PRINT DATE: 03/19/97

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL HARDWARE
NUMBER:M8-1SS-E005 -X

SUBSYSTEM NAME: ECLSS - ARPCS

REVISION: 2 04/08/97

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:VALVE, NEGATIVE PRESS RELIEF CARELTON TECHNOLOGIES	MC250-0002-0075 2725-0001-3

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EXTERNAL AIRLOCK NEGATIVE PRESSURE RELIEF VALVE

QUANTITY OF LIKE ITEMS: 2
TWO

FUNCTION:
TWO VALVES MOUNTED FOR PARALLEL FLOW, EACH OF WHICH ALLOWS SUFFICIENT FLOW INTO THE ODS TO MAINTAIN THE ODS STRUCTURAL CRUSHING PRESSURE AT LESS THAN 0.5 PSID DURING DESCENT. EACH RELIEF VALVE CONTAINS A SEALING CAP INTEGRAL TO ITS ASSEMBLY. VALVES ARE MOUNTED ON THE EXTERNAL AIRLOCK BULKHEAD WITH A SINGLE O-RING SEAL PER VALVE.

REFERENCE DOCUMENTS: V828-341015
V828-341002

PRINT DATE: 03/19/97

FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE
NUMBER: M8-1SS-E005-03

REVISION#: 2 04/08/97

SUBSYSTEM NAME: ECLSS - ARPCS
LRU: VALVE, NEGATIVE PRESSURE RELIEF
ITEM NAME: VALVE, NEGATIVE PRESSURE RELIEF

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO CLOSE, INTERNAL LEAKAGE

MISSION PHASE:
OO ON-ORBIT
DO DE-ORBIT

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

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

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
A)

B)
N/A - NEGATIVE PRESSURE RELIEF VALVE AND CAP ARE IN STANDBY UNTIL REQUIRED.

C)

METHOD OF FAULT DETECTION:
NONE FOR FIRST FAILURE. SECOND ASSOCIATED FAILURE CAN BE DETECTED THROUGH INSTRUMENTATION/PHYSICAL OBSERVATION - LOSS OF PRESSURE IN ODS HABITABLE VOLUME. (INTERNAL LEAKAGE FAILURE MODE ONLY.) A FAILS TO CLOSE CONDITION OF THIS VALVE IS NOT DETECTABLE.

CORRECTING ACTION: MANUAL

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CORRECTING ACTION DESCRIPTION:
NONE FOR FIRST FAILURE SINCE CAP WILL PREVENT EXTERNAL LEAKAGE. IF CAP STARTS TO LEAK, CREW COULD REPLACE IT WITH THE CAP FROM THE REDUNDANT RELIEF VALVE DURING IVA OR EVA. IF CAP CANNOT BE REPLACED DURING IVA CREW COULD CLOSE APPROPRIATE HATCH(S) TO ISOLATE LEAKAGE. THERE IS NO WORKAROUND IF THIRD FAILURE OCCURS DURING AN EVA.

REMARKS/RECOMMENDATIONS:
VALVE CAP PROVIDES A REDUNDANT SEAL AGAINST AN INTERNAL LEAKAGE CONDITION OF THE VALVE. THE CRITICALITY AND EFFECTS SECTIONS ADDRESS THE WORST CASE SCENARIO OF AN INTERNAL LEAKAGE CONDITION. A VALVE HAS TO FIRST OPEN BEFORE IT CAN FAIL TO CLOSE AND THESE VALVES ARE NORMALLY OPEN DURING DESCENT WHEN A NEGATIVE DELTA-PRESSURE BETWEEN THE EXTERNAL AIRLOCK AND OUTSIDE EXISTS. A RELIEF VALVE FAILING TO CLOSE HAS NO EFFECT ON CREW SAFETY, VEHICLE PERFORMANCE, OR MISSION SUCCESS. THE INTERNAL LEAKAGE FAILURE MODE APPLIES ONLY DURING THE ON-ORBIT (OO) MISSION PHASE AND THE FAILS TO CLOSE FAILURE MODE APPLIES ONLY DURING THE DE-ORBIT (DO) MISSION PHASE. VALVE IS ACCESSIBLE FOR IN-FLIGHT MAINTENANCE.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF REDUNDANCY - RELIEF VALVE CAP REMAINS TO SEAL AGAINST LOSS OF EXTERNAL AIRLOCK ATMOSPHERE.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT FIRST FAILURE. RELIEF VALVE CAP WILL PROVIDE ADEQUATE PROTECTION AGAINST LOSS OF PRESSURIZATION WITHIN ODS AND SPACE STATION WHEN 576 BULKHEAD HATCH AND EXTERNAL AIRLOCK UPPER HATCH ARE OPEN.

