

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 04-2-PF11-X

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

REVISION : 0 01/05/89 W

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	AUXILIARY POWER UNIT (APU) SUNDSTRAND	MC201-0001-0201 72986J
LRU :	AUXILIARY POWER UNIT (APU) SUNDSTRAND	MC201-0001-0211 72986JK
LRU :	AUXILIARY POWER UNIT (APU) SUNDSTRAND	MC201-0001-0221 72986JL
SRU :	FUEL PUMP SUNDSTRAND	722745 SAME

QUANTITY OF LIKE ITEMS: 3  
ONE PER APU

DESCRIPTION/FUNCTION:  
PUMP, FUEL (HYDRAZINE) - POSITIVE DISPLACEMENT (GEAR)

TO TRANSFER FUEL AT INCREASED PRESSURE FROM SUPPLY TO DISCHARGE. THE PUMP INCORPORATES A START BY-PASS VALVE FOR STARTING, RELIEF VALVE TO PROTECT AGAINST DOWNSTREAM BLOCKAGE, AND FILTER AT THE OUTLET (50V46FL12) TO PREVENT CONTAMINATION FROM FLOWING DOWNSTREAM.

MASTER MEAS. LIST NUMBERS: V46P0120A

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## SUMMARY

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

ITEM NAME: FUEL PUMP

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	HZE FLG
04-2-PP11-03	PLUGGED OR RESTRICTED	X	1R2	
04-2-PP11-10	MECHANISM - PREMATURE, FAST, OR INADVERTENT OPERATION	X	1 1	
04-2-PP11-11	NO OUTPUT OR FAILS OFF	X	1R2	

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SUBSYSTEM: AUXILIARY POWER UNIT (APU)  
 LRU AUXILIARY POWER UNIT (APU)  
 ITEM NAME: FUEL PUMP

REVISION: 0 01/05/89 W

CRITICALITY OF THIS  
 FAILURE MODE: 1 1

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 FAILURE MODE:

SHAFT FACE SEAL FAILS, IN A MANNER TO PROVIDE AN IGNITION SOURCE FOR  
 LEAKING HYDRAZINE.

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

CAUSE:

STRUCTURAL FAILURE, EXCESSIVE WEAR, PROCESSING ERROR OF MATING RING OR  
 SEAL MATERIAL.

CRITICALITY 1/1 DURING INTACT ABORT ONLY?  
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REDUNDANCY SCREEN A) N/A  
 B) N/A  
 C) N/A

PASS/FAIL RATIONALE:

A)

B)

C)  
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- FAILURE EFFECTS -  
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(A) SUBSYSTEM:

POSSIBLE DETONATION OF HYDRAZINE IN DRAIN SYSTEM OR FUEL PUMP. LOSS OF  
 APU.

(B) INTERFACING SUBSYSTEM(S):

LOSS OF ONE HYDRAULIC PUMP AND POSSIBLE DAMAGE TO ADJACENT EQUIPMENT  
 INCLUDING OTHER APU.

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(C) MISSION:  
ABORT DECISION IS REQUIRED IF FAILURE OCCURS PRIOR TO ENTRY COMMITMENT.

(D) CREW, VEHICLE, AND ELEMENT(S):  
POSSIBLE LOSS OF CREW/VEHICLE IF ADJACENT APU DAMAGED OR FIRE AND EXPLOSION RESULTS FROM HYDRAZINE LEAKAGE. FUEL ISOLATION VALVES AUTOMATICALLY CLOSE TO MINIMIZE FIRE OR FUEL LEAKAGE INTO AFT COMPARTMENT.

(E) FUNCTIONAL CRITICALITY EFFECTS  
NONE

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- DISPOSITION RATIONALE -  
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(A) DESIGN:  
SEAL MATERIAL IS PURE CARBON P658 RC MATING AGAINST #2 CHROME PLATED FINISH WITH FACES OF SEALING SURFACE FLAT WITHIN 0.000020 FOR A LOW FRICTION AND LONG LIFE SEAL.

THE FUEL PUMP IS BEING REDESIGNED FOR THE IAPU PER MCR 10063 REV 17. THIS REDESIGN WILL ELIMINATE THE POSSIBILITY OF METAL-TO-METAL CONTACT IN THE PRESENCE OF FUEL WITHIN THE PUMP.

(B) TEST:  
FUEL PUMP LEAK CHECKED AND RUN-IN DURING ATP.

APU CERTIFIED FOR 27 MISSIONS, 41.7 HR.

OMRSD: NONE. THE SHAFT FACE SEALS ARE INTERNAL TO THE APU FUEL PUMP MAKING DIRECT OMRSD TESTING INVASIVE AND ILLOGICAL BECAUSE IT WOULD REQUIRE DISASSEMBLY OF THE FUEL PUMP.

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

CONTAMINATION CONTROL  
CLEANLINESS TO LEVEL 100 IS VERIFIED BY INSPECTION. FLUID SAMPLES ARE ANALYZED FOR CONTAMINATION AND VERIFIED BY INSPECTION. 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. TORQUING IS VERIFIED BY INSPECTION. SEAL AND MATING RING ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION  
RADIOGRAPHIC, PENETRANT, AND MAGNETIC PARTICLE INSPECTION FOR SURFACE AND SUBSURFACE DEFECTS IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES  
CHROME PLATING PER SPECIFICATION REQUIREMENTS IS VERIFIED BY

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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.

(D) FAILURE HISTORY:

DEVELOPMENT TEST FAILURES ON NONPRODUCTION HARDWARE CAUSED BY USING INCORRECT CARBON MATERIAL AND INCORRECT FINISH ON MATING RING (REF CAR A6898-010). PROPER MATERIAL CONTROL IMPLEMENTED.

(E) OPERATIONAL USE:

NONE.

- APPROVALS -

RELIABILITY ENGINEERING: T. R. BOLTZ  
 DESIGN ENGINEERING : J. R. MUNROE  
 QUALITY ENGINEERING : W. J. SMITH  
 NASA RELIABILITY :  
 NASA SUBSYSTEM MANAGER :  
 NASA QUALITY ASSURANCE :

*[Handwritten signatures and dates]*  
 T. R. Boltz 01/05/83  
 J. R. Munroe 1/6/83  
 W. J. Smith 1-19-83  
 W. J. Smith 1-19-83 for W. Smith  
 W. J. Smith 1-19-83