

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER:M8-1SS-E001 -X**

SUBSYSTEM NAME: ECLSS - ARPCS

REVISION: 2 04/08/97

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:HATCH ASSEMBLY ROCKWELL INT'L	M072-593830-001 M072-593830-001
SRU	:VALVE, EQUALIZATION CARLETON TECHNOLOGIES	MC250-0004-0012 2763-0001-B

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

**QUANTITY OF LIKE ITEMS: 2
TWO**

FUNCTION:
PROVIDES FOR EQUALIZING PRESSURE ACROSS THE EXTERNAL AIRLOCK AFT HATCH, BETWEEN THE EXTERNAL AIRLOCK AND PAYLOAD BAY (WHEN NO PRESSURIZED PAYLOAD IS INSTALLED) OR BETWEEN THE EXTERNAL AIRLOCK AND TUNNEL ADAPTER (WHEN A PRESSURIZED PAYLOAD IS INSTALLED). EACH VALVE OPERATES INDEPENDENTLY WITH POSITIVE DETENTS AT TWO POSITIONS. VALVE CAN BE ACTUATED FROM EITHER SIDE OF HATCH.

REFERENCE DOCUMENTS: M072-593828

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NUMBER: M8-1SS-E001-03

REVISION#: 2 04/08/97

SUBSYSTEM NAME: ECLSS - ARPCS
 LRU: VALVE, EQUALIZATION
 ITEM NAME: VALVE, EQUALIZATION

CRITICALITY OF THIS
 FAILURE MODE: 1R3

FAILURE MODE:
 FAILS TO OPEN

MISSION PHASE: OO ON-ORBIT

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

CAUSE:
 MECHANICAL SHOCK, EXCESSIVE VIBRATION, PHYSICAL BINDING/JAMMING,
 CORROSION, PIECE PART STRUCTURAL FAILURE

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
 B) PASS
 C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

METHOD OF FAULT DETECTION:
 OBSERVATION - DELTA PRESSURE GAUGE AT EXTERNAL AIRLOCK AFT HATCH WOULD
 INDICATE PRESSURE IS NOT BEING EQUALIZED. PHYSICAL OBSERVATION - CREW
 UNABLE TO PHYSICALLY OPEN VALVE.

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:
 CREW COULD UTILIZE REDUNDANT EQUALIZATION VALVE TO EQUALIZE PRESSURE
 ACROSS HATCH. WHEN NO PRESSURIZED PAYLOAD IS INSTALLED, CREW COULD

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UTILIZE EXTERNAL AIRLOCK DEPRESSURIZATION VALVE TO EQUALIZE EXTERNAL AIRLOCK PRESSURE TO OUTSIDE PRESSURE. WHEN A PRESSURIZED PAYLOAD IS INSTALLED CREW COULD PERFORM THE FOLLOWING WORKAROUND FOLLOWING FAILURE OF SECOND EQUALIZATION VALVE DURING AN EVA: ANOTHER EVA CREWMEMBER WITHIN EXTERNAL AIRLOCK COULD DEPRESSURE EXTERNAL AIRLOCK USING THE DEPRESS VALVING WITHIN THIS AIRLOCK TO ALLOW OPENING OF THE AFT HATCH. ONCE ALL EVA CREWMEMBERS ARE INSIDE THE EXTERNAL AIRLOCK, BOTH THE AIRLOCK AND TUNNEL CAN BE REPRESSURIZED FOR CREW ENTRY INTO CREW CABIN.

REMARKS/RECOMMENDATIONS:

CRITICALITY OF THIS FAILURE MODE IS BASED ON THE WORST CASE EFFECT WHEN THERE IS A PRESSURIZED PAYLOAD INSTALLED AND EXTERNAL AIRLOCK AFT HATCH IS CLOSED DURING AN EVA. RECOMMEND THAT THE EXTERNAL AIRLOCK AFT HATCH BE REMOVED IF A PRESSURIZED PAYLOAD IS INSTALLED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NO EFFECT WHEN A PRESSURIZED PAYLOAD IS NOT INSTALLED SINCE EXTERNAL AIRLOCK AFT HATCH REMAINS CLOSED DURING NOMINAL MISSION. WHEN A PRESSURIZED PAYLOAD IS INSTALLED, FAILURE TO EQUALIZE PRESSURE ACROSS AFT HATCH COULD PRECLUDE IT'S OPENING.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT ON ORBITER INTERFACING SUBSYSTEMS.

(C) MISSION:

NO EFFECT UNTIL ALL MEANS OF EQUALIZING PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH ARE LOST. LOSING ALL PRESSURE EQUALIZATION CAPABILITIES WOULD PREVENT OPENING OF AFT HATCH RESULTING IN LOSS OF MISSION OBJECTIVES ASSOCIATED WITH: (1) THE INABILITY TO PERFORM A PLANNED EVA; OR (2) THE PRESSURIZED PAYLOAD (WHEN INSTALLED).

