

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER:M8-1SS-E057 -X**

SUBSYSTEM NAME: ECLSS - ISS OXYGEN TRANSFER SYSTEM

REVISION: 1 10/22/97

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:LINES & FITTINGS	V828-643051
LRU	:LINES & FITTINGS	M072-643416
LRU	:LINES & FITTINGS	ME276-0054-1001
SRU	:LINES & FITTINGS MULTIPLE SOURCES	MULTIPLE P/N'S

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
ISS OXYGEN TRANSFER LINES, FITTINGS, & QUICK DISCONNECTS**

**QUANTITY OF LIKE ITEMS: 15
FIFTEEN**

FUNCTION:

PROVIDES A SINGLE SUPPLY PATH OF OXYGEN FROM THE EVA MANUAL O2 SHUTOFF VALVE, LOCATED WITHIN THE PAYLOAD BAY, TO A QUICK DISCONNECT LOCATED AT THE DOCKING BASE/PMA INTERFACE. OXYGEN LINES BETWEEN THE EMU OXYGEN LINE AND DOCKING BASE ARE MOUNTED OUTSIDE OF THE EXTERNAL AIRLOCK. OXYGEN LINES THAT EXTEND FROM THE DOCKING BASE BULKHEAD TO THE ISS ARE ROUTED INSIDE THE DOCKING BASE AND ISS PMA.

REFERENCE DOCUMENTS: V076-643036
VS28-643001
M072-643416

**FAILURE MODES EFFECTS ANALYSIS FMEA -- NON-CIL FAILURE MODE
NUMBER: M8-1SS-E057-01**

REVISION#: 0 04/08/97

SUBSYSTEM NAME: ECLSS - ISS OXYGEN TRANSFER SYSTEM
LRU: ISS OXYGEN TRANSFER LINES
ITEM NAME: LINES, QUICK DISCONNECTS, & FITTINGS

CRITICALITY OF THIS
FAILURE MODE: 1R3

FAILURE MODE:
EXTERNAL LEAKAGE (GROSS)

MISSION PHASE: OO ON-ORBIT

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

CAUSE:
CORROSION, MECHANICAL SHOCK, EXCESSIVE VIBRATION

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:

NONE UNTIL THE UPSTREAM MID DECK OXYGEN SHUTOFF VALVE IS OPEN. THEN EXTERNAL LEAKAGE OF OXYGEN CAN BE DETECTED THROUGH INSTRUMENTATION - REDUCED OR LOSS OF EMU OXYGEN PRESSURE INDICATION ON THE AWB2D PANEL PRESSURE GAUGE AND OR THE ORBITER CRT OR A BY A DROP IN ORBITER OXYGEN PRESSURE.

CORRECTING ACTION: MANUAL

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CORRECTING ACTION DESCRIPTION:

CREW COULD CLOSE OXYGEN SHUTOFF VALVE LOCATED IN THE MID DECK OR PERFORM ORBITER O2 LEAK ISOLATION TO STOP LEAKAGE IF LEAKAGE CANNOT BE STOPPED BY THE SHUTOFF VALVE. IF REQUIRED, CREW COULD THEN UTILIZE AN EMU THAT CONTAINS A SUFFICIENT AMOUNT OF OXYGEN TO PERFORM AN EVA. CREW COULD ALSO PERFORM AN EVA TO CLOSE THE EXTERNAL MANUAL O2 VALVE WHICH WILL STOP AN EXTERNAL LEAKAGE OF OXYGEN IN THESE LINES/FITTINGS/QD'S.

REMARKS/RECOMMENDATIONS:

A SINGLE PATH PROVIDES OXYGEN TO THE ISS FROM THE ORBITER GO2 SYSTEM. OXYGEN LINES DOWNSTREAM OF OXYGEN SHUTOFF VALVE ARE NOT PRESSURIZED UNTIL OXYGEN TRANSFER TO ISS TAKES PLACE. GO2 TRANSFER CAN OCCUR DURING SLEEP CYCLES, DURING CREW OR CARGO TRANSFERS BETWEEN ORBITER AND ISS, OR DURING EVA ACTIVITY. CLOSING ORBITER EMERGENCY OXYGEN VALVING TO TERMINATE LEAKAGE IS A CRITICALITY 1/1 CONDITION.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

OXYGEN SUPPLY IS DIVERTED AWAY FROM THE EMU ECLSS PANEL AND SPACE STATION.

(B) INTERFACING SUBSYSTEM(S):

INCREASED USE OF OXYGEN. POSSIBLE HIGH OXYGEN PRESSURE IN DOCKING BASE/PMA AREA IF A LEAK FROM AN INTERNAL LINE/QUICK DISCONNECT/FITTING IS NOT ISOLATED. POSSIBLE FLAMMABILITY VIOLATION. POTENTIAL LOSS OF EMERGENCY O2 SYSTEM DUE TO EXCESSIVE OXYGEN LEAKAGE. CLOSING UPSTREAM O2 SHUTOFF VALVE TO ISOLATE LEAKAGE WILL LOSE OXYGEN SUPPLY FOR RECHARGING EMU'S RESULTING IN LOSS OF EVA CAPABILITIES.

(C) MISSION:

CREW DECISION TO ABORT MISSION WOULD RESULT IN LOSS OF MISSION OBJECTIVES. LES/AIRLOCK O2 SUPPORT HAS BEEN LOST IF LEAKAGE IS SIGNIFICANT. CABIN O2 MAKEUP CAPABILITY IS STILL AVAILABLE.