(C) MISSION:
NO EFFECT FIRST AND SECOND FAILURE (RELIEF VALVE CAP LEAKAGE). POSSIBLE LOSS OF MISSION OBJECTIVES IF LEAKY CAP CANNOT BE REPLACED AND LEAKAGE OCCURS PRIOR TO DOCKING OR PRIOR TO COMPLETION OF IVA.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST AND SECOND FAILURE. FAILURE TO REPLACE A LEAKY CAP COULD JEOPARDIZE SAFETY OF CREW AND VEHICLE IF 576 BULHEAD HATCH CANNOT BE CLOSED DURING IVA OR EXTERNAL AIRLOCK CANNOT BE REPRESSURIZED FOLLOWING AN EVA.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE (VALVE INTERNAL LEAKAGE) - NO EFFECT.

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SECOND ASSOCIATED FAILURE (RELIEF CAP LEAKAGE) IF OCCURS:
DURING IVA - EXCESSIVE LOSS OF HABITABLE PRESSURE WITHIN ODS WITH 576 BULKHEAD HATCH OPEN. INCREASED USE OF CONSUMABLES WITHIN CREW CABIN. - CRITICALITY 1R2 CONDITION.
DURING EVA - INABILITY TO REPRESSURIZE EXTERNAL AIRLOCK FOR EVA CREWMEMBER'S RETURN TO CREW CABIN. - CRITICALITY 1R2 CONDITION.
POSSIBLE LOSS OF PRESSURE IN SPACE STATION IF SECOND FAILURE OCCURS WHILE EXTERNAL AIRLOCK UPPER HATCH IS OPEN.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
DURING IVA - THIRD FAILURE (INABILITY TO REPLACE CAP WITH CAP FROM REDUNDANT VALVE) - UNABLE TO CIRCUMVENT EXTERNAL LEAKAGE THROUGH THIS VALVE. CONTINUOUS LOSS OF CONSUMABLES.
FOURTH FAILURE (INABILITY TO CLOSE 576 BULKHEAD HATCH) - LOSS OF CAPABILITY TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE FROM CREW CABIN COULD RESULT IN LOSS OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.
DURING EVA - THIRD FAILURE (INABILITY TO REPLACE CAP WITH CAP FROM REDUNDANT VALVE) - INABILITY TO REPRESSURIZE EXTERNAL AIRLOCK FOR EVA CREWMEMBER'S 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: SECONDS

TIME FROM DETECTION TO COMPLETED CORRECTING ACTION: MINUTES

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 SUFFICIENT TIME TO REPLACE THE CRACKED CAP WITH THE CAP FROM THE GOOD PRESSURE RELIEF VALVE BEFORE PROBLEM BECOMES CATASTROPHIC.

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

HAZARD(S) DESCRIPTION:
EXTERNAL LEAKAGE OF CREW MODULE/ODS RESULTING IN LOSS OF HABITABLE ENVIRONMENT (ORBI 511). INABILITY TO RETURN FROM EVA DUE TO AIRLOCK HATCH FAILURES AND / OR REPRESSURIZATION OF THE AIRLOCK (ORBI 162).

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- APPROVALS -

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