

## SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 04-2-TH11-X

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

REVISION : 2 89/07/11

	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 : ■	TURBINE CONTAINMENT HOUSING SUNDSTRAND	718499 STELLITE 31
■ SRU : ■	TURBINE EXHAUST HOUSING SUNDSTRAND	718507 STELLITE 31
■ SRU : ■	TURBINE CONTAINMENT HOUSING SUNDSTRAND	737422 UDIMET LX
■ SRU : ■	TURBINE EXHAUST HOUSING SUNDSTRAND	737423 UDIMET LX

## ■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

■ QUANTITY OF LIKE ITEMS: 6  
1 EACH PART NUMBER PER APU

■ FUNCTION:  
CONTAINS TURBINE AND DIRECTS APU EXHAUST PRODUCTS TO EXHAUST DUCT.

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SUBSYSTEM: AUXILIARY POWER UNIT (APU)  
LRU :AUXILIARY POWER UNIT (APU)  
ITEM NAME: TURBINE EXHAUST HOUSING

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CRITICALITY OF THIS  
FAILURE MODE: 1/1

■ 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

■ CAUSE:  
RUPTURE, SEAL OR WELDED JOINT FAILURE, TEST PORT LEAKAGE

■ 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:  
NO EFFECT ON APU OPERATION.

■ (B) INTERFACING SUBSYSTEM(S):  
AFT COMPARTMENT IS EXPOSED TO HOT EXHAUST PRODUCTS. HEAT MAY DAMAGE  
SURROUNDING HARDWARE.

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- (C) MISSION:  
NO EFFECT UNLESS DETECTED OR FAILURE PROPAGATES.
- (D) CREW, VEHICLE, AND ELEMENT(S):  
POSSIBLE LOSS OF CREW/VEHICLE DUE TO FIRE, EXPLOSION, OR ADJACENT EQUIPMENT DAMAGE CAUSING CRITICAL FAILURE MODES.
- (E) FUNCTIONAL CRITICALITY EFFECTS  
NONE

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- DISPOSITION RATIONALE -  
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- (A) DESIGN:  
TURBINE HOUSINGS ARE WELD-FABRICATED FROM A COMBINATION OF STELLITE 31 OR UDINET LX CASTING AND INCONEL SHEET. MATERIAL IS HIGHLY RESISTANT TO NITRIDING. ~~HOUSINGS HAVE DOUBLE WALL CONSTRUCTION, WITH THE INNER SPACE VENTING TO THE EXHAUST.~~ MAXIMUM PRESSURE DIFFERENTIAL IS APPROXIMATELY 3 PSI AT SEA LEVEL AND 6 PSI AT ALTITUDE. THIS LOW DRIVING FORCE MINIMIZES BOTH OCCURRENCE AND EFFECTS OF GAS LEAKAGE.

THE CONTAINMENT HOUSING SUPPORTS THE CONTAINMENT RING AND SERVES AS A 180 DEG RETURN CHANNEL AND 2ND STAGE TURBINE NOZZLE.

THE EXHAUST HOUSING COLLECTS EXHAUST PRODUCTS AND PROVIDES AN INTERFACE WITH THE EXHAUST DUCT. IN ADDITION, IT SERVES AS A SUPPORT FOR THE GAS GENERATOR ASSEMBLY IN A MANNER THAT ALLOWS EXHAUST GAS TO COOL THE THE EXTERIOR OF THE GAS GENERATOR.

STELLITE 31:

TURBINE HOUSING LIFE IS MONITORED THROUGH THE LIMITED LIFE SPECIFICATION MF0004-028. TURBINE HOUSINGS ARE SUBJECT TO THERMAL-STRESS CRACKING AND ARE LIFE-LIMITED TO 20 HR OF APU OPERATION, AFTER WHICH THEY ARE REMOVED AND REPLACED. LIMITED LIFE (ACCUMULATED LIFE) TABLES ARE REVIEWED PRIOR TO EACH FLIGHT TO INSURE LIFE LIMIT IS NOT EXCEEDED PRIOR TO COMPLETION OF NEXT MISSION.

TURBINE HOUSING MATERIAL CHANGES FROM STELLITE 31 TO UDINET LX ARE BEING PHASED IN THROUGH ATTRITION. UDINET LX IS NOT LIFE LIMITED.

- (B) TEST:  
P/N 718507 PROOF PRESSURES TO 20 PSIG, NO PERMANENT DEFORMATION PERMITTED. P/N 718499 PROOF PRESSURE AND LEAK TESTED TO 185 PSIG FOR HOUSING/PLENUM AND 20 PSIG FOR THE OUTER SHELL. LIMIT OF 0.002 IN CHANGE PERMITTED FOR SELECTED DIMENSIONS.

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OMRSD: THE TURBINE HOUSINGS ARE TESTED EVERY FLOW FOR EXTERNAL LEAKAGE BY THE EXHAUST DUCT LEAK TEST.

■ (C) INSPECTION:

RECEIVING INSPECTION

MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS PER REQUIREMENTS IS 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.

NONDESTRUCTIVE EVALUATION

PENETRANT AND RADIOGRAPHIC INSPECTION OF HOUSINGS AFTER MACHINING IS VERIFIED. ULTRASONIC INSPECTION OF EDW IS VERIFIED BY INSPECTION. MAGNETIC PARTICLE INSPECTION IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

INSPECTION VERIFIES WELDING AND FORGING HEAT TREATMENT.

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:

TURBINE HOUSINGS ARE SUBJECT TO THERMAL STRESS CRACKING (REF CAR A6548) BUT HAVE NOT EXPERIENCED ANY THROUGH CRACKS.


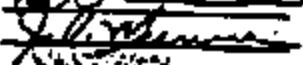

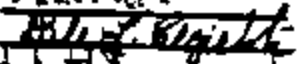
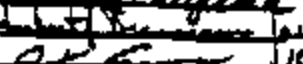

LIMITED LIFE WITH A SUBSTANTIAL MARGIN HAS BEEN IMPOSED ON THE HOUSINGS (SEE THE DESIGN SECTION).

■ (E) OPERATIONAL USE:

NONE

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- APPROVALS -

RELIABILITY ENGINEERING :	T. R. BOLTZ	TRB :		
DESIGN ENGINEERING :	J. R. MINROE			
QUALITY ENGINEERING :	W. J. SMITH	WJS :		
NASA RELIABILITY :				
NASA SUBSYSTEM MANAGER :				10-2-89
NASA QUALITY ASSURANCE :				10-2-89

10/4/89