

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER:M8-1SS-E058 -X**

**SUBSYSTEM NAME: ECLSS - ISS OXYGEN TRANSFER SYSTEM
REVISION: 0 04/08/97**

PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:VALVE, O2 MANUAL SHUTOFF CARLETON TECHNOLOGIES	MC250-0004-0006 1-4-00-51-27

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
ISS OXYGEN TRANSFER EVA MANUAL SHUTOFF VALVE**

**QUANTITY OF LIKE ITEMS: 1
ONE**

FUNCTION:

PROVIDES A QUICK MEANS OF SHUTTING OFF OXYGEN FLOW TO THE SPACE STATION PRIOR TO PHYSICALLY CUTTING THE EXTERNAL RIGID O2 LINE DURING AN EMERGENCY SEPARATION EVA. DURING THIS EVA THE CREW HAS TO REMOVE THE 86 BOLTS AND CUT THE O2/N2 LINES AND ELECTRICAL CABLES TO ENABLE ORBITER/ISS SEPARATION. VALVE IS MOUNTED TO THE OUTSIDE OF THE EXTERNAL AIRLOCK UPPER CYLINDER AND IS MANUALLY OPERATED. VALVE IS NORMALLY OPEN DURING THE ENTIRE MISSION AND ONLY CLOSED DURING AN EMERGENCY SEPARATION.

REFERENCE DOCUMENTS: V828-643051

FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

NUMBER: M8-1SS-E058-02

REVISION#: 0 04/08/97

SUBSYSTEM NAME: ECLSS - ISS OXYGEN TRANSFER SYSTEM

LRU: ISS O2 TRANSFER EVA MANUAL SHUTOFF VALVE

CRITICALITY OF THIS

ITEM NAME: VALVE, ISS EVA MANUAL O2 SHUTOFF

FAILURE MODE: 1R3

FAILURE MODE:

FAILS TO CLOSE, INTERNAL LEAKAGE

MISSION PHASE: OO ON-ORBIT
DO DE-ORBITVEHICLE/PAYLOAD/KIT EFFECTIVITY: 103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR**CAUSE:**

CONTAMINATION, CORROSION, MECHANICAL SHOCK, EXCESSIVE VIBRATION, PHYSICAL BINDING/JAMMING, MATERIAL DEFECT, SEAL MATERIAL DEGRADATION

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:

FAILS TO CLOSE FAILURE MODE: INSTRUMENTATION - AN OXYGEN PRESSURE INDICATION ON DOCKING BASE GO2 PANEL PRESSURE GAUGE OR AN ORBITER OXYGEN SUPPLY DEPLETION INDICATION.

INTERNAL LEAKAGE FAILURE MODE: NONE UNTIL SERIES UPSTREAM VALVES INTERNALLY LEAK AND A DOWNSTREAM EXTERNAL LEAK OCCURS. THEN FAILURE CAN BE DETECTED THROUGH INSTRUMENTATION BY AN INCREASE USE IN O2 CONSUMABLES.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1SS-E058-02**

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:

FAILS TO CLOSE FAILURE MODE: CREW COULD CLOSE UPSTREAM O2 SHUTOFF VALVE. FAILURE TO CLOSE THIS VALVE, FOLLOWING A DOWNSTREAM LEAK, WOULD REQUIRE ORBITER O2 LEAK ISOLATION TROUBLESHOOTING PRIOR TO CUTTING EXTERNAL OXYGEN RIGID LINE.

INTERNAL LEAKAGE FAILURE MODE: NONE. THE CLOSED UPSTREAM O2 SHUTOFF VALVE PROVIDES REDUNDANCY AGAINST AN INTERNAL LEAKAGE FAILURE MODE. SUBSEQUENT INTERNAL LEAKAGE OF THIS VALVE AND EXTERNAL LEAKAGE OF A COMPONENT DOWNSTREAM OF THIS VALVE WOULD REQUIRE ORBITER O2 LEAK ISOLATION TROUBLESHOOTING.

REMARKS/RECOMMENDATIONS:

THIS VALVE, WHICH IS MANUALLY OPERATED, IS ONLY CLOSED DURING AN EMERGENCY SEPARATION WHEN THE 96 BOLTS HOLDING THE DOCKING BASE TO THE EXTERNAL AIRLOCK ARE REMOVED. A MINIMUM OF TWO FAILURES ARE REQUIRED BEFORE THE 96 BOLTS ARE REMOVED TO ENABLE SEPARATION. THE DOWNSTREAM RIGID O2 LINE IS CUT AFTER THE SHUTOFF VALVE IS CLOSED. OTHER SERIES CLOSED OXYGEN CONTROL VALVES PROVIDE REDUNDANCY AGAINST AN INTERNAL LEAKAGE FAILURE MODE OF THE SHUTOFF VALVE WHEN IT IS CLOSED. RECOMMEND THAT THE DOWNSTREAM RIGID LINE BE PINCHED CLOSED, PRIOR TO BEING CUT, TO MINIMIZE THE AMOUNT OF OXYGEN LEAKAGE IN THE EVENT ALL UPSTREAM SERIES VALVES CANNOT BE CLOSED.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ISOLATION BETWEEN THE MID DECK O2 SHUTOFF VALVE AND COMPONENTS DOWNSTREAM OF EVA MANUAL VALVE.

