PRINT DATE: 02/06/98

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 GO2 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 GO2 PANEL AND IS MANUALLY OPERATED. VALVE IS NORMALLY OPEN DURING ISS OXYGEN TRANSFER OPERATIONS.

REFERENCE DOCUMENTS: VS28-643001
V076-643036

PRINT DATE: 03/31/97

FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE
NUMBER: M8-1SS-E059-02

REVISION#: 0 04/08/97

SUBSYSTEM NAME: ECLSS - ISS OXYGEN TRANSFER SYSTEM
LRU: DOCKING BASE GO2 PANEL
ITEM NAME: VALVE, ISS O2 TRANSFER MANUAL SHUTOFF

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO CLOSE, INTERNAL LEAKAGE

MISSION PHASE:
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT

VEHICLE/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 REQUIRE.

C)

METHOD OF FAULT DETECTION:
FAILS TO CLOSE FAILURE MODE: VISUAL OBSERVATION - CONTINUOUS TRANSFER OF OXYGEN TO SPACE STATION.
ORBITER INSTRUMENTATION - PRESSURE INDICATION ON O2 GAUGE ON DOCKING BASE GO2 PANEL. CONTINUOUS QUANTITY DEPLETION INDICATION ON AFFECTED ORBITER O2 TANK(S).
ISS INSTRUMENTATION - QUANTITY LEVELS IN AFFECTED SPACE STATION O2 TANK(S) INDICATE TANKS ARE STILL BEING FILLED.

INTERNAL LEAKAGE FAILURE MODE: NONE UNTIL AN INTERNAL LEAKAGE OF THE DOWNSTREAM QD AND UPSTREAM O2 SHUTOFF VALVE OCCUR, THEN EXTERNAL

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LEAKAGE OF OXYGEN CAN BE DETECTED THROUGH ORBITER INSTRUMENTATION BY A QUANTITY DEPLETION INDICATION ON AFFECTED ORBITER O2 TANK(S).

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:
FAILS TO CLOSE FAILURE MODE: CREW CAN TERMINATE OXYGEN TRANSFER BY CLOSING MID DECK O2 SHUTOFF VALVE OR BY DISCONNECTING AN ISS O2 FLEXIBLE TRANSFER LINE USING THE QUICK DISCONNECT.

INTERNAL LEAKAGE FAILURE MODE: NONE FOR FIRST TWO FAILURES. EXTERNAL LEAKAGE OF OXYGEN FOLLOWING THIRD FAILURE WOULD REQUIRE CREW TO PERFORM ORBITER GO2 LEAK ISOLATION TROUBLESHOOTING.

REMARKS/RECOMMENDATIONS:
ALL QD'S ARE SELF SEALING. A SERIES QD AND SHUTOFF VALVE PROVIDE REDUNDANCY AGAINST A FAILS TO CLOSE AND AN INTERNAL LEAKAGE CONDITION OF THE OXYGEN SHUTOFF VALVE. SHUTOFF VALVE IS ONLY OPEN DURING ORBITER/ISS OXYGEN TRANSFER OPERATIONS AND REMAINS CLOSED ALL OTHER TIMES. A FAILS TO CLOSE FAILURE MODE OCCURS ONLY DURING THE ON-ORBIT MISSION PHASE, WHERE AS, AN INTERNAL LEAKAGE FAILURE MODE CAN OCCUR DURING LIFT-OFF, ON-ORBIT, OR A DE-ORBIT MISSION PHASE.

- FAILURE EFFECTS -

(A) SUBSYSTEM:
INABILITY TO NOMINALLY ISOLATE OXYGEN FLOW BETWEEN THE UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD.

(B) INTERFACING SUBSYSTEM(S):
NO INITIAL EFFECT SINCE MID DECK O2 SHUTOFF VALVE AND QUICK DISCONNECT PROVIDE BACKUP MEANS TO SHUTOFF OXYGEN FLOW TO ISS. POSSIBLE FLAMMABILITY VIOLATION FOLLOWING THIRD FAILURE.

(C) MISSION:
NO EFFECT UNTIL OXYGEN TRANSFER CANNOT BE TERMINATED USING THE QD OR SHUTOFF VALVE. THEN INCREASE USE OF O2 COULD RESULT IN EARLY MISSION TERMINATION. SHUTDOWN OF O2 TO EMU SERVICE PANEL FOLLOWING SECOND FAILURE WOULD PRECLUDE EVA CAPABILITIES RESULTING IN LOSS OF MISSION OBJECTIVES ASSOCIATED WITH SUBSEQUENT PLANNED EVA'S.

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(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT UNTIL THE DOWNSTREAM QD INTERNALLY LEAKS AND UPSTREAM MID DECK O2 SHUTOFF VALVE FAILS TO CLOSE. THEN INABILITY OF ORBITER TO ISOLATE LEAK COULD RESULT IN INADEQUATE O2 SUPPLY TO LES STATIONS RESULTING IN A POTENTIAL LOSS OF CREW AND VEHICLE. WORKAROUND TO CLOSE UPSTREAM MID DECK O2 VALVE TO STOP LEAKAGE WOULD LOSE O2 TO EMU'S RESULTING IN LOSS OF CAPABILITY TO PERFORM CONTINGENCY EVA.

(E) FUNCTIONAL CRITICALITY EFFECTS:
LOSS OF EMERGENCY OXYGEN SYSTEM
(1A) FIRST FAILURE (SHUTOFF VALVE FAILS TO CLOSE OR INTERNALLY LEAKS) - INABILITY TO NOMINALLY ISOLATE OXYGEN FLOW BETWEEN THE UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD.
(2A) SECOND FAILURE (DOWNSTREAM LINE, FITTING, OR QD LEAKS) - EXTERNAL LEAKAGE OF OXYGEN MAY DEPLETE ORBITER OXYGEN SUPPLY. OXYGEN BUILDUP IN DOCKING BASE.
(3A) THIRD FAILURE (MID DECK O2 SHUTOFF VALVE FAILS TO CLOSE OR INTERNALLY LEAKS) - INABILITY TO NOMINALLY STOP EXTERNAL LEAKAGE OF OXYGEN. CONTINUOUS DEPLETION OF ORIBITER O2 SUPPLY REQUIRING CREW TO EVA TO CLOSE MANUAL O2 VALVE.
(4A) FOURTH 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 FAILS TO CLOSE OR INTERNALLY LEAKS) - INABILITY TO NOMINALLY ISOLATE OXYGEN FLOW BETWEEN THE UPSTREAM MID DECK O2 SHUTOFF VALVE AND DOWNSTREAM QD.
(2B) SECOND FAILURE (DOWNSTREAM LINE, FITTING, OR QD LEAKS) - 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.
(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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
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.

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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, 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	:	M. W. GUENTHER	:
DESIGN ENGINEER	:	K. J. KELLY	: