SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AUXILIARY POWER (APUS) FMEA NO 04-2 -CONTL1-12 REV:02/26/86

ASSEMBLY :APU CONTROLLER
P/N RI :MC201-0001-0065
P/N VENDOR:SS P/N 729485C
QUANTITY :3
:1 CONTROL CIRCUIT PER
:APU CONTROLLER,1 PER APU

ABORT, RTLS, AOA, ATO, TAL			CRIT. FUNC:	1R
VEHICLE EFFECTIVITY:	102 X	103 X	CRIT. HDW:	2
PHASE(S):	PL X LO X OO		104 X	DO X LS X

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
DES	J R MUNROE	DES	SSM
REL	T R BOLTZ	REL	REL
QE	W J SMITH	QE	QE

ITEM:
PRIMARY SPEED CONTROL (ELECTRONIC CONTROL CIRCUIT)

FUNCTION:
(1) PROVIDES AN OUTPUT SIGNAL TO CLOSE THE NORMALLY OPEN CONTROL VALVE (50V46CV12) IN RESPONSE TO MPU #3, TO MAINTAIN TURBINE SPEED - NORMAL (103 %) OR SECONDARY (115 %) SPEED WITHIN +/- 8 %; (2) CONDITIONS OUTPUT FROM MPU #3 AND PROVIDES A TURBINE SPEED INDICATION FOR THE CREW (V46R0135A).

FAILURE MODE:
PREMATURE OUTPUT. (PREMATURELY PRODUCES SIGNAL TO CLOSE VALVE)

CAUSE(S):
INTERNAL PIECE-PART FAILURE, SHORTED VALVE DRIVER, EMI

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) LOSS OF ONE APU SYSTEM. APU UNDERSPEEDS AND SHUTS DOWN; ALSO, POSSIBILITY OF FUEL OVERHEATING AND DECOMPOSING, RESULTING IN RUPTURE OF VALVE WHILE APU IS NOT OPERATING.

(B) LOSS OF SHAFT POWER TO ONE HYDRAULIC PUMP

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

(D) NO EFFECT UNTIL SECOND SYSTEM LOST. POSSIBLE LOSS OF CREW/VEHICLE IF CREW PROCEDURES ARE NOT FOLLOWED AND IF CONTROLLER POWER IS NOT REMOVED AFTER APU SHUTDOWN. CRITICALITY 1 FOR SSME-INDUCED RTLS, ATO, AOA, OR TAL DUE TO THE POSSIBLE ADDITIONAL LOSS OF ASSOCIATED APU/HYD AND MAIN ENGINE.

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(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 CPPL 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 VACULM (-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.

(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.

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

IF ENTRY, A HOT RESTART IS PERFORMED IF REQUIRED, TO GAIN A SECOND APU.