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

NO EFFECT UNTIL ALL MEANS OF EQUALIZING PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH ARE LOST. THEN INABILITY TO OPEN HATCH TO PERFORM A CONTINGENCY EVA OR TO RETURN FROM AN EVA COULD RESULT IN LOSS OF CREW AND/OR VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

IF A PRESSURIZED PAYLOAD IS NOT INSTALLED:
FIRST FAILURE (FIRST EQUALIZATION VALVE FAILS TO OPEN) - NO EFFECT.

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SECOND FAILURE (SECOND EQUALIZATION VALVE FAILS TO OPEN) - INABILITY TO EQUALIZE PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH USING EITHER EQUALIZATION VALVE.

THIRD FAILURE (EXTERNAL AIRLOCK MANUAL DEPRESSURIZATION VALVE FAILS TO OPEN) - LOSS OF CAPABILITY TO EQUALIZE PRESSURE BETWEEN EXTERNAL AIRLOCK AND OUTSIDE ATMOSPHERE. FAILURE TO EQUALIZE PRESSURE WILL PRECLUDE OPENING OF EXTERNAL AIRLOCK AFT HATCH RESULTING IN THE INABILITY TO PERFORM AN EVA. - CRITICALITY 2R3 CONDITION.

FOURTH FAILURE (FAILURE REQUIRING A CONTINGENCY EVA) - POSSIBLE LOSS OF CREW AND VEHICLE IF CONTINGENCY EVA IS REQUIRED TO CORRECT A CRIT 1 CONDITION. - CRITICALITY 1R3 CONDITION.

IF A PRESSURIZED PAYLOAD IS INSTALLED:

FIRST FAILURE (FIRST EQUALIZATION VALVE FAILS TO OPEN) - NO EFFECT.

SECOND FAILURE (SECOND EQUALIZATION VALVE FAILS TO OPEN) - INABILITY TO EQUALIZE PRESSURE ACROSS EXTERNAL AIRLOCK AFT HATCH WOULD LOSE CAPABILITY TO OPEN HATCH. IF SECOND FAILURE OCCURS:

PRIOR TO AN EVA - LOSS MISSION OBJECTIVES ASSOCIATED WITH A PLANNED EVA OR WITH A PRESSURIZED PAYLOAD. - CRITICALITY 2R3 CONDITION)

THIRD FAILURE (FAILURE REQUIRING A CONTINGENCY EVA) - POSSIBLE LOSS OF CREW AND VEHICLE IF CONTINGENCY EVA IS REQUIRED TO CORRECT A CRIT 1 CONDITION. - CRITICALITY 1R3 CONDITION.

DURING AN EVA - POSSIBLE LOSS OF EVA CREWMEMBERS IF HATCH CANNOT BE OPENED FOR CREW'S RETURN TO CREW CABIN. - CRITICALITY 1R2 CONDITION

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

FOR THE FOLLOWING TWO CASES: (1) WHEN A PRESSURIZED PAYLOAD IS NOT INSTALLED; AND (2) WHEN A PRESSURIZED PAYLOAD IS INSTALLED PRIOR TO AN EVA; ALL WORKAROUNDS HAVE ALREADY BEEN CONSIDERED WHEN DETERMINING CRITICALITY. FOR THE CASE WHEN A PRESSURIZED PAYLOAD IS INSTALLED AND BOTH EQUALIZATION VALVES FAIL TO OPEN, FOLLOWING AN EVA, FAILURE TO PERFORM THE WORKAROUND TO EQUALIZE PRESSURE ACROSS THE HATCH (THIRD FAILURE) COULD RESULT IN LOSS OF EVA CREWMEMBERS IF HATCH CANNOT BE OPENED FOR CREW'S RETURN INTO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN TUNNEL ADAPTER UNTIL LANDING.) - CRITICALITY 1R3 CONDITION.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: IMMEDIATE

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 OPEN REDUNDANT EQUALIZATION VALVE OR OPEN EXTERNAL AIRLOCK MANUAL DEPRESS VALVE (WHEN A PRESSURIZED PAYLOAD IS NOT INSTALLED) OR PERFORM WORKAROUND TO EQUALIZE PRESSURE ACROSS AFT HATCH BEFORE THE NEED FOR PERFORMING A CONTINGENCY EVA OR FOR THE EVA CREWMEMBER'S RETURN TO CREW CABIN BECAME CATASTROPHIC.


HAZARD REPORT NUMBER(S): ORBI 162. FF-09

HAZARD(S) DESCRIPTION:
INABILITY TO RETURN FROM EVA DUE TO AIRLOCK HATCH FAILURES AND / OR REPRESSURIZATION OF THE AIRLOCK (ORBI 162). INABILITY TO SAFELY PERFORM EVA (FF-09).

- APPROVALS -

SS & PAE
DESIGN ENGINEER

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: K. J. KELLY

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