

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - NON-CIL HARDWARE**  
**NUMBER: M8-1SS-E008 -X**

SUBSYSTEM NAME: ECLSS - ARPCS

REVISION: 2

04/08/97

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**PART DATA**


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|     | <b>PART NAME</b>                                | <b>PART NUMBER</b>                 |
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|     | <b>VENDOR NAME</b>                              | <b>VENDOR NUMBER</b>               |
| LRU | :HATCH ASSEMBLY<br>ROCKWELL INT'L               | M072-593828-001<br>M072-593828-001 |
| SRU | :GAUGE, DELTA PRESSURE<br>CARELTON TECHNOLOGIES | MC250-0004-0007<br>2767-0001-7     |

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
**EXTERNAL AIRLOCK UPPER HATCH DIFFERENTIAL PRESSURE GAUGE**

**QUANTITY OF LIKE ITEMS: 2**  
**TWO**

**FUNCTION:**  
 PROVIDES STATUS OF DIFFERENTIAL PRESSURE ACROSS EXTERNAL AIRLOCK UPPER HATCH (BETWEEN THE EXTERNAL AIRLOCK AND THE VESTIBULE TUNNEL) SO THAT CREW CAN ASCERTAIN CONDITIONS BEFORE OPENING THE HATCH. GAUGE MEASURES DELTA PRESSURE BETWEEN PLUS 20 AND MINUS 20 PSID AND IS LOCATED ON BOTH SIDES OF THE EXTERNAL AIRLOCK UPPER HATCH (EXTERNAL AIRLOCK AND VESTIBULE TUNNEL).

**REFERENCE DOCUMENTS:** V519-331052  
 V519-593302

## FAILURE MODES EFFECTS ANALYSIS FMEA - NON-CIL FAILURE MODE

NUMBER: M8-1SS-E009-01

REVISION#: 2 04/08/97

SUBSYSTEM NAME: ECLSS - APRCS  
LRU: GAUGE, DELTA PRESSURE  
ITEM NAME: GAUGE, DELTA PRESSURE

CRITICALITY OF THIS  
FAILURE MODE: 1R3

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FAILURE MODE:  
LEAKAGE

MISSION PHASE: OO ON-ORBIT

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

CAUSE:  
CORROSION, VIBRATION, MECHANICAL SHOCK, POROSITY

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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REDUNDANCY SCREEN A) PASS  
B) PASS  
C) PASS

## PASS/FAIL RATIONALE:

A)

B)

C)

METHOD OF FAULT DETECTION:  
INSTRUMENTATION - DELTA-PRESSURE INDICATION ACROSS UPPER HATCH.

CORRECTING ACTION: MANUAL

CORRECTING ACTION DESCRIPTION:  
WHEN ORBITER AND ISS ARE NOT DOCKED, CREW COULD SEAL LEAK USING TAPE OR  
OTHER AVAILABLE MATERIAL OR ISOLATE LEAK BY CLOSING 576 BULKHEAD HATCH.

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**REMARKS/RECOMMENDATIONS:**

CRITICALITY OF THIS FAILURE MODE IS BASED ON THE WORST CASE EFFECT WHEN THE ORBITER AND ISS ARE NOT DOCKED.

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

INABILITY TO ISOLATE THE VESTIBULE TUNNEL FROM EXTERNAL AIRLOCK ENVIRONMENT.

**(B) INTERFACING SUBSYSTEM(S):**

SLOW LOSS OF CONSUMABLES, WHEN ORBITER AND SPACE STATION ARE NOT DOCKED. EXCESSIVE LOSS OF CONSUMABLES GIVEN A SIMILAR FAILURE OF SECOND DELTA-PRESSURE GAUGE ON SAME HATCH.

**(C) MISSION:**

WORST CASE, CREW DECISION TO ABORT MISSION DUE TO LOSS OF CONSUMABLES. IF LEAKAGE FROM A SINGLE GAUGE OCCURS WHILE ORBITER & SPACE STATION ARE DOCKED - INABILITY TO DEPRESSURIZE VESTIBULE TUNNEL FOR SEPARATION WITHOUT EFFECTING THE ODS VOLUMES. IF FAILURE OCCURS WHILE ORBITER AND SPACE STATION ARE NOT DOCKED - LOSS OF CAPABILITY TO PERFORM PLANNED EVA DUE TO INABILITY TO REPRESSURIZE EXTERNAL AIRLOCK FOR RETURNING TO THE CREW MODULE.

