

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
 NUMBER: 04-2-FL12-X

5050270A
 ATTACHMENT -
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SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

REVISION : 3 02/19/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU	AUXILIARY POWER UNIT (APU)	MC201-2001-02XX
■	SUNOSTRAND	729867XX/754949
■ LRU	AUXILIARY POWER UNIT (APU)	MC201-2001-03XX
■	SUNOSTRAND	729867XX/754949
■ LRU	AUXILIARY POWER UNIT (APU)	MC201-2001-04XX
■	SUNOSTRAND	742211
■ SRU	FILTER	590446
■	WINTEC	SAME
■ SRU	FILTER	5904883
■	PURGLATOR	SAME

 PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
 FILTER, HIGH PRESSURE FUEL FEEDLINE

- QUANTITY OF LIKE ITEMS: 3
 ONE PER APU

- FUNCTION:
 TO COLLECT CONTAMINANTS IN FUEL AND PREVENT THEM FROM CAUSING FAILURE IN
 DOWNSTREAM COMPONENTS. NOTE: REPLACEABLE PART OF FUEL PUMP (OUTLET).

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SUBSYSTEM: AUXILIARY POWER UNIT (APU)
LRU :AUXILIARY POWER UNIT (APU)
ITEM NAME: FILTER

REVISION# 3 01/28/91 R

CRITICALITY OF THIS
FAILURE MODE:IR2

- FAILURE MODE:
PLUGGED (FLOW RESTRICTION)

MISSION PHASE:

PL	PRELAUNCH
LO	LIFT-OFF
DO	DE-ORBIT
LS	LANDING SAFING

- VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102	COLUMBIA
: 103	DISCOVERY
: 104	ATLANTIS
: 105	ENDEAVOUR

- CAUSE:
CONTAMINATION ACCUMULATION

- CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES

AOA	ABORT ONCE AROUND
ATO	ABORT TO ORBIT
RTL	RETURN TO LAUNCH SITE
TAL	TRANS ATLANTIC ABORT

- REDUNDANCY SCREEN A) PASS
- B) PASS
- C) PASS

PASS/FAIL RATIONALE:

- A)
- B)
- C)

}

*RI-DWY SHOULD
PROVIDE WRITTEN
PASS/FAIL RATIONALE
WHEN THESE
APRIL QUARTERS 5/99
ARE FINALIZED
Mayer 4/26/91*

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- FAILURE EFFECTS -

- (A) SUBSYSTEM:
FUNCTIONAL DEGRADATION. GRADUAL INCREASE IN PRESSURE DROP ACROSS THE FILTER WOULD ULTIMATELY RESULT IN FUEL STARVATION, TURBINE UNDERSPEED AND SAFE SHUTDOWN.
- (B) INTERFACING SUBSYSTEM(S):
POSSIBLE LOSS OF SHAFT POWER TO ONE HYDRAULIC PUMP.
- (C) MISSION:
ABORT DECISION IS REQUIRED IF FAILURE OCCURS PRIOR TO ENTRY COMMITMENT.
- (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT UNTIL SECOND SYSTEM LOSS. CRITICALITY 1 FOR SSME-INDUCED RTLS, ATO, AOA, OR TAL, DUE TO THE POSSIBLE ADDITIONAL LOSS OF ASSOCIATED APU/HYD AND MAIN ENGINE.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
LOSS OF CREW/VEHICLE IF TWO OF THREE APU'S LOST.

- DISPOSITION RATIONALE -

- (A) DESIGN:
5900446 (WINTEC) - THE FILTER RATING IS 10-MICRON NOMINAL, 25-MICRON ABSOLUTE. THE PRESSURE DROP IS 5 PSID AT RATED FLOW (1.5 GPM) (FLOW DIRECTION IS FROM INSIDE TO OUTSIDE).

THE FILTER CAPACITY IS 0.9 GRAMS AC COARSE DUST WITH A MAXIMUM PRESSURE DROP OF 50 PSID AT RATED FLOW (EST).

THE FILTER ELEMENT COLLAPSE PRESSURE IS 1300 PSID, THE FILTER IS DESIGNED FOR HYDRAZINE (MIL-P-26536C) SERVICE AT TEMPERATURES OF 45 TO 200 DEG F, NON-OPERATING AND 45 TO 300 DEG F OPERATING.

5904683 (PUROLATOR TECHNOLOGIES) - THE PERFORMANCE CHARACTERISTICS ARE THE SAME AS THE OTHER EXCEPT THAT THIS UNIT USES A SINTERED FILTER ELEMENT RATHER THAN THE WIRE CLOTH.

THE SINTERED ELEMENT ALLOWS GAS TO PASS THROUGH THE PORES AT A LOWER PRESSURE ELIMINATING THE "BUBBLE TRAP" THAT CAUSED ERRATIC CHAMBER PRESSURE TO OCCUR WHEN THE TRAPPED BUBBLE IS RELEASED DURING APU OPERATION.

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■ (B) TEST:

CERTIFICATION TESTS CONDUCTED ARE 27 MISSION DUTY CYCLES, THERMAL VACUUM, BENCH SHOCK, FOR A TOTAL OF 41.7 HR OPERATION INCLUDING VIBRATIONS.

OMRSD: FLOW THROUGH FILTER IS VERIFIED DURING T-5 MIN RUN EVERY FLOW.

■ (C) INSPECTION:

RECEIVING INSPECTION
MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 100 IS VERIFIED BY INSPECTION. FLUID SAMPLES ARE INSPECTED FOR CONTAMINATION. ULTRASONIC CLEANING IS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

BURR INSPECTION IS VERIFIED BY INSPECTION. MANUFACTURING, ASSEMBLY, AND INSTALLATION PROVISIONS ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

BUBBLE TEST IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

WELDING PER SPECIFICATION REQUIREMENTS IS VERIFIED BY INSPECTION. SINTERING OF PURULATOR FILTER ELEMENT PER SPECIFICATION REQUIREMENTS IS VERIFIED BY INSPECTION.

TESTING

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE, AND SHIPPING PROCEDURES ARE VERIFIED BY INSPECTION.

■ (D) FAILURE HISTORY:

NONE; HOWEVER, FORWARD AND REVERSE FLUSHING OF THE FILTER FROM STS-9 REVEALED EXCESSIVE PARTICULATE CONTAMINATION BEYOND ACCEPTABLE FUEL LIMITS.

■ (E) OPERATIONAL USE:

IF APU SHUTS DOWN, REMAINING APU'S GO TO HIGH SPEED AND AUTOMATIC SHUTDOWN IS INHIBITED TO PRECLUDE INADVERTENT SHUTDOWNS.

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- APPROVALS -

RELIABILITY ENGINEERING:	D. R. ATAPATTU	:	<i>DR Atapattu</i>	
DESIGN ENGINEERING	: J. R. MUNROE	:	<i>J. R. Munroe</i>	1-21-91
QUALITY ENGINEERING	: O. J. BUTTNER	:	<i>O. J. Buttner</i>	1-21-91
NASA RELIABILITY	: <i>O. CONNOR</i>	:	<i>O. Connor</i>	1-25-91
NASA SUBSYSTEM MANAGER	: <i>D. YOUNG</i>	:	<i>D. Young</i>	1-25-91
NASA QUALITY ASSURANCE	: J. WILLIAMS	:	<i>J. Williams</i>	1-21-91