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

AN UNCONTROLLED GROSS EXTERNAL LEAKAGE COULD RESULT IN INADEQUATE O2 SUPPLY TO LES STATIONS AND SPACE STATION. LOSS OF LES SUPPORT CAPABILITY MAY RESULT IN LOSS OF CREW IF UNCONTROLLED LEAK RATE PROHIBITS LES SYSTEM PRESSURIZATION AND LES IS REQUIRED. LOSS OF O2 TO EMU'S COULD RESULT IN LOSS OF CAPABILITY TO PERFORM CONTINGENCY EVA. LOSS OF O2 SUPPLY TO ISS COULD IMPACT SPACE STATION OPERATIONS. POTENTIAL FOR CREW INJURY OR LOSS DUE TO A HIGH PRESSURE JET FROM AN EXPOSED GO2 LINE PIN HOLE LEAK DURING IVA OR EVA.

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(E) FUNCTIONAL CRITICALITY EFFECTS:

LOSS OF EMERGENCY OXYGEN SYSTEM

(1A) FIRST FAILURE (EXTERNAL LEAKAGE OF A LINE, FITTING, OR QUICK DISCONNECT) - OXYGEN IS DIVERTED OUT LEAKY LINE/FITTING/QD RESULTING IN AN INADEQUATE O2 SUPPLY TO LES STATIONS.

(2A) SECOND FAILURE (FAILURE THAT REQUIRED THE LES TO BE USED) - LOSS OF ORBITER OXYGEN SUPPLY RESULTING IN POTENTIAL LOSS OF CREW AND VEHICLE. - CRITICALITY 1R2 CONDITION.

INABILITY TO PERFORM CONTINGENCY EVA

(1B) FIRST FAILURE (EXTERNAL LEAKAGE OF A LINE, FITTING, OR QUICK DISCONNECT) - OXYGEN IS DIVERTED AWAY FROM EMU PANEL. LOSS OF O2 TO EMU'S COULD RESULT IN LOSS OF EVA CAPABILITIES IF EMU O2 TANKS ARE EMPTY. CREW DECISION TO ABORT MISSION WOULD RESULT IN LOSS OF MISSION OBJECTIVES - CRITICALITY 2/2 CONDITION.

(2B) SECOND FAILURE (FAILURE NECESSITATING AN EVA TO PREVENT A POTENTIAL CATASTROPHIC SITUATION) - INABILITY TO PERFORM A CONTINGENCY EVA TO CORRECT A CRIT 1 CONDITION COULD RESULT IN LOSS OF CREW AND VEHICLE - CRITICALITY 1R2 CONDITION.

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

LOSS OF EMERGENCY OXYGEN SYSTEM

(3A) THIRD FAILURE (INABILITY TO CLOSE O2 SHUTOFF VALVE) - CONTINUOUS DEPLETION OF ORBITER OXYGEN.

(4A) FOURTH FAILURE (INABILITY TO CLOSE EVA MANUAL O2 VALVE) - GROSS EXTERNAL LEAKAGE RESULTS IN INADEQUATE O2 SUPPLY TO LES STATIONS. LOSS OF LES SUPPORT CAPABILITY MAY RESULT IN LOSS OF CREW IF LEAK RATE PROHIBITS LES SYSTEM PRESSURIZATION AND LES IS REQUIRED. NOTE - IN AN 8.0 PSIA HOLE IN CABIN CONTINGENCY MODE, AN EXTERNAL LEAK ALLOWING FLOW INTO THE CABIN MAY NOT BE CATASTROPHIC SINCE THERE IS A POSSIBILITY OF SAFELY BREATHING CABIN AIR, INTO WHICH THE O2 IS LEAKING, BY RAISING LES VISOR. WORST CASE FAILURE WOULD BE IN CASE OF CONTAMINATED CABIN ATMOSPHERE, WHEN LEAKAGE PREVENTS ADEQUATE FLOW TO LES STATIONS AND CABIN AIR MAY NOT BE SAFE FOR BREATHING. - CRITICALITY 1R3 CONDITION.

INABILITY TO PERFORM CONTINGENCY EVA

(3B) CREW COULD TEMPORARILY OPEN THE MID DECK O2 SHUTOFF VALVE TO SERVICE THE EMU'S, IF REQUIRED, TO PERFORM AN EVA TO CLOSE THE MANUAL SHUTOFF VALVE. FAILURE TO CLOSE THIS VALVE WOULD RESULT IN LOSS OF CONTINGENCY EVA CAPABILITIES. POSSIBLE LOSS OF CREW AND VEHICLE IF CONTINGENCY EVA IS REQUIRED TO CORRECT A CRIT 1 EVENT. - CRITICALITY 1R3 CONDITION.

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- 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 AMPLE TIME TO STOP OXYGEN LEAKAGE BEFORE A GROSS
OXYGEN LEAK BECAME CATASTROPHIC.

HAZARD REPORT NUMBER(S): ORBI 270, ORBI 299, ORBI 404, ORBI 405, FF-09

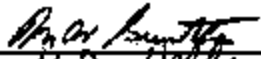
HAZARD(S) DESCRIPTION:

INABILITY TO SUPPLY O2 TO CABIN/CREW (ORBI 270). FLAMMABILITY THREAT IN THE
CABIN DUE TO O2 LEAKAGE FROM AIR REVITALIZATION PRESSURE CONTROL SYSTEM
(ARPCS) OR OTHER SYSTEM (ORBI 299). IVA CREW HAZARDS DUE TO ISS ODS: HIGH
PRESSURE LEAK JETS IN GO2 LINES (ORBI 404). EVA CREW HAZARDS DUE TO ISS ODS:
HIGH PRESSURE LEAK JETS IN GO2 LINES (ORBI 405). INABILITY TO SAFELY PERFORM
EVA (FF-09).

- APPROVALS -

SS & PAE
DESIGN ENGINEER

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

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