

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE**  
**NUMBER: 04-2-BD01 -X**

**SUBSYSTEM NAME: AUXILIARY POWER (APUS)**

**REVISION: 1**      **09/02/98**

**PART DATA**

|     | <b>PART NAME</b>          | <b>PART NUMBER</b>         |
|-----|---------------------------|----------------------------|
|     | <b>VENDOR NAME</b>        | <b>VENDOR NUMBER</b>       |
| LRU | : BURST DISK<br>HYDRODYNE | ME251-0017-0001<br>48-5806 |
|     | :                         |                            |

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

THE BURST DISK ASSEMBLY CONSISTS OF A SPRING/DIAPHRAGM SYSTEM AND A SHARP CUTTING DEVICE ENCLOSED IN A PRESSURE-SEALED STEEL BODY. IT IS PROVIDED WITH A TEST PORT DOWNSTREAM OF THE DIAPHRAGM LOCATION FOR LEAK CHECK PURPOSES. IT IS LOCATED IMMEDIATELY DOWNSTREAM OF THE DRAIN SYSTEM CATCH BOTTLE AND UPSTREAM OF THE RELIEF VALVE.

**REFERENCE DESIGNATORS:**

**QUANTITY OF LIKE ITEMS: 3**  
ONE PER APU

**FUNCTION:**

THE FUNCTION OF THE BURST DISK IS TO PROVIDE REDUNDANCY TO THE RELIEF VALVE AND TO PREVENT THE LOSS OF PRE-LAUNCH DRAIN SYSTEM PRESSURE THROUGH RELIEF VALVE LEAKAGE. FUEL PUMP LEAKAGE, COMBINED WITH RELIEF VALVE LEAKAGE, MAY REDUCE THE PRESSURE DOWNSTREAM OF THE FUEL TANK ISOLATION VALVE TO A LEVEL UNACCEPTABLE FOR APU PRE-START ACTIVATION OF THE ISOLATION VALVE. FLIGHT RULE A10.1.2-2 DOES NOT ALLOW FUEL TANK ISOLATION VALVE OPENING WHEN THE DOWNSTREAM PRESSURE IS LESS THAN 15 PSIA DUE TO ADIABATIC BUBBLE COMPRESSION DETONATION CONCERNS (CRIT 1/1).

**FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE**

NUMBER: 04-2-BD01-02

REVISION#: 1 09/02/98

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

LRU: BURST DISK

ITEM NAME: BURST DISK

CRITICALITY OF THIS

FAILURE MODE: 1/1

FAILURE MODE:  
EXTERNAL LEAK

|                |    |                |
|----------------|----|----------------|
| MISSION PHASE: | PL | PRE-LAUNCH     |
|                | LO | LIFT-OFF       |
|                | OO | ON-ORBIT       |
|                | DO | DE-ORBIT       |
|                | LS | LANDING/SAFING |

|                                  |     |           |
|----------------------------------|-----|-----------|
| VEHICLE/PAYLOAD/KIT EFFECTIVITY: | 102 | COLUMBIA  |
|                                  | 103 | DISCOVERY |
|                                  | 104 | ATLANTIS  |
|                                  | 105 | ENDEAVOUR |

CAUSE:  
CORROSION, POOR HANDLING, CRACKED WELDS.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

|                   |        |
|-------------------|--------|
| REDUNDANCY SCREEN | A) N/A |
|                   | B) N/A |
|                   | C) N/A |

PASS/FAIL RATIONALE:

A)

B)

C)

**- FAILURE EFFECTS -**

(A) SUBSYSTEM:

POSSIBLE LOSS OF ONE APU SYSTEM BEFORE MISSION COMPLETION IF EXTERNAL LEAKAGE OCCURS. POSSIBLE LOSS OF ADJACENT AND/OR REDUNDANT APU HARDWARE DUE TO FIRE OR CHEMICAL ATTACK.

