

CRITICAL ITEMS LIST

PROJECT: SMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 21120F1177

SHEET: 1

P/N REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2900	0	MOA INHIBIT QTY 6 CIRCUITRY SCHEMATIC 2563717	MODE: CONTINUOUS DIRECT DRIVE OUTPUT FROM CW ON CCW DRIVE WHEN ANOTHER JOINT IS COMMANDED. CAUSE(S): (1) TRANSISTOR A201 FAILS SHORT.	JOINT WITH FAULT WILL DRIVE UNCOMMANDED IN DIRECT DRIVE CW ON CCW WHEN ANOTHER JOINT IS COMMANDED. WORST CASE UNEXPECTED MOTION. TWO JOINTS DRIVE. UNANNOUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A		DESIGN FEATURES ----- COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003. THE DIODE AND TRANSISTOR, WHICH COMPRISE AN OPTO-ISOLATOR, ARE SUBJECTED TO THE SAME QUALITY AND APPLICATION CONTROLS AS APPLIED TO DISCRETE SEMICONDUCTORS. DISCRETE SEMICONDUCTION DEVICES SPECIFIED TO AT LEAST THE 1X LEVEL OF MIL-S-19500. ALL DEVICES ARE SUBJECTED TO RE-SCREENING BY AN INDEPENDANT TEST HOUSE. SAMPLES OF ALL PROCURED LOTS/DATE CODES ARE SUBJECTED TO DESTRUCTIVE PHYSICAL ANALYSIS (DPA) TO VERIFY THE INTEGRITY OF THE MANUFACTURING PROCESSES. DEVICE STRESS LEVELS ARE, DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003 AND VERIFIED BY DESIGN REVIEW. ALL RESISTORS AND CAPACITORS USED IN THE DESIGN ARE SELECTED FROM ESTABLISHED RELIABILITY (ER) TYPES. LIFE EXPECTANCY IS INCREASED BY ENSURING THAT ALL ALLOWABLE STRESS LEVELS ARE DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003. ALL CERAMIC AND ELECTROLYTIC CAPACITORS ARE ROUTINELY SUBJECTED TO RADIOGRAPHIC INSPECTION.

RMS/ELEC - 569

PREPARED BY: HEWG

SUPERSEDING DATE: 11 SEP 06

APPROVED BY: _____

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 5116DF1177

SHEET: 2

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / TIME, 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2900	0	MDA INHIBIT QTY & CIRCUITRY SCHEMATIC 2563717	MODE: CONTINUOUS DIRECT DRIVE OUTPUT FROM CW OR CCW DRIVE WHEN ANOTHER JOINT IS COMMANDED. CAUSE(S): (1) TRANSISTER A201 FAILS SHORT.	JOINT WITH FAULT WILL DRIVE UNCOMMANDED IN DIRECT DRIVE CW OR CCW WHEN ANOTHER JOINT IS COMMANDED. WORST CASE UNEXPECTED MOTION. TWO JOINTS DRIVE, UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ----- N/A		ACCEPTANCE TESTS ----- THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 O THERMAL: PLUS 70 DEGREES C TO -25 DEGREES C DURATION - 1 1/2 CYCLES THE SPA IS THEN TESTED AS PART OF THE JOINTS ACCEPTANCE TESTS (VIBRATION AND THERMAL VACUUM TEST). THE SPA'S/JOINTS UNDERGO RMS SYSTEM TESTS (TP510 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE. QUALIFICATION TESTS ----- THE SPA IS SUBJECTED TO THE FOLLOWING SRU QUALIFICATION TEST ENVIRONMENTS. THE SPA WAS ALSO TESTED AS PART OF THE JOINT QUALIFICATION TESTS. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 O SHOCK: 20G/11 MS/3 AXES (6 DIRECTIONS) O THERMAL VAC: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1110 [±] 6 TORR O HUMIDITY: TESTED WITH THE SHOULDER JOINT O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RSD1) FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16967

RMS/ELEC - 570

PREPARED BY: HMLG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

DATE:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51140F1177

SHEET: 3

PNR REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. I/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2900	0	NOA INHIBIT QTY-6 CIRCUITRY SCHEMATIC 2563717	<p>MODE: CONTINUOUS DIRECT DRIVE OUTPUT FROM CW OR CCW DRIVE WHEN ANOTHER JOINT IS COMMANDED.</p> <p>CAUSE(S): (1) TRANSISTOR A201 FAILS SHORT.</p>	<p>JOINT WITH FAULT WILL DRIVE UNCOMMANDED IN DIRECT DRIVE CW OR CCW WHEN ANOTHER JOINT IS COMMANDED.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION. TWO JOINTS DRIVE. UNANNOUNCED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PAIRS REMAINING</p> <p>N/A</p>	<p>QA/INSPECTIONS</p> <p>UNITS ARE MANUFACTURED UNDER DOCUMENTED QUALITY CONTROLS. THESE CONTROLS ARE EXERCISED THROUGHOUT DESIGN PROCUREMENT, PLANNING, RECEIVING, PROCESSING, FABRICATION, ASSEMBLY, TESTING AND SHIPPING OF THE UNITS. MANDATORY INSPECTION POINTS ARE EMPLOYED AT VARIOUS STAGES OF FABRICATION ASSEMBLY AND TEST. GOVERNMENT SOURCE INSPECTION IS INVOKED AT VARIOUS CONTROL LEVELS.</p> <p>EEE PARTS INSPECTION IS PERFORMED AS REQUIRED BY SPAR-RMS-PA.003. EACH EEE PART IS QUALIFIED AT THE PART LEVEL TO THE REQUIREMENTS OF THE APPLICABLE SPECIFICATION. ALL EEE PARTS ARE 100X SCREENED AND BURNED IN, AS A MINIMUM AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100X RE-SCREENED IN ACCORDANCE WITH REQUIREMENTS, BY AN INDEPENDENT SPAR APPROVED TESTING FACILITY. DPA IS PERFORMED AS REQUIRED BY PA.003 ON A RANDOMLY SELECTED 5X OF PARTS, MAXIMUM 5 PIECES, MINIMUM 3 PIECES FOR EACH LOT NUMBER/DATE CODE OF PARTS RECEIVED.</p> <p>WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSC8000 STANDARD NUMBER 95A.</p> <p>RECEIVING INSPECTION VERIFIES THAT ALL PARTS RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED TO PARTS DURING SHIPMENT, THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION AND SCREENING DATA CLEARLY IDENTIFIES ACCEPTABLE PARTS.</p> <p>PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE,</p> <p>PRINTED CIRCUIT BOARD INSPECTION FOR TRACK SEPARATION, DAMAGE AND ADEQUACY OF PLATED THROUGH HOLES,</p> <p>COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA HQ 5300.4(3A) STANDARD, AS MODIFIED BY JSC 0800A.</p> <p>CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES.</p> <p>POST P.C. BD. INSTALLATION INSPECTION, CLEANLINESS AND WORKMANSHIP (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT)</p> <p>P.C. BD. INSTALLATION INSPECTION, CHECK FOR CORRECT BOARD INSTALLATION, ALIGNMENT OF BOARDS, PROPER CONNECTOR CONTACT MATING, WIRE ROUTING, STRAPPING OF WIRES ETC.,</p> <p>PRE CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>PRE-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS WELL CONFIGURATION VERIFICATION TO AS DESIGN ETC. (MANDATORY INSPECTION POINT).</p>	

