

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

NUMBER: M8-1SS-E007-02

REVISION#: 2 04/08/97

SUBSYSTEM NAME: ECLSS - ARPCS

LRU: CAP, EQUALIZATION VALVE PRESSURE

CRITICALITY OF THIS

ITEM NAME: CAP, EQUALIZATION VALVE PRESSURE

FAILURE MODE: 1R3

FAILURE MODE:
LEAKAGE

MISSION PHASE: OO ON-ORBIT

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

CAUSE:

MECHANICAL SHOCK, VIBRATION, CORROSION, POROSITY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

A)

B)

N/A - 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 UPPER HATCH WOULD INDICATE LEAKAGE ONLY AFTER AN INTERNAL LEAKAGE FAILURE OF ASSOCIATED EQUALIZATION VALVE AND WHILE ORBITER AND SPACE STATION ARE NOT DOCKED.

CORRECTING ACTION: MANUAL

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CORRECTING ACTION DESCRIPTION:

NONE WHEN ORBITER/ISS ARE DOCKED SINCE UPPER HATCH IS OPEN. NO CREW ACTION REQUIRED UNTIL VALVE INTERNALLY LEAKS WHEN ORBITER/ISS ARE NOT DOCKED. THEN CREW COULD USE 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 THE ORBITER AND ISS ARE NOT DOCKED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF SECONDARY SEAL TO EQUALIZATION VALVE.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT UNTIL PRIMARY SEAL (EQUALIZATION VALVE) IS LOST. LOSS OF ISOLATION BETWEEN EXTERNAL AIRLOCK AND OUTSIDE ATMOSPHERE FOLLOWING INTERNAL LEAKAGE OF ASSOCIATED EQUALIZATION VALVE (WHEN ORBITER AND ISS ARE NOT DOCKED) COULD RESULT IN AN EXCESSIVE USE OF CONSUMABLES.

(C) MISSION:

NO EFFECT UNTIL PRIMARY SEAL (EQUALIZATION VALVE) IS LOST. THEN: IF VALVE FAILURE OCCURS: (1) PRIOR TO DOCKING WITH THE SPACE STATION - MISSION WOULD BE TERMINATED DUE TO EXCESSIVE LOSS OF CONSUMABLES; (2) WHEN ORBITER & SPACE STATION ARE DOCKED - INABILITY TO DEPRESSURIZE VESTIBULE TUNNEL FOR SEPARATION WITHOUT EFFECTING THE ODS VOLUMES; (3) WHEN ORBITER/SPACE STATION ARE NOT DOCKED - LOSS OF CAPABILITY TO PERFORM PLANNED EVA DUE TO INABILITY TO REPRESSURIZE EXTERNAL AIRLOCK FOR RETURNING TO THE CREW MODULE.

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

NO EFFECT UNTIL EQUALIZATION VALVE INTERNALLY LEAKS. THEN POSSIBLE LOSS OF CREW DURING NON-DOCKED IVA/EVA ACTIVITIES.

(E) FUNCTIONAL CRITICALITY EFFECTS:

FIRST FAILURE (PRESSURE CAP LEAKAGE) - NO EFFECT. LOSS OF SECONDARY SEAL ONLY.

SECOND ASSOCIATED FAILURE (EQUALIZATION VALVE INTERNAL LEAKAGE) IF OCCURS:

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DURING IVA (CAMERA PREPARATION FOR DOCKING) WHEN ORBITER/SPACE STATION ARE NOT DOCKED:

EXTERNAL LEAKAGE OF HABITABLE PRESSURE RESULTING IN AN INCREASED USE OF CONSUMABLES. - CRITICALITY 1R2 CONDITION

DURING EVA WHEN ORBITER/SPACE STATION ARE NOT DOCKED:

UNABLE TO MAINTAIN PRESSURE WITHIN EXTERNAL AIRLOCK FOR EVA CREWMEMBERS RETURN TO CREW CABIN. - CRITICALITY 1R2 CONDITION.

IF SECOND FAILURE OCCURS WHEN ORBITER/SPACE STATION ARE DOCKED:

POSSIBLE LOSS OF PRESSURE IN SPACE STATION IF ISOLATION BETWEEN EXTERNAL AIRLOCK AND SPACE STATION IS LOST DURING EVA AND IF EXTERNAL AIRLOCK IS DEPRESSURIZED.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

DURING IVA WHEN ORBITER/ISS ARE NOT DOCKED:

THIRD FAILURE (INABILITY TO UTILIZE OTHER EQUALIZATION VALVE CAPS) - UNABLE TO MAINTAIN PRESSURE WITHIN EXTERNAL AIRLOCK.

FOURTH FAILURE (INABILITY TO CLOG INLET OF EQUALIZATION VALVE REQUIRING SECONDARY LEAK PROTECTION) - UNABLE TO STOP

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 WHEN ORBITER/ISS ARE NOT DOCKED:

THIRD FAILURE (INABILITY TO UTILIZE OTHER EQUALIZATION VALVE CAPS) - UNABLE TO SEAL INTERNAL VALVE LEAKAGE USING THESE CAPS.

FOURTH FAILURE (INABILITY TO CLOG INLET OF EQUALIZATION VALVE REQUIRING SECONDARY LEAK PROTECTION) - 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.

- TIME FRAME -

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:
WHILE ORBITER AND SPACE STATION ARE NOT DOCKED, CREW WOULD HAVE ENOUGH TIME TO STOP LEAKAGE BY UTILIZING REDUNDANT CAP (FROM OTHER VALVES) OR CLOGGING INLET OF 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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