

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

SUBSYSTEM NAME: AUXILIARY POWER (APUS)

REVISION: 1 **09/02/98**

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: BURST DISK HYDRODYNE	ME251-0017-0001 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).

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NUMBER: 04-2-BD01-01**

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SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

LRU: BURST DISK

ITEM NAME: BURST DISK

**CRITICALITY OF THIS
FAILURE MODE: 1R3**

**FAILURE MODE:
FAILS TO BURST**

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:
MATERIAL, FAILED SPRING**

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

**A)
IMPOSSIBLE TO DETERMINE IF THE BURST DISK WILL FAIL TO RUPTURE AT THE
REQUIRED PRESSURE WITHOUT DESTROYING THE COMPONENT.**

**B)
N/A-DETECTABLE BY DRAIN SYSTEM PRESSURE TRANSDUCERS**

**C)
A SINGLE FAILURE EVENT CANNOT CAUSE LOSS OF APU REDUNDANCY.**

- FAILURE EFFECTS -

**(A) SUBSYSTEM:
NONE FOR THE FIRST FAILURE.**

**(B) INTERFACING SUBSYSTEM(S):
NONE FOR THE FIRST FAILURE.**

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(C) MISSION:
NONE WITHOUT ADDITIONAL FAILURES.

(D) CREW, VEHICLE, AND ELEMENT(S):
NONE WITHOUT ADDITIONAL FAILURES.

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE AFTER 3 FAILURES:
(1) GROSS LEAK AT THE SHAFT SEAL OF AN APU FUEL PUMP.
(2) FAILURE OF A BURST DISK TO BURST MAY CAUSE SUFFICIENT INCREASE OF THE CATCH BOTTLE PRESSURE TO CAUSE THE INTRUSION OF HYDRAZINE INTO THE GEARBOX RESULTING IN WAX FORMATION (POSSIBLE APU LOSS).
(3) LOSS OF ONE OF THE TWO REMAINING APU'S COULD CAUSE POSSIBLE LOSS OF CREW/VEHICLE.

-DISPOSITION RATIONALE-

(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.

(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

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

NON-DESTRUCTIVE EVALUATION

WELDS ARE VERIFIED BY PENETRANT INSPECTION. QUALIFICATION WELDS WERE CROSS-SECTIONED AND VERIFIED BY M&P PRIOR TO PROCEEDING WITH PRODUCTION WELDS. WELDS 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:

WHEN FAILURE IS DETECTED: (1) DURING ASCENT PRESSURE INCREASE MAY REQUIRE APU SHUTDOWN POST MECO IF PRESSURE REACHES APU LOSS DEFINITION VALUE IN THE FLIGHT RULE (A10.1.1-1), (2) DURING DESCENT PRESSURE INCREASE MAY REQUIRE APU SHUTDOWN IF PRESSURE REACHES APU LOSS DEFINITION VALUE IN THE FLIGHT RULE A10.1.1-1 AND IF THIS HAPPENS THE REMAINING APU'S ARE COMMANDED TO HIGH SPEED AT TAEM.

- APPROVALS -

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	:
JSC NASA SR&RA	: D. BEAUGH
USA/SAM	: M. BURGHARDT

_____	<i>D.F. Mikula</i>
_____	<i>K.E. Ryan</i>
_____	<i>Michael A. Weiser</i>
_____	<i>T. Farkas, Jr.</i>
_____	<i>David D. Beaught 11/17/98</i>
_____	<i>M. Burghardt 11/17/98</i>
_____	<i>Elizabeth Little 11/18/98</i>