

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE
NUMBER:M8-1SS-E059 -X**

SUBSYSTEM NAME: ECLSS - ISS OXYGEN TRANSFER SYSTEM

REVISION: 0 04/08/97

PART DATA

| | PART NAME VENDOR NAME | PART NUMBER VENDOR NUMBER |
|-----|--|--------------------------------------|
| LRU | :PANEL, DOCKING BASE G02 | V076-643044-001 |
| SRU | :VALVE, O2 MANUAL SHUTOFF CARLETON TECHNOLOGIES | MC250-0004-0006 1-4-00-51-27 |

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DOCKING BASE G02 PANEL ISS OXYGEN TRANSFER MANUAL SHUTOFF VALVE**

**QUANTITY OF LIKE ITEMS: 1
ONE**

FUNCTION:
PROVIDES A QUICK MEANS OF SHUTTING OFF OXYGEN FLOW TO THE SPACE STATION. VALVE IS LOCATED ON THE DOCKING BASE G02 PANEL AND IS MANUALLY OPERATED. VALVE IS NORMALLY OPEN DURING ISS OXYGEN TRANSFER OPERATIONS.

REFERENCE DOCUMENTS: VS28-643001
V076-643036

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CORRECTING ACTION DESCRIPTION:

CREW COULD CLOSE MID DECK O2 SHUTOFF VALVE OR PERFORM AN EVA TO CLOSE THE EXTERNAL MANUAL O2 SHUTOFF VALVE TO TERMINATE OXYGEN LEAKAGE AT THE DOCKING BASE O2 VALVE. CREW CAN UTILIZE AN EMU CONTAINING OXYGEN TO PERFORM AN EVA. IF ALL EMU O2 TANKS ARE EMPTY CREW COULD TEMPORARILY OPEN THE MID DECK O2 SHUTOFF VALVE LONG ENOUGH TO SERVICE THE EMU'S.

REMARKS/RECOMMENDATIONS:

A SINGLE PATH PROVIDES OXYGEN TO THE ISS FROM THE ORBITER GO2 SYSTEM. OXYGEN LINES AND COMPONENTS DOWNSTREAM OF THE MID DECK O2 SHUTOFF VALVE ARE NOT PRESSURIZED UNTIL OXYGEN TRANSFER TO ISS TAKES PLACE. GO2 TRANSFER CAN OCCUR ONLY DURING SLEEP CYCLES, DURING CREW OR CARGO TRANSFERS BETWEEN ORBITER AND ISS, OR DURING EVA OPERATIONS. CLOSING ORBITER EMERGENCY OXYGEN VALVING TO TERMINATE LEAKAGE IS A CRITICALITY 1/1 EVENT.

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ISOLATION BETWEEN UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD. DURING RESOURCE TRANSFER OXYGEN IS DIVERTED BEFORE IT REACHES THE SPACE STATION.

(B) INTERFACING SUBSYSTEM(S):

NO INITIAL EFFECT SINCE MID DECK O2 SHUTOFF VALVE PROVIDES A BACKUP SEAL TO THIS VALVE. POSSIBLE FLAMMABILITY VIOLATION FOLLOWING SECOND FAILURE.

(C) MISSION:

NO EFFECT UNTIL THE UPSTREAM MID DECK O2 SHUTOFF VALVE INTERNALLY LEAKS. THEN INCREASE USE OF O2 COULD RESULT IN EARLY MISSION TERMINATION. CLOSING OF UPSTREAM MID DECK O2 SHUTOFF VALVE TO STOP EXTERNAL LEAKAGE OF OXYGEN WOULD LOSE O2 TO EMU SERVICE PANEL RESULTING IN LOSS OF EVA CAPABILITY IF EMU O2 TANKS ARE EMPTY. POSSIBLE LOSS OF MISSION OBJECTIVES ASSOCIATED WITH SUBSEQUENT PLANNED EVA'S.

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

NO EFFECT UNTIL THE UPSTREAM MID DECK O2 SHUTOFF VALVE INTERNALLY LEAKS. THEN INABILITY OF ORBITER TO ISOLATE 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. 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.

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(E) FUNCTIONAL CRITICALITY EFFECTS:

FIRST FAILURE (SHUTOFF VALVE EXTERNALLY LEAKS) - LOSS OF ISOLATION BETWEEN UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD. DURING RESOURCE TRANSFER OXYGEN IS DIVERTED BEFORE IT REACHES THE SPACE STATION.

SECOND FAILURE (MID DECK O2 SHUTOFF VALVE INTERNALLY LEAKS) - OXYGEN IS FREE TO FLOW INTO DOCKING BASE. INCREASE USE OF CONSUMABLES WOULD REQUIRE ORBITER GO2 LEAK ISOLATION TROUBLESHOOTING RESULTING IN EARLY MISSION TERMINATION. - CRITICALITY 2R3 CONDITION. EXTERNAL LEAK COULD DIVERT O2 AWAY FROM THE EMU SERVICING PANEL RESULTING IN LOSS OF EVA CAPABILITIES IF EMU O2 TANKS ARE EMPTY.

(3A) 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.

LOSS OF EMERGENCY OXYGEN SYSTEM

(1A) FIRST FAILURE (SHUTOFF VALVE EXTERNALLY LEAKS) - ISOLATE OXYGEN FLOW BETWEEN THE UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD.

(2A) SECOND FAILURE (MID DECK O2 SHUTOFF VALVE FAILS TO CLOSE OR INTERNALLY LEAKS) - INABILITY TO NOMINALLY STOP EXTERNAL LEAKAGE OF OXYGEN. CONTINUOUS DEPLETION OF ORBITER O2 SUPPLY REQUIRING CREW TO EVA TO CLOSE MANUAL O2 VALVE.

(3A) THIRD FAILURE (FAILURE THAT REQUIRED THE LES TO BE USED) - LOSS OF ORBITER OXYGEN SUPPLY RESULTING IN POTENTIAL LOSS OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.

INABILITY TO PERFORM CONTINGENCY EVA

(1B) FIRST FAILURE (SHUTOFF VALVE EXTERNALLY LEAKS) - INABILITY TO NOMINALLY ISOLATE OXYGEN FLOW BETWEEN THE UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD. EXTERNAL LEAKAGE OF OXYGEN MAY REQUIRE CREW TO CLOSE UPSTREAM MID DECK O2 SHUTOFF VALVE RESULTING IN LOSS OF OXYGEN TO EMU SERVICE PANEL. LOSS OF O2 FOR SERVING EMU'S MAY PRECLUDE EVA CAPABILITY IF EMU O2 TANKS ARE EMPTY.

(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

INABILITY TO PERFORM AN EVA TO TERMINATE EXTERNAL LEAKAGE OF OXYGEN BY CLOSING EVA MANUAL O2 SHUTOFF VALVE DOES NOT EFFECT CRITICALITY OF THIS FAILURE MODE. CRITICALITY REMAINS AT 1R3.

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

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CONTINGENCY EVA IS REQUIRED TO CORRECT A CRIT 1 EVENT. - 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 WOULD HAVE AMPLE TIME TO CLOSE MID DECK O2 SHUTOFF VALVE OR
PERFORM ORBITER GO2 LEAK ISOLATION BEFORE PROBLEM BECAME CATASTROPHIC.**

HAZARD REPORT NUMBER(S): ORBI 270, ORBI 299, 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). INABILITY TO SAFELY PERFORM EVA (FF-09).**

- APPROVALS -

SS & PAE
DESIGN ENGINEER

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