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

NO EFFECT FIRST FAILURE SINCE AIR MAKEUP CAPABILITY OF ORBITER ARPCS WILL PRECLUDE A LOSS OF PRESSURE IN HABITABLE VOLUMES. INABILITY TO PERFORM CORRECTIVE ACTION FOLLOWING SIMILAR FAILURE OF SECOND GAUGE ON SAME HATCH COULD RESULT IN LOSS OF CREW DURING NON-DOCKED IVA/EVA ACTIVITIES.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

FIRST FAILURE - SLOW LOSS OF CONSUMABLES WHICH MAY RESULT IN CREW ACTION TO ABORT MISSION. - CRITICALITY 2/2 CONDITION

**DURING EVA WHEN ORBITER/SPACE STATION ARE NOT DOCKED:**

(2A) SECOND FAILURE (LEAKAGE OF SECOND GAUGE) - PRESSURE WITHIN EXTERNAL AIRLOCK CANNOT BE MAINTAINED FOR EVA CREWMEMBER'S RETURN TO CREW CABIN. - CRITICALITY 1R2 CONDITION.

**DURING IVA (CAMERA PREPARATION FOR DOCKING) WHEN ORBITER/SPACE STATION ARE NOT DOCKED:**

(2B) SECOND FAILURE (LEAKAGE OF SECOND GAUGE) - EXCESSIVE EXTERNAL LEAKAGE OF HABITABLE PRESSURE WOULD EXCEED CONSUMABLE MAKEUP CAPABILITY OF ORBITER ARPCS RESULTING IN AN INCREASED USE OF CONSUMABLES WITHIN EXTERNAL AIRLOCK. - CRITICALITY 1R2 CONDITION.

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**IF SECOND FAILURE OCCURS WHEN ORBITER/SPACE STATION ARE DOCKED:  
POSSIBLE LOSS OF PRESSURE IN SPACE STATION IF ISOLATION BETWEEN EXTERNAL  
AIRLOCK AND SPACE STATION IS LOST DURING EVA WHEN EXTERNAL AIRLOCK IS  
DEPRESSURIZED.**

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

**(F) RATIONALE FOR CRITICALITY DOWNGRADE:**

**DURING EVA WHEN ORBITER/SPACE STATION ARE NOT DOCKED:**

**(3A) THIRD FAILURE (INABILITY TO SEAL LEAK ON BOTH GAUGES) - UNABLE TO  
MAINTAIN PRESSURE WITHIN EXTERNAL AIRLOCK. POSSIBLE LOSS OF CREWMEMBERS  
IF EXTERNAL AIRLOCK VOLUME CANNOT BE REPRESSURIZED FOR CREW RETURN TO  
CREW CABIN. (EVA CREWMEMBERS MUST REMAIN IN AIRLOCK UNTIL LANDING.) -  
CRITICALITY 1R3 CONDITION.**

**DURING IVA (CAMERA PREPARATION FOR DOCKING) WHEN ORBITER/SPACE STATION  
ARE NOT DOCKED:**

**(3B) THIRD FAILURE (INABILITY TO SEAL LEAK ON BOTH GAUGES) - UNABLE TO STOP  
EXCESSIVE EXTERNAL LEAKAGE OF PRESSURE WITHIN EXTERNAL AIRLOCK.**

**(4B) FOURTH FAILURE (INABILITY TO CLOSE 576 BULKHEAD HATCH) - LOSS OF  
CAPABILITY TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE COULD  
RESULT IN LOSS OF CREW AND VEHICLE. - CRITICALITY 1R3 CONDITION.**

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**- TIME FRAME -**

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**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:**

**WHILE ORBITER AND SPACE STATION ARE NOT DOCKED, CREW WOULD HAVE ENOUGH  
TIME TO ISOLATE EXTERNAL LEAKAGE OF HABITABLE PRESSURE BY CLOSING 576  
BULKHEAD BEFORE LOSS OF CONSUMABLES DURING IVA BECAME CATASTROPHIC.**

**HAZARD REPORT NUMBER(S): ORBI 511, ORBI 162**

**HAZARD(S) DESCRIPTION:**

**LOSS OF HABITABLE PRESSURE IN CREW CABIN HABITABLE VOLUME (ORBI 511),  
INABILITY TO RETURN FROM EVA DUE TO AIRLOCK HATCH FAILURES AND / OR  
REPRESSURIZATION OF THE AIRLOCK (ORBI 162).**

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- APPROVALS -

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SS & PAE  
DESIGN ENGINEER

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: K. J. KELLY

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