(B) INTERFACING SUBSYSTEM(S):

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POSSIBLE LOSS OF ADJACENT AND/OR REDUNDANT HARDWARE DUE TO FIRE OR CHEMICAL ATTACK.

**(C) MISSION:**  
POSSIBLE LOSS OF MISSION.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
POSSIBLE LOSS OF CREW/VEHICLE IF LEAKING FUEL IS IGNITED OR IF ADJACENT AND/OR REDUNDANT HARDWARE IS LOST DUE TO FIRE OR CHEMICAL ATTACK.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**  
POSSIBLE LOSS OF CREW/VEHICLE IF HYDRAZINE RELEASED BY FAILURES IS IGNITED.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
THE BURST DISK SPRING/DIAPHRAGM ASSEMBLY IS CALIBRATED TO RELIABLY MOVE TO THE OVER-CENTER POSITION AT A VERY NARROW RANGE OF APPLIED PRESSURE. THE EDGE SHARPNESS OF THE CUTTING DEVICE DOWNSTREAM OF THE DIAPHRAGM IS VERIFIED DURING ASSEMBLY BY VISUAL INSPECTION. THE THICKNESS OF THE DIAPHRAGM MATERIAL IS CLOSELY INSPECTED TO MEET NARROW DIMENSIONAL TOLERANCES. TESTING AT BURST DISK RUPTURE PRESSURE VERIFIED NO HOUSING EXTERNAL LEAKAGE.

**(B) TEST:**  
THE BURST DISK DIAPHRAGM RUPTURE PRESSURE WAS VERIFIED DURING QUALIFICATION TESTING. ACCEPTANCE TESTS ONLY VERIFY THE BURST DISK INTACT CONDITION.

GROUND TURNAROUND TEST  
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD

**(C) INSPECTION:**  
IDENTIFICATION AND GENERAL APPEARANCE ARE VERIFIED AT RECEIVING.

CONTAMINATION CONTROL  
FLUID SAMPLES ARE ANALYZED FOR CONTAMINATION AND VERIFIED CLEAN TO LEVEL 100 BY INSPECTION. CORROSION RESISTANT MATERIALS ARE USED IN CONSTRUCTION OF THE BURST DISK.

ASSEMBLY/INSTALLATION  
MANUFACTURING, ASSEMBLY, AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION.

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**NON-DESTRUCTIVE EVALUATION**

PENETRANT INSPECTION OF WELDS AND ASSEMBLIES IS VERIFIED. QUALIFICATION WELDS WERE CROSS-SECTIONED AND VERIFIED BY M&P PRIOR TO PRODUCTION WELDS AND ARE ALSO VERIFIED BY PROOF PRESSURE TESTS.

**TESTING**

CALIBRATION OF TOOLS AND TEST EQUIPMENT IS VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION.

**HANDLING/PACKAGING**

HANDLING, PACKAGING, AND SHIPPING PROCEDURES ARE VERIFIED.

**(D) FAILURE HISTORY:**

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATA BASE.

**(E) OPERATIONAL USE:**

POST MECC; CLOSE ISOLATION VALVES.

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**- APPROVALS -**

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|                          |                 |
|--------------------------|-----------------|
| SS & PAE MANAGER         | : D. F. MIKULA  |
| SS & PAE ENGINEER        | : K. E. RYAN    |
| VEHICLE & SYSTEMS DESIGN | : M. A. WEISER  |
| BNA SSM                  | : T. FARKAS, JR |
| JSC MOD                  | : M. FRANK      |
| JSC NASA SR&A            | : D. BEAUGH     |
| USA/SAM                  | : A. BERNHART   |

|                                   |
|-----------------------------------|
| : <i>[Signature]</i>              |
| : <i>K. E. Ryan</i>               |
| : <i>Michael A. Weiser</i>        |
| : <i>S. M. Gammeter for</i>       |
| : <i>[Signature]</i>              |
| : <i>David D. Beaught 11/6/98</i> |
| : <i>[Signature]</i>              |

*Suzanne Little 11/6/98*