLOCK AFT HATCH.

**REFERENCE DOCUMENTS:** M072-593830
V519-331051

**FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE**
**NUMBER: M8-1SS-E006-02**

**REVISION#:** 2 04/08/97

**SUBSYSTEM NAME:** ECLSS - ARPCS
**LRU:** CAP, EQUALIZATION VALVE PRESSURE
**ITEM NAME:** CAP, EQUALIZATION VALVE PRESSURE

**CRITICALITY OF THIS FAILURE MODE:** 1R3

**FAILURE MODE:**
LEAKAGE

**MISSION PHASE:** OO ON-ORBIT

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

**CAUSE:**
MECHANICAL SHOCK, EXCESSIVE VIBRATION, CORROSION, POROSITY

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

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

**PASS/FAIL RATIONALE:**
A)

B)
N/A - BECAUSE THE EQUALIZATION VALVE IS THE PRIMARY SEALING COMPONENT AND THE CAP IS STANDBY REDUNDANCY.

C)

**METHOD OF FAULT DETECTION:**
A CRACKED PRESSURE CAP COULD BE VISUALLY DETECTED AT TIME OF INSTALLATION OR REMOVAL. DELTA PRESSURE ACROSS EXTERNAL AIRLOCK HATCH WOULD INDICATE LEAKAGE ONLY AFTER AN INTERNAL LEAKAGE FAILURE OF ASSOCIATED EQUALIZATION VALVE.

**CORRECTING ACTION:** MANUAL

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**CORRECTING ACTION DESCRIPTION:**
NO CREW ACTION REQUIRED FOR FIRST FAILURE. CREW COULD UTILIZE REDUNDANT PRESSURE CAP (FROM OTHER VALVES) ON EQUALIZATION VALVE THAT REQUIRES SECONDARY LEAKAGE PROTECTION. IF ANOTHER CAP IS NOT AVAILABLE, CREW CAN STOP LEAKAGE BY CLOGGING THE VALVE INLET WITH ANY AVAILABLE MATERIAL. (DELTA-PRESSURE ACROSS VALVE WILL KEEP THE MATERIAL IN PLACE.) IF THIS FAILS CREW COULD ISOLATE EXTERNAL LEAKAGE BY CLOSING 576 BULKHEAD HATCH.

**REMARKS/RECOMMENDATIONS:**
CRITICALITY OF THIS FAILURE MODE IS BASED ON THE WORST CASE EFFECT WHEN THERE IS NO PRESSURIZED PAYLOAD INSTALLED. RECOMMEND THAT THE EXTERNAL AIRLOCK AFT HATCH BE REMOVED IF A PRESSURIZED PAYLOAD IS INSTALLED.

## - FAILURE EFFECTS -

**(A) SUBSYSTEM:**
LOSS OF SECONDARY SEAL TO EQUALIZATION VALVE.

**(B) INTERFACING SUBSYSTEM(S):**
NO EFFECT FIRST FAILURE. LOSS OF ISOLATION BETWEEN EXTERNAL AIRLOCK AND OUTSIDE ATMOSPHERE FOLLOWING INTERNAL LEAKAGE OF ASSOCIATED EQUALIZATION VALVE (WHEN NO PRESSURIZED PAYLOAD IS INSTALLED) OR LEAKAGE OF EXTERNAL AIRLOCK PRESSURE INTO A DEPRESSURIZED TUNNEL ADAPTER DURING AN EVA (WHEN A PRESSURIZED PAYLOAD IS INSTALLED). BOTH SCENARIOS RESULT IN AN EXCESSIVE USE OF CONSUMABLES.

**(C) MISSION:**
NO EFFECT FIRST FAILURE. POSSIBLE LOSS OF MISSION OBJECTIVES IF SECOND ASSOCIATED FAILURE (INTERNAL LEAKAGE OF EQUALIZATION VALVE) OCCURS AND PLANNED EVA CANNOT BE PERFORMED.

