

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER:M8-1SS-E039 -X**

**SUBSYSTEM NAME: ECLSS - EMU POTABLE & WASTE WATER SYSTEM
REVISION: 2 02/12/98**

PART DATA

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

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
EMU POTABLE WATER SUPPLY LINES AND FITTINGS**

**QUANTITY OF LIKE ITEMS: 1
ONE SET PER SUBSYSTEM**

**FUNCTION:
PROVIDES A SINGLE SUPPLY PATH OF POTABLE WATER FROM A MID DECK FLUID
CONNECTION TO THE MID DECK SHUTOFF VALVE. WATER IS USED FOR DRINKING
AND EMU COOLING PURPOSES.**

**REFERENCE DOCUMENTS: VS28-643001
V828-643051**

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE
NUMBER: M8-1SS-E039-01

REVISION#: 1 04/17/98

SUBSYSTEM NAME: ECLSS - EMU POTABLE & WASTE WATER SYSTEM
 LRU: EMU POTABLE WATER SUPPLY LINES
 ITEM NAME: LINES & FITTINGS

CRITICALITY OF THIS
 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, EXCESSIVE VIBRATION, MATERIAL DEFECT,
 FATIGUE

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) PASS
B) N/A
C) PASS

PASS/FAIL RATIONALE:

A)

B)

N/A - REDUNDANCY IS IN STANDBY UNTIL REQUIRED.

C)

METHOD OF FAULT DETECTION:

VISUAL OBSERVATION - WATER BUILDUP WITHIN MID DECK AREA.
 INSTRUMENTATION - REDUCED OR LOSS OF POTABLE WATER PRESSURE INDICATION
 ON THE AWB2D PANEL PRESSURE GAUGE. REDUCED OR LOSS OF WATER PRESSURE
 TO EMU'S CAN ALSO BE OBTAINED FROM THE ISSA POTABLE WATER SUPPLY
 PRESSURE TRANSDUCER.

CORRECTING ACTION: MANUAL

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CORRECTING ACTION DESCRIPTION:

CREW COULD SHUT OFF POTABLE WATER SUPPLY BY DISCONNECTING THE QD LOCATED AT THE MICROBIAL CHECK VALVE OR BY CLOSING SELECTIVE ORBITER WATER TANK ISOLATION VALVES. THEN CREW COULD UTILIZE AN EMU THAT CONTAINS WATER TO PERFORM AN EVA. AN EXTERNAL LEAKAGE OF POTABLE WATER WITHIN MID DECK COULD BE STOPPED BY CUTTING OUT THE AFFECTED LINE AND SPLICING IN A SECTION OF FLEXIBLE HOSE (FLEXIBLE HOSE & CLAMPS ARE PART OF A CONTINGENCY KIT). TO REDUCE THE USE OF EMU POTABLE WATER CREW COULD MANEUVER ORBITER/ISS SUCH THAT EVA CREWMEMBERS ARE NOT EXPOSED TO THE SUN DURING AN EVA. SINCE THIS FAILURE WOULD RESULT IN LOSS OF POTABLE WATER TRANSFER TO EMU'S AND ISS, CREW COULD EITHER: (1) TAP OFF POTABLE WATER IN THE GALLEY FOR USE BY THE EMU'S AND FOR TRANSFER TO ISS; OR (2) TRANSFER BOTTLES OF POTABLE WATER FROM ORBITER TO ISS.

REMARKS/RECOMMENDATIONS:

THIS WATER IS USED FOR EMU DRINKING AND COOLING PURPOSES AND FOR TRANSFER TO SPACE STATION. THE EMU POTABLE WATER TANK IS FULL PRIOR TO LAUNCH. POTABLE WATER PRESSURE IS LOW.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

POTABLE WATER SUPPLY IS DIVERTED BEFORE IT REACHES THE SHUTOFF VALVE.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT FIRST FAILURE. INCREASED USE OF POTABLE WATER FOLLOWING FIFTH FAILURE COULD POTENTIALLY DRAIN ORBITER FLASH EVAP SYSTEM. POTENTIAL FOR WATER BUILDUP IN CREW CABIN MID DECK. NO INITIAL EFFECT - LOSS OF POTABLE WATER SUPPLY COULD RESULT IN LOSS OF EVA CAPABILITIES SUBSEQUENT TO FIRST EVA SINCE WATER IS NOT AVAILABLE TO COOL BOTH EMU'S.

(C) MISSION:

NO INITIAL EFFECT. WORST CASE, LOSS OF CAPABILITY TO PERFORM A SECOND PLANNED EVA DUE TO LOSS OF POTABLE WATER TO ALL EMU'S. LOSS OF MISSION OBJECTIVES ASSOCIATED WITH PLANNED EVA'S SUBSEQUENT TO INITIAL EVA. LOSS OF POTABLE WATER TO STATION FOLLOWING FOUR FAILURES WOULD RESULT IN LOSS OF MISSION OBJECTIVES ASSOCIATED WITH ISS WATER TRANSFER.

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

NO EFFECT FIRST FAILURE. LOSS OF POTABLE WATER FOR USE BY EMU'S, WHEN REQUIRED, WOULD LOSE CONTINGENCY EVA CAPABILITIES RESULTING IN LOSS OF CREW AND VEHICLE. INADVERTENT DRAINING OF ORBITER FLASH EVAP SYSTEM FOLLOWING FOURTH FAILURE COULD RESULT IN LOSS OF CREW AND VEHICLE.

