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

NUMBER: M8-1MR-E006-X

SUBSYSTEM NAME: ECLSS - EXTERNAL AIRLOCK

REVISION: 2 9/15/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	CAP, PRESSURE CARELTON TECHNOLOGIES	MC250-0004-0010 2763-2001-7

## PART DATA

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

REFERENCE DESIGNATORS:

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: M072-593626

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FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE  
 NUMBER: M8-1MR-E005-02

REVISION# 2 9/15/95

SUBSYSTEM NAME: ECLSS - EXTERNAL AIRLOCK  
 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: 104 ATLANTIS

CAUSE:  
 MECHANICAL SHOCK, VIBRATION, CORROSION, POROSITY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? N/A

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: CREW COULD USE REDUNDANT PRESSURE CAP (FROM OTHER  
 VALVES) ON EQUALIZATION VALVE THAT REQUIRES SECONDARY LEAKAGE  
 PROTECTION. CREW COULD ISOLATE LEAKAGE FROM CREW CABIN BY CLOSING  
 APPROPRIATE HATCH(S) FOLLOWING INTERNAL LEAKAGE OF ASSOCIATED  
 EQUALIZATION VALVE.

## REMARKS/RECOMMENDATIONS:

EFFECTS ON EVA RECOVERY ARE MINIMIZED SINCE TUNNEL ADAPTER 'C' HATCH IS  
 THE PRIMARY HATCH FOR PERFORMING AN EVA AND AN ADDED FIFTH HATCH WILL  
 ISOLATE TUNNEL ADAPTER AND EXTERNAL AIRLOCK VOLUMES.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL FAILURE MODE  
NUMBER: MB-1MR-E006-02**

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

NO EFFECT. LOSS OF SECONDARY SEAL TO EQUALIZATION VALVE.

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

NO EFFECT FIRST FAILURE. FOLLOWING INTERNAL LEAKAGE OF ASSOCIATED EQUALIZATION VALVE: MIR 1 - INABILITY TO ISOLATE SPACELAB DURING EVA AND SUBSEQUENT REPRESSURIZATION OF EXTERNAL AIRLOCK VOLUME WHEN EVA IS PERFORMED OUT EXTERNAL AIRLOCK: MULTI-MIR - LOSS OF EXTERNAL AIRLOCK PRESSURE TO OUTSIDE ENVIRONMENT RESULTING IN AN INCREASED USE OF CONSUMABLES.

**(C) MISSION:**

NO EFFECT UNTIL EQUALIZATION VALVE INTERNALLY LEAKS. THEN LEAKAGE OF PRESSURE CAP MAY PRECLUDE A PLANNED EVA.

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

NO EFFECT UNTIL EQUALIZATION VALVE INTERNALLY LEAKS. POSSIBLE LOSS OF EVA CREWMEMBERS DUE TO INABILITY TO RECOVER FROM EVA OUT EXTERNAL AIRLOCK IF SECOND ASSOCIATED FAILURE (LOSS OF CAP) OCCURS (MIR 1 & MULTI-MIR). (THIS ASSUMES TUNNEL ADAPTER "C" HATCH HAS FAILED FIRST.) LOSS OF EXTERNAL PRESSURE IF SECOND ASSOCIATED FAILURE (LOSS OF CAP) OCCURS DURING IVA RESULTING IN POTENTIAL LOSS OF CREWMEMBERS (MULTI-MIR).

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

FIRST FAILURE - NO EFFECT.

SECOND ASSOCIATED FAILURE (EQUALIZATION VALVE INTERNAL LEAKAGE):

MIR 1 - NO EFFECT ON EVA RECOVERY SINCE TUNNEL ADAPTER "C" HATCH IS THE PRIMARY HATCH FOR PERFORMING AN EVA AND FIFTH HATCH WILL ISOLATE TUNNEL ADAPTER VOLUME FROM EXTERNAL AIRLOCK VOLUME.

MULTI-MIR - LOSS OF EXTERNAL AIRLOCK PRESSURE TO OUTSIDE ATMOSPHERE. INCREASED USE OF CONSUMABLES.

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

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

THIRD FAILURE (INABILITY TO UTILIZE TUNNEL ADAPTER "C" HATCH FOR PERFORMING AN EVA) - POSSIBLE LOSS OF EVA CREWMEMBERS IF ODS VOLUME CANNOT BE REPRESSURIZED FOR RETURN TO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING). (MIR 1 & MULTI-MIR)

FOURTH & FIFTH FAILURES (INABILITY TO CLOSE CREW CABIN HATCH & FIFTH HATCH) - LOSS OF CAPABILITY TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE COULD RESULT IN LOSS OF CREW AND VEHICLE. POSSIBLE LOSS OF PRESSURE IN MIR IF SECOND FAILURE OCCURS WHILE EXTERNAL AIRLOCK UPPER HATCH IS OPEN. (MULTI-MIR).

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**- TIME FRAME -**

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TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS TO MINUTES

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TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: SECONDS

IS TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?  
YES

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:  
CREW WOULD HAVE ENOUGH TIME TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE  
PRESSURE BY CLOSING THE APPROPRIATE HATCHES BEFORE THE PROBLEM BECAME  
CATASTROPHIC.

HAZARDS REPORT NUMBER(S): ORBI 511

HAZARD(S) DESCRIPTION:  
LOSS OF HABITABLE PRESSURE.

- APPROVALS -

PRODUCT ASSURANCE ENGR. : M. W. GUENTHER  
DESIGN ENGINEER : K. J. KELLY

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