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PRINT DATE: 11/22/91

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: 04-2-TP14-X

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

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	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU : ■	AUXILIARY POWER UNIT (APU) SUNDSTRAND	MC201-0001-02XX 729867XX/754949
■ LRU : ■	AUXILIARY POWER UNIT (APU) SUNDSTRAND	MC201-0001-03XX 729867XX/754949A
■ LRU : ■	AUXILIARY POWER UNIT (APU) SUNDSTRAND	MC201-0001-04XX X742211X
■ SRU : ■	COUPLING SYMMETRICS	5900444
■ SRU : ■	COUPLING SYMMETRICS	59202

 PART DATA

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
COUPLING, APU FUEL PUMP FILTER BOWL DRAIN (TPX4), APU FUEL PUMP SEAL
CAVITY DRAIN PURGE (TPX6)
- QUANTITY OF LIKE ITEMS: 6
ONE EACH AS DESCRIBED ABOVE PER APU
- FUNCTION:
 - (1) TPX4 COUPLING USED EXCLUSIVELY FOR SUNDSTRAND FLUSH AND
DECONTAMINATION OPERATIONS.
 - (2) TPX6 COUPLING USED FOR FUEL PUMP SEAL CAVITY PURGE OPERATIONS.

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LRU :AUXILIARY POWER UNIT (APU)
ITEM NAME: COUPLING

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CRITICALITY OF THIS
FAILURE MODE:1R2■ FAILURE MODE:
EXTERNAL LEAKAGE

MISSION PHASE:

PL	PRELAUNCH
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:
SEAL FAILURES, PIECE-PART FAILURES, CONTAMINATION, APU DETONATION

■ CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

■ REDUNDANCY SCREEN A) FAIL
 ■ B) FAIL
 ■ C) PASS

PASS/FAIL RATIONALE:

- A)
CAP ACTS AS REDUNDANT SEAL. THE CAP SEAL IS NOT CAPABLE OF CHECKOUT DURING GROUND-TURNAROUND BECAUSE NO TEST PORT OR EQUIPMENT IS PROVIDED.
- B)
LOSS OF EITHER POPPET OR CAP SEAL NOT DETECTABLE IN FLIGHT.
- C)

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- FAILURE EFFECTS -

- (A) SUBSYSTEM:
POSSIBLE LOSS OF ONE APU SYSTEM BEFORE MISSION COMPLETION.
FIRE/EXPLOSION HAZARD IN AFT COMPARTMENT.
- (B) INTERFACING SUBSYSTEM(S):
POSSIBLE LOSS OF SHAFT POWER TO ONE HYDRAULIC PUMP. RAW FUEL IN AFT COMPARTMENT. POSSIBLE DAMAGE TO ADJACENT HARDWARE.
- (C) MISSION:
ABORT DECISION IS REQUIRED, IF FAILURE OCCURS PRIOR TO ENTRY COMMITMENT.
- (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT UNLESS FUEL IS IGNITED, OR UNTIL SECOND APU SYSTEM IS LOST.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
1ST FAILURE - FUEL LEAKAGE PAST ONE OF TWO SEALS - NO EFFECT.
2ND FAILURE - FUEL LEAKAGE PAST BOTH SEALS RESULTS IN HYDRAZINE LEAKAGE INTO AFT AND POSSIBLE LOSS OF CREW VEHICLE DUE TO FIRE/EXPLOSION.

- DISPOSITION RATIONALE -

- (A) DESIGN:
THE POPPET AND CAP SEALS BACK UP EACH OTHER AND ARE ETHYLENE PROPYLENE O'RINGS. COUPLING IS MADE OF CRES 316 WITH A SPRING MADE OF 17-7PH. END FITTING IS A ROSAN LOCK RING, CRES A286.
- (B) TEST:
THE COUPLING AND CAP ARE LEAK CHECKED AND PROOFED DURING ATP AT 2250 PSIG. THE COUPLING AND CAP ARE TESTED SEPARATELY TO HOLD THE PRESSURE. ONCE INSTALLED ON THE APU. THE COUPLING IS LEAK CHECKED PER THE APU ATP LEAK CHECK PROCEDURES WITH THE CAP OFF.

OMRSD:

TPX4 - POPPET IS LEAK CHECKED (MASS SPEC USING HELIUM) WITH CAP OFF WHENEVER ~~NEW APU IS INSTALLED~~. CAPS ARE RE-INSTALLED WITH TORQUE OF 20-25 LBS. *THE DRAIN SYSTEM IS OBTAINED*

INCH -
TPX4 & TPX6 - TOXIC VAPOR CHECKS (WITH CAP ON) ARE PERFORMED PRIOR TO EACH FLIGHT AND INSPECTED FOR EVIDENCE OF N2H4 LEAKAGE AFTER EACH FLIGHT. CAPS ARE INSTALLED WITH TORQUE OF 20-25 IN-LBS.

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- (C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESSES CERTIFICATIONS ARE VERIFIED.

CONTAMINATION CONTROL
CLEANLINESS TO LEVEL 100 IS VERIFIED BY INSPECTION. PARTS PASSIVATION
AND OTHER CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

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

CRITICAL PROCESSES
HEAT TREATMENT IS VERIFIED BY INSPECTION, INCLUDING ROCKWELL HARDNESS
TEST.

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.

- (D) FAILURE HISTORY:
NONE

- (E) OPERATIONAL USE:
SHUT DOWN APU BASED ON SYSTEM TEMPERATURES AND FLIGHT PHASE. IF FUEL
LEAK IS DETERMINED THEN APU IS CONSIDERED LOST (FLIGHT RULE 10-1).

- APPROVALS -

RELIABILITY ENGINEERING: D. R. ATAPATTU
DESIGN ENGINEERING : J. R. MUNROE
QUALITY ENGINEERING : W. J. SMITH
NASA RELIABILITY :
NASA SUBSYSTEM MANAGER :
NASA QUALITY ASSURANCE :

Robert D. Khan
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