PAGE: 1 PRINT DATE: 10/10/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL HARDWARE
NUMBER: M8-1MR-E002-X

SUBSYSTEM NAME: ECLSS - EXTERNAL AIRLOCK
REVISION: 2 9/15/95

| | PART NAME<br>VENDOR NAME | PART NUMBER<br>VENDOR NUMBER |
|---|---|---|
| LRU : | VALVE, EQUALIZATION<br>CARLETON TECHNOLIGIES | MC250-0004-0012<br>2763-0001-9 |

PART DATA

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**
EXTERNAL AIRLOCK UPPER HATCH EQUALIZATION VALVE

**REFERENCE DESIGNATORS:**

**QUANTITY OF LIKE ITEMS:** 2
TWO

**FUNCTION:**
PROVIDES FOR EQUALIZING PRESSURE ACROSS THE EXTERNAL AIRLOCK UPPER HATCH, BETWEEN THE EXTERNAL AIRLOCK AND THE VESTIBULE TUNNEL. EACH VALVE OPERATES INDEPENDENTLY WITH POSITIVE DETENTS AT TWO POSITIONS. VALVE CAN BE ACTUATED FROM EITHER SIDE OF HATCH.

**REFERENCE DOCUMENTS:** M072-593829

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-E002- 02

REVISION* 2 9/15/95

SUBSYSTEM NAME: ECLSS - EXTERNAL AIRLOCK
LRU: VALVE, EQUALIZATION
ITEM NAME: VALVE, EQUALIZATION

CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS TO CLOSE, INTERNAL LEAKAGE

MISSION PHASE:
OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:
CONTAMINATION, PHYSICAL BINDING/JAMMING, CORROSION, VIBRATION, MECHANICAL SHOCK, POROSITY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? N/A

REDUNDANCY SCREEN
A) PASS
B) N/A
C) PASS

PASS/FAIL RATIONALE:
A)

B)
N/A - SINCE EQUALIZATION VALVE AND CAP ARE IN STANDBY REDUNDANCY TO EACH OTHER FOR "INTERNAL LEAKAGE" FAILURE MODE

C)

METHOD OF FAULT DETECTION:
NONE FOR FIRST FAILURE. SECOND FAILURE: INSTRUMENTATION - DELTA-PRESSURE INDICATION; AND VISUAL OBSERVATION - LOSS OF PRESSURE IN HABITABLE AREA WHEN ORBITER AND MIR ARE NOT DOCKED.

CORRECTING ACTION: NO CREW ACTION REQUIRED IF CAP IS INSTALLED. IF CAP IS NOT INSTALLED, CREW SHOULD INSTALL CAP AND USE REDUNDANT EQUALIZATION VALVE. DURING IVA WHILE ORBITER AND MIR ARE NOT DOCKED CREW COULD ISOLATE EXTERNAL LEAKAGE BY CLOSING APPROPRIATE HATCH(S).

REMARKS/RECOMMENDATIONS:
EFFECTS ON EVA RECOVERY ARE MINIMIZED SINCE TUNNEL ADAPTER "C" HATCH IS THE PRIMARY HATCH FOR PERFORMING AN EVA AND AN ADDED FIFTH HATCH WILL ISOLATE TUNNEL ADAPTER AND EXTERNAL AIRLOCK VOLUMES.

FAILURE MODES EFFECTS ANALYSIS (FMEA) – NON-CIL FAILURE MODE
NUMBER: M8-1MR-E002-02

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF PRIMARY SEAL.

(B) INTERFACING SUBSYSTEM(S):
NO EFFECT FIRST FAILURE SINCE CAP PROVIDES REDUNDANT SEAL.

(C) MISSION:
NO EFFECT FIRST FAILURE. SECOND ASSOCIATED FAILURE (CAP LEAKAGE): (1) IF FAILURE OCCURS PRIOR TO DOCKING WITH THE MIR STATION, MISSION WOULD BE TERMINATED DUE TO EXCESSIVE LOSS OF CONSUMABLES; (2) IF FAILURE OCCURS WHILE ORBITER & MIR ARE DOCKED - INABILITY TO DEPRESSURIZE VESTIBULE TUNNEL FOR SEPARATION WITHOUT EFFECTING THE AIRLOCK AND TUNNEL ADAPTER (MIR 1 ONLY) VOLUMES; (3) LOSS OF CAPABILITY TO PERFORM EVA OUT EXTERNAL AIRLOCK WHEN ORBITER/MIR ARE NOT DOCKED DUE TO INABILITY TO REPRESSURIZE THE AIRLOCK VOLUME FOR RETURNING TO THE CREW MODULE.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT FIRST FAILURE. SECOND ASSOCIATED FAILURE COULD RESULT IN LOSS OF CREW DURING NON-DOCKED IVA ACTIVITES.

(E) FUNCTIONAL CRITICALITY EFFECTS:
FIRST FAILURE - NO EFFECT.
SECOND ASSOCIATED FAILURE (LEAKAGE OF CAP):
WHEN ORBITER/MIR ARE NOT DOCKED; (1) IF SECOND FAILURE OCCURS DURING IVA (CAMERA PREPARATION FOR DOCKING OR SPACELAB OPERATIONS (MIR 1ONLY)) EXCESSIVE LOSS OF CONSUMABLES CAN JEOPARDIZE CREW SAFETY; (2) IF SECOND FAILURE OCCURS DURING EVA OUT EXTERNAL AIRLOCK, POSSIBLE LOSS OF EVA CREWMEMBERS IF AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOR RETURN TO CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING). THIS WOULD REQUIRE AN ADDITIONAL FAILURE TO OPEN TUNNEL ADAPTER "C" HATCH SINCE THIS HATCH IS PRIMARY FOR PERFORMING AN EVA

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

(F) RATIONALE FOR CRITICALITY DOWNGRADE:
THIRD & FOURTH FAILURES (INABILITY TO CLOSE FIFTH HATCH AND CREW CABIN HATCH) OCCUR DURING UNDOCKED IVA ACTIVITIES - LOSS OF CAPABILITY TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE FROM CREW CABIN RESULTING IN EXCESSIVE LOSS OF CONSUMABLES. CREW SAFETY JEOPARDIZED UPON LOSS OF CONSUMABLES.

- TIME FRAME -

TIME FROM FAILURE TO CRITICAL EFFECT: HOURS TO DAYS

TIME FROM FAILURE OCCURRENCE TO DETECTION: SECONDS TO MINUTES

TIME FROM DETECTION TO COMPLETED CORRECTIVE ACTION: SECONDS

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
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IS TIME REQUIRED TO IMPLEMENT CORRECTIVE ACTION LESS THAN TIME TO EFFECT?
YES

RATIONALE FOR TIME TO CORRECTING ACTION VS TIME TO EFFECT:
CREW WOULD HAVE ENOUGH TIME TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE BY CLOSING THE APPROPRIATE HATCHES BEFORE THE PROBLEM BECAME CATASTROPHIC.

HAZARDS REPORT NUMBER(S): ORBI 511

HAZARD(S) DESCRIPTION:
LOSS OF HABITABLE PRESSURE.

- APPROVALS -

| | | | |
|---|---|---|---|
| PRODUCT ASSURANCE ENGR. | : | M. W. GUENTHER | : |
| DESIGN ENGINEER | : | K. J. KELLY | : |