

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 04-2-CONTL2-X

SUBSYSTEM NAME: AUXILIARY POWER UNIT (APU)

REVISION : 2 89/08/09

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	APU CONTROLLER SUNSTRAND	MC201-0001-0075 7294850

- EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
HIGH SPEED CONTROL (ELECTRONIC CONTROL CIRCUIT).
- QUANTITY OF LIKE ITEMS: 3
1 CONTROL CIRCUIT PER APU CONTROLLER, 1 PER APU
- FUNCTION:
 - (1) PROVIDES AN OUTPUT SIGNAL TO OPEN THE NORMALLY CLOSED SHUTOFF VALVE (LV13) IN RESPONSE TO A "START" COMMAND WITH PRE-START CONDITIONS SATISFIED OR TO A "COOL" COMMAND FOR AN UNCONDITIONAL START.
 - (2) CANCELS OUTPUT SIGNAL (IN RESPONSE TO MPU #2) AND ALLOWS VALVE TO CLOSE WHEN TURBINE SPEED APPROACHES 113 PLUS OR MINUS 8 PER CENT.
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SHUTTLE CRITICAL ITEMS LIST - ORBITER

NUMBER: 04-2-CONT12-11

REVISION# 2 89/08/09

SUBSYSTEM: AUXILIARY POWER UNIT (APU)

LRU :APU CONTROLLER

ITEM NAME: APU CONTROLLER

CRITICALITY OF THIS
FAILURE MODE:1R2

FAILURE MODE:

LOSS OF OUTPUT, (FAILS TO PRODUCE AND MAINTAIN SIGNAL TO OPEN VALVE).

MISSION PHASE:

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

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS

CAUSE:

CONTROLLER INTERNAL PIECE-PART FAILURE - OPEN CIRCUIT, LOSS OF DRIVE
SIGNAL, EMI.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? Y

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

REDUNDANCY SCREEN A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

LOSS OF ONE APU SYSTEM; APU SHUTS DOWN.

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(B) INTERFACING SUBSYSTEM(S):
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 LOST. CRITICALITY 1 FOR SSME-INDUCED
RTL, ATO, AOA, OR TAL DUE TO THE POSSIBLE ADDITIONAL LOSS OF ASSOCIATED
APU/HYD AND MAIN ENGINE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:
ELECTRICAL COMPONENTS ARE REQUIRED TO BE QUALIFIED, PROPERLY DERATED
AND APPLIED PER MC201-0001, PARAGRAPH 3.3.2.2. MECHANICAL PARTS
SELECTED FROM MFO004-100. ELECTRICAL PARTS SELECTED FROM MFO004-400.
CONFORMAL COATING PER SUNDSTRAND SPEC CP 17.32-01. CLEANLINESS PER
MA0110-301. CONTROLLER VIBRATION DAMPED AT MOUNTING.

THE OPPL CALLS FOR GLASSIVATION FOR INTEGRATED CIRCUIT DIE, SINGLE SEAL
FOR TANTALUM WET SLUG CAPACITORS, ETC. DERATING OF EEE PARTS IS
EXPANDED BEYOND THE SIMPLISTIC (75% X RATED) REQUIREMENTS OF THE
CONTRACT.

(B) TEST:
CONTROLLER IS FUNCTIONALLY TESTED DURING ATP. CONTROLLER IS SUBJECTED
TO AVT. CONTROLLER IS THERMAL TESTED DURING ATP - RANGE 70 DEG F, 130
DEG F, 30 DEG F.

CONTROLLER IS QUALIFIED FOR QAVT, EMI, THERMAL VACUUM (-65 DEG F TO 165
DEG F, 80 K FT FOR 10 CYCLES). ADDITIONAL HUMIDITY, FLIGHT VIBRATION,
AND THERMAL VACUUM TESTS ARE CONDUCTED FOR THE OPERATIONAL
CONFIGURATION.

ALL EEE PARTS ARE SUBJECTED TO SCREENING AND BURN-IN TESTS TO DETECT
MARGINAL PARTS AND TO INDUCE INFANT MORTALITY FAILURES.

QMRSD: LPS AUTO BITE TEST IS PERFORMED ON EACH APU EVERY FLOW.

(C) INSPECTION:
RECEIVING INSPECTION
VISUAL AND DIMENSIONAL INSPECTIONS ARE PERFORMED ON ALL INCOMING
PARTS. MATERIAL AND PROCESSES CERTIFICATIONS ARE VERIFIED.

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CONTAMINATION CONTROL
CLEANLINESS IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MANUFACTURING, ASSEMBLY, AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
SOLDERING TO NHB 5300.4(3A) IS VERIFIED BY INSPECTION.

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



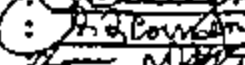
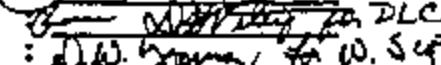
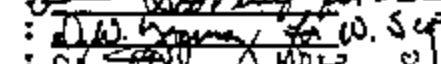

HANDLING/PACKAGING
HANDLING, PACKAGING, STORAGE, AND SHIPPING PROCEDURES ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NO FLIGHT FAILURES TO DATE. SANGAMO CAPACITORS FAILED IN ATP, RESULTING IN ALL CAPACITORS BEING CHANGED OUT (CAR AC9235).

ALTERNATE PART WAS SUBSTITUTED IN CONTROLLER, RESULTING IN ERRATIC OUTPUT DURING VEHICLE CHECKOUT (CAR AC2853). CIRCUIT WAS REDESIGNED TO BE IMMUNE TO COMPONENT MANUFACTURING VARIATIONS.

(E) OPERATIONAL USE:
REMAINING APU'S GO TO HIGH SPEED AND AUTOMATIC SHUTDOWN IS INHIBITED TO PRECLUDE INADVERTENT SHUTDOWNS.

- APPROVALS -

RELIABILITY ENGINEERING:	T. R. BOLTZ	TRB	
DESIGN ENGINEERING	: J. R. MUNROE		
QUALITY ENGINEERING	: D. DESAI	DD	
NASA RELIABILITY	:		
NASA SUBSYSTEM MANAGER	:		
NASA QUALITY ASSURANCE	:		

DLC
W. Scott 9-8-89
8/21/89