**(D) CREW, VEHICLE, AND ELEMENT(S):**
NO EFFECT FIRST FAILURE. SUBSEQUENT INTERNAL LEAKAGE OF EQUALIZATION VALVE COULD: (1) RESULT IN LOSS OF ODS PRESSURIZATION WHICH COULD JEOPARDIZE THE SAFETY OF CREW AND VEHICLE OR (2) RESULT IN POSSIBLE LOSS OF EVA CREWMEMBERS IF FAILURE OCCURS DURING AN EVA AND WORKAROUND CANNOT MAINTAIN PRESSURE WITHIN ODS FOR CREW RETURN TO CREW CABIN.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**
FIRST FAILURE (PRESSURE CAP LEAKS) - NO EFFECT, LOSS OF SECONDARY SEAL ONLY.
SECOND FAILURE (ASSOCIATED EQUALIZATION VALVE INTERNALLY LEAKS) - LOSS OF PRIMARY SEAL RESULTING IN THE FOLLOWING:

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**PRIOR TO DOCKING WITH THE SPACE STATION STATION**
POSSIBLE LOSS OF MISSION OR EARLY MISSION TERMINATION DUE TO EXCESSIVE LOSS OF CONSUMABLES. CRITICALITY 2R3 CONDITION.

**DURING IVA**
POSSIBLE LOSS OF CONSUMABLES IN ODS. POSSIBLE LOSS OF PRESSURE IN SPACE STATION IF FAILURES OCCUR WHILE EXTERNAL AIRLOCK UPPER HATCH IS OPEN. - CRITICALITY 1R2 CONDITION.

**DURING AN EVA**
INABILITY TO RETURN FROM AN EVA FOLLOWING SECOND FAILURE SINCE ODS VOLUME CANNOT BE REPRESSURIZED. - CRITICALITY 1R2 CONDITION

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

**(F) RATIONALE FOR CRITICALITY DOWNGRADE:**
THIRD FAILURE (INABILITY TO UTILIZE OTHER EQUALIZATION VALVE CAPS) - UNABLE TO STOP LEAKAGE THROUGH VALVE USING THESE CAPS.

FOURTH FAILURE (INABILITY TO CLOG INLET OF EQUALIZATION VALVE REQUIRING SECONDARY LEAK PROTECTION) IF OCCURS:
**DURING IVA:**
CONTINUOUS LOSS OF EXTERNAL AIRLOCK PRESSURE TO THE OUTSIDE RESULTING IN AN INCREASE USE OF ORBITER CONSUMABLES.
FIFTH FAILURE (INABILITY TO CLOSE 576 BULKHEAD HATCH) - LOSS OF CAPABILITY TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE FROM CREW CABIN. INCREASED USE OF CONSUMABLES COULD JEOPARDIZE SAFETY OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.

**DURING EVA:**
UNABLE TO MAINTAIN PRESSURE WITHIN EXTERNAL AIRLOCK. POSSIBLE LOSS OF CREWMEMBERS IF EXTERNAL AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOR CREW RETURN TO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING.) - CRITICALITY 1R3 CONDITION.

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**- TIME FRAME -**

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

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

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

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

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**RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:**
CREW WOULD HAVE ENOUGH TIME TO UTILIZED REDUNDANT CAP (FROM OTHER VALVES), CLOG INLET OF LEAKY EQUALIZATION VALVE, OR ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE BY CLOSING THE 576 BULKHEAD HATCH BEFORE THE PROBLEM BECAME CATASTROPHIC.

**HAZARD REPORT NUMBER(S):** ORBI 511, ORBI 162

**HAZARD(S) DESCRIPTION:**
LOSS OF HABITABLE PRESSURE IN CREW CABIN HABITABLE VOLUME (ORBI 511). INABILITY TO RETURN FROM EVA DUE TO AIRLOCK HATCH FAILURES AND / OR REPRESSURIZATION OF THE AIRLOCK (ORBI 162).

- APPROVALS -

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|---|---|---|---|
| SS & PAE | : | M. W. GUENTHER | : |
| DESIGN ENGINEER | : | K. J. KELLY | : |