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-CONTL2-11

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.

(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 RTLS, 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 MF0004-100. ELECTRICAL PARTS SELECTED FROM MF0004-400. 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.

OMRSD: 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.

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 VRB :
DESIGN ENGINEERING : J. R. MUNROE :
QUALITY ENGINEERING : D. DESAI :
NASA RELIABILITY :
NASA SUBSYSTEM MANAGER :
NASA QUALITY ASSURANCE :