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT UNTIL OXYGEN FLOW TO THE SPACE STATION CANNOT BE TERMINATED USING OTHER SERIES VALVES. THEN RIGID O2 LINE WILL HAVE TO BE CUT, WHILE PRESSURIZED, TO ENABLE EMERGENCY SEPARATION RESULTING IN AN EXTERNAL LEAKAGE OF OXYGEN. CLOSING OF UPSTREAM MID DECK O2 SHUTOFF VALVE TO CIRCUMVENT THIS FAILURE WOULD LOSE OXYGEN FLOW TO THE EMU SERVICING PANEL RESULTING IN LOSS OF SUBSEQUENT EVA CAPABILITIES.

(C) MISSION:

NO EFFECT SINCE THE MISSION IS ALREADY LOST WHEN CLOSING OF THIS VALVE IS REQUIRED.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1SS-E058-02**

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

NO EFFECT UNTIL EMERGENCY EVA SEPARATION IS REQUIRED AND DOWNSTREAM MID DECK O2 SHUTOFF VALVE CANNOT BE CLOSED. THEN INABILITY OF ORBITER TO ISOLATE THIS LEAK COULD RESULT IN INADEQUATE O2 SUPPLY TO LES STATIONS. LOSS OF LES SUPPORT CAPABILITY MAY RESULT IN LOSS OF CREW IF UNCONTROLLED LEAK RATE PROHIBITS LES SYSTEM PRESSURIZATION AND LES IS REQUIRED. CLOSING OF MID DECK O2 SHUTOFF VALVE TO CIRCUMVENT THIS FAILURE WOULD LOSE OXYGEN SUPPLY FOR SERVICING EMU'S RESULTING IN LOSS OF SUBSEQUENT EVA CAPABILITIES. IF A SECOND EVA IS REQUIRED TO CORRECT A CRIT 1 CONDITION, INABILITY TO PERFORM THIS EVA COULD JEOPARDIZE THE SAFETY OF CREW AND VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

LOSS OF EMERGENCY OXYGEN SYSTEM

(1A) FIRST FAILURE (EXTERNAL LEAKAGE OF A LINE, FITTING, OR QUICK DISCONNECT DOWNSTREAM OF THE EVA MANUAL SHUTOFF VALVE OR CONTINGENCY SEPARATION IS REQUIRED) - EXTERNAL LEAKAGE OF OXYGEN RESULTING IN PREMATURE DEPLETION OF ORBITER O2.

(2A) SECOND FAILURE (EVA MANUAL O2 VALVE FAILS TO CLOSE OR INTERNALLY LEAKS) - LOSS OF ISOLATION BETWEEN THE MID DECK O2 SHUTOFF VALVE AND COMPONENTS DOWNSTREAM OF EVA MANUAL VALVE.

(3A) THIRD FAILURE (FAILURE THAT REQUIRED THE LES TO BE USED) - 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

(1B) FIRST FAILURE (EXTERNAL LEAKAGE OF A LINE, FITTING, OR QUICK DISCONNECT DOWNSTREAM OF THE EVA MANUAL SHUTOFF VALVE OR CONTINGENCY SEPARATION IS REQUIRED) - OXYGEN IS DIVERTED AWAY FROM EMU PANEL.

(2B) SECOND FAILURE (EVA MANUAL O2 VALVE FAILS TO CLOSE OR INTERNALLY LEAKS) - LOSS OF CAPABILITY TO TERMINATE EXTERNAL LEAKAGE OF O2. CLOSURE OF MID DECK O2 SHUTOFF VALVE WOULD RESULT IN LOSS OF O2 TO EMU'S. LOSS OF EVA CAPABILITIES IF EMU O2 TANKS ARE EMPTY. CREW DECISION TO ABORT MISSION WOULD RESULT IN LOSS OF MISSION OBJECTIVES - CRITICALITY 2R3 CONDITION.

(3B) THIRD 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 1R3 CONDITION.

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

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
NUMBER: M8-1SS-E068-02**

(F) RATIONALE FOR CRITICALITY DOWNGRADE:

LOSS OF EMERGENCY OXYGEN SYSTEM

LOSS OF CAPABILITY TO CLOSE MID DECK O2 SHUTOFF VALVE TO ISOLATE EXTERNAL LEAKAGE OF O2 FROM ORBITER LES DOES NOT EFFECT CRITICALITY OF THIS FAILURE MODE. CRITICALITY REMAINS AT 1R3.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: MINUTES

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 PERFORM O2 LEAK ISOLATION TROUBLESHOOTING BEFORE LOSS OF O2 BECAME CATASTROPHIC.

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

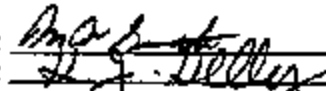
HAZARD(S) DESCRIPTION:

INABILITY TO SUPPLY O2 TO CABIN/CREW (ORBI 270), INABILITY TO SAFELY PERFORM EVA (FF-09)

- APPROVALS -

SS & PAE
DESIGN ENGINEER

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

: 
: 