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(E) FUNCTIONAL CRITICALITY EFFECTS:

LOSS OF ORBITER FLASH EVAP SYSTEM:

FIRST FAILURE (EXTERNAL LEAKAGE OF POTABLE WATER) - INADVERTENT DRAINING OF WATER FROM ORBITER FLASH EVAP SYSTEM. UNABLE TO NOMINALLY STOP INADVERTENT DRAINING OF WATER FROM ORBITER FLASH EVAP SYSTEM WITHOUT PERFORMING A WORKAROUND. - CRITICALITY 1/1 CONDITION

LOSS OF CONTINGENCY EVA CAPABILITIES:

FIRST FAILURE (EXTERNAL LEAKAGE OF POTABLE WATER) - WORST CASE IF FAILURE OCCURS FOLLOWING AN INITIAL EVA. THEN LOSS OF WATER SUPPLY FOR COOLING ALL EMU'S WOULD PRECLUDE SUBSEQUENT EVA CAPABILITIES. POTENTIAL LOSS OF CONTINGENCY EVA OPERATIONS. - CRITICALITY 1R2 CONDITION.

LOSS OF WATER TRANSFER TO STATION:

FIRST FAILURE (EXTERNAL LEAKAGE OF POTABLE WATER) - WATER IS DIVERTED AWAY FROM SPACE STATION. LOSS OF MISSION OBJECTIVES ASSOCIATED WITH ISS WATER TRANSFER. - CRITICALITY 2/2 CONDITION

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

LOSS OF ORBITER FLASH EVAP SYSTEM:

SECOND FAILURE (UNABLE TO PERFORM WORKAROUND TO DISCONNECT QD) - UNABLE TO STOP INADVERTENT DRAINING OF ORBITER FLASH EVAP SYSTEM USING THIS QD.

THIRD FAILURE (INABILITY TO BYPASS LEAK USING FLEX LINE) - UNABLE TO STOP INADVERTENT DRAINING OF ORBITER FLASH EVAP SYSTEM USING THIS WORKAROUND.

FOURTH FAILURE (UNABLE TO STOP FLOW OF WATER TO AIRLOCK BY CLOSING APPROPRIATE ORBITER TANK ISOLATION VALVES) - UNABLE TO PERFORM WORKAROUND TO ISOLATE EXTERNAL LEAKAGE OF WATER FROM ORBITER POTABLE & SUPPLY WATER SYSTEM. CONTINUOUS DRAINING OF ORBITER FLASH EVAP SYSTEM COULD RESULT IN POTENTIAL LOSS OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.

LOSS OF CONTINGENCY EVA CAPABILITIES:

SECOND FAILURE (INABILITY TO BYPASS LEAK USING FLEX LINE) - UNABLE TO STOP EXTERNAL LEAKAGE OF POTABLE WATER.

THIRD FAILURE (INABILITY TO TAP POTABLE WATER FROM GALLEY) - UNABLE TO RESTORE WATER FLOW TO EMU SERVICE PANEL.

FOURTH FAILURE (UNABLE TO PERFORM WORKAROUND TO MANEUVER ORBITER/ISS) - EVA CREWMEMBERS WOULD BE EXPOSED TO THE SUN DURING AN EVA REQUIRING EMU SUBLIMATORS TO BE ON RESULTING IN AN INCREASED USE OF EMU POTABLE WATER. LOSS OF POTABLE WATER SUPPLY TO EMU'S WOULD PRECLUDE SUBSEQUENT EVA'S.

FIFTH 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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LOSS OF WATER TRANSFER TO STATION:
SECOND FAILURE (INABILITY TO BYPASS LEAK USING FLEX LINE) - UNABLE TO RESTORE WATER FLOW TO SPACE STATION.
THIRD FAILURE (INABILITY TO TAP POTABLE WATER FROM GALLEY) - LOSS OF WATER TRANSFER TO SPACE STATION USING EXTERNAL FLEXIBLE HOSE.
FOURTH FAILURE (INABILITY TO TRANSFER POTABLE WATER BOTTLES) - LOSS OF ALL POTABLE WATER TRANSFER CAPABILITIES TO STATION RESULTING IN LOSS OF RELATED MISSION OBJECTIVES. - CRITICALITY 2R3 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 WOULD HAVE SUFFICIENT TIME TO STOP EXTERNAL LEAKAGE OF POTABLE WATER OR MANEUVER ORBITER/ISS SUCH THAT EVA CREWMEMBERS ARE NOT EXPOSED TO THE SUN BEFORE LOSS OF EMU POTABLE WATER BECOMES CATASTROPHIC OR PERFORM ALTERNATE MEANS OF TRANSFERRING POTABLE WATER TO THE STATION BEFORE TRANSFER LOSS BECOMES CRITICAL TO COMPLETING MISSION OBJECTIVES.

HAZARD REPORT NUMBER(S): ORBI 276, FF-09

HAZARD(S) DESCRIPTION:
LOSS OF FLASH EVAPORATION FUNCTION (ORBI 276), INABILITY TO SAFELY PERFORM EVA (FF-09).

- APPROVALS -

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