

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER: M8-1SS-E037 -X**

SUBSYSTEM NAME: ECLSS - EMU LIQUID COOLING SYSTEM

REVISION: 1

10/22/97

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:LINES & FITTINGS	M072-643401
LRU	:LINES & FITTINGS	M072-643403
LRU	:LINES & FITTINGS	V828-643050
SRU	:LINES & FITTINGS MULTIPLE SOURCES	MULTIPLE P/N'S

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

EMU LIQUID COOLING SUPPLY/RETURN LINES, FEEDTHRU'S, QUICK DISCONNECTS, FITTINGS, AND COUPLINGS

QUANTITY OF LIKE ITEMS: 1
ONE SET PER SUBSYSTEM

FUNCTION:

PROVIDES TWO INDEPENDENT SUPPLY AND RETURN PATHS OF LIQUID COOLANT BETWEEN THE MID DECK FLUID CONNECTIONS AND EXTERNAL AIRLOCK EMU INTERFACE FOR COOLING EMU'S.

REFERENCE DOCUMENTS:

- VS28-643001
- V828-643050
- V828-643051
- M072-643403

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

NUMBER: M8-1SS-E037-01

REVISION#: 0 04/08/97

SUBSYSTEM NAME: ECLSS - EMU LIQUID COOLING SYSTEM

LRU: EMU LIQUID COOLING SUPPLY/RETURN LINES

CRITICALITY OF THIS

ITEM NAME: LINES, FEEDTHRU'S, QD'S, & FITTINGS

FAILURE MODE: 1R3

FAILURE MODE:
EXTERNAL LEAKAGE

MISSION PHASE: OO ON-ORBIT

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

CAUSE:
CORROSION, MECHANICAL SHOCK, VIBRATION, MATERIAL DEFECT, FATIGUE

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:
VISUAL OBSERVATION - WATER BUILDUP IN HABITABLE AREAS.
INSTRUMENTATION - EMU LIQUID COOLING PRESSURE ANOMALY IN AFFECTED COOLANT LOOP.

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:
IF FAILURE OCCURS IN THE SUPPLY PATH, CREW COULD SHUT OFF LIQUID COOLANT TO AFFECTED COOLANT LOOP UPSTREAM OF THE MID DECK CONNECTIONS. IF FAILURE OCCURS IN THE RETURN PATCH, CREW COULD CONTINUE TO UTILIZE

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AFFECTED COOLANT LOOP DEPENDING ON MAGNITUDE OF LEAKAGE OR STOP LEAKAGE IN RETURN PATH BY DISCONNECTING THE EMU ON AFFECTED COOLANT LOOP. IN EITHER CASE, CREW CAN THEN UTILIZE REDUNDANT COOLANT LOOP TO COOL EMU'S.

REMARKS/RECOMMENDATIONS:

EACH COOLANT LOOP IS DEDICATED TO A SINGLE EMU. A PLANNED EVA REQUIRES THE USE OF A MINIMUM OF THREE EMU'S (FOR THREE EVA CREWMEMBERS) WHILE A CONTINGENCY EVA REQUIRES A MINIMUM OF TWO EMU'S (FOR TWO EVA CREWMEMBERS).

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LIQUID COOLANT ON AFFECTED LOOP: (1) SUPPLY PATH IS DIVERTED BEFORE IT REACHES AFFECTED EMU; OR (2) RETURN PATH IS DIVERTED BEFORE IT REACHES THE ORBITER LIQUID COOLING SYSTEM.

(B) INTERFACING SUBSYSTEM(S):

POSSIBLE INCREASED USE OF LIQUID COOLANT. POTENTIAL FOR WATER BUILDUP IN EXTERNAL AIRLOCK, PAYLOAD BAY, OR MID DECK DEPENDING ON LOCATION OF LEAKAGE. INABILITY TO COOL EMU USING AFFECTED COOLANT LOOP.

(C) MISSION:

COOLING OF EMU'S FROM A SINGLE PORT WOULD RESULT IN PREPARING ONLY ONE EMU AT A TIME FOR EVA. LOSS OF PLANNED EVA CAPABILITIES FOLLOWING SIMILAR FAILURE IN REDUNDANT LOOP RESULTING IN LOSS OF MISSION OBJECTIVES ASSOCIATED WITH A PLANNED EVA.

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

INABILITY TO PERFORM CONTINGENCY EVA FOLLOWING SECOND FAILURE COULD RESULT IN LOSS OF CREW AND VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

FIRST FAILURE (EXTERNAL LEAKAGE OF ONE LIQUID COOLANT LOOP) - INABILITY TO COOL EMU FROM ONE PORT RESULTING IN ONLY ONE EMU PORT AVAILABLE FOR EMU SERVICING. NO EFFECT, REDUNDANT LOOP PROVIDED.
SECOND FAILURE (EXTERNAL LEAKAGE OF SECOND LIQUID COOLANT LOOP) - LOSS OF CAPABILITY TO UTILIZE ALL EMU'S RESULTING IN LOSS OF EVA CAPABILITIES. - CRITICALITY 2R3 CONDITION.
THIRD FAILURE (FAILURE NECESSITATING AN EVA TO PREVENT A POTENTIAL CATASTROPHIC SITUATION) - INABILITY TO PERFORM CONTINGENCY EVA TO CORRECT A CRIT 1 CONDITION COULD RESULT IN LOSS OF CREW AND VEHICLE - CRITICALITY 1R3 CONDITION.

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DESIGN CRITICALITY (PRIOR TO DOWNGRADE, DESCRIBED IN (F)): 1R3

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

NONE. ALL REDUNDANCY HAS ALREADY BEEN CONSIDERED IN DETERMINING THE 1R3 CRITICALITY OF THIS FAILURE MODE.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS

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 UTILIZE REDUNDANT COOLANT LOOP TO SERVICE ALL EMU'S BEFORE PROBLEM BECOMES CATASTROPHIC.

HAZARD REPORT NUMBER(S): FF-09

HAZARD(S) DESCRIPTION:

INABILITY TO SAFELY PERFORM EVA.

- APPROVALS -

SS & PAE
DESIGN ENGINEER

: M. W. GUENTHER
: K. J. KELLY

: *M. W. Guenther*
: *K. J. Kelly*