RMS/ELEC - 571

PREPARED BY: MIMG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 511207177

SHEET: 5

PMA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	RMR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
2900	0	MOA INHIBIT QTY: 6 CIRCUITRY SCHEMATIC 2563717	<p>MODE: CONTINUOUS DIRECT DRIVE OUTPUT FROM CW OR CCW DRIVE WHEN ANOTHER JOINT IS COMMANDED.</p> <p>CAUSE(S): (1) TRANSISTER AZ01 FAILS SHORT.</p>	<p>JOINT WITH FAULT WILL DRIVE UNCOMMANDED IN DIRECT DRIVE CW OR CCW WHEN ANOTHER JOINT IS COMMANDED.</p> <p>WORST CASE UNEXPECTED MOTION. TWO JOINTS DRIVE. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING N/A</p>		<p>A TEST READINESS REVIEW (TRR) WHICH INCLUDES VERIFICATION OF TEST PERSONNEL, TEST DOCUMENTS, TEST EQUIPMENT CALIBRATION/ VALIDATION STATUS AND HARDWARE CONFIGURATION IS CONVENED BY QUALITY ASSURANCE IN CONJUNCTION WITH ENGINEERING, RELIABILITY, CONFIGURATION CONTROL, SUPPLIER AS APPLICABLE, AND THE GOVERNMENT REPRESENTATIVE, PRIOR TO THE START OF ANY FORMAL TESTING (ACCEPTANCE OR QUALIFICATION).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>INTEGRATION OF UNIT TO JOINT SRU - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTORS FOR BENT OR PUSHBACK CONTACTS, VISUAL, CLEANLINESS, INTERCONNECT WIRING AND POWER UP TEST TO THE APPROPRIATE JOINT INSPECTION TEST PROCEDURE (ITP) ETC.</p> <p>JOINT LEVEL PRE-ACCEPTANCE TEST INSPECTION, INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC.</p> <p>JOINT LEVEL ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>SRMS SYSTEMS INTEGRATION, THE INTEGRATION OF MECHANICAL ARM SUBASSEMBLIES AND THE FLIGHT CABIN EQUIPMENT TO FORM THE SRMS. INSPECTIONS ARE PERFORMED AT EACH PHASE OF INTEGRATION WHICH INCLUDES GROUNDING CHECKS, THRU WIRING CHECKS, WIRING ROUTING, INTERFACE CONNECTORS FOR BENT OR PUSH BACK CONTACTS ETC.</p> <p>SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p>

RMS/ELEC - 572

PREPARED BY: M/WG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

DATE:

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 21140F1177

SHEET: 5

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. I:1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2900	0	MDA INHIBIT QTY: 6 CIRCUITRY SCHEMATIC 2563717	<p>MODE: CONTINUOUS DIRECT DRIVE OUTPUT FROM CW OR CCW DRIVE WHEN ANOTHER JOINT IS COMMANDED.</p> <p>CAUSE(S): (1) TRANSISTER A201 FAILS SHORT.</p>	<p>JOINT WITH FAULT WILL DRIVE UNCOMMANDED IN DIRECT DRIVE CW OR CLW WHEN ANOTHER JOINT IS COMMANDED.</p> <p>WORST CASE UNEXPECTED MOTION. TWO JOINTS DRIVE. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REOUNDANT PATHS REMAINING N/A</p>		<p>FAILURE HISTORY THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

RMS/ELEC - 573

PREPARED BY: HMG

SUPERSEDING DATE: 17 SEP 86

APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 211401177

SHEET: 6

PREP REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOURLY / TIME, %/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2900	0	MOA INHIBIT QTY 6 CIRCUITRY SCHEMATIC 2563717	MODE: CONTINUOUS DIRECT DRIVE OUTPUT FROM CW OR CCW DRIVE WHEN ANOTHER JOINT IS COMMANDED. CAUSE(S): (1) TRANSISTER AZ01 FAILS SHORT.	JOINT WITH FAULT WILL DRIVE UNCOMMANDED IN DIRECT DRIVE CW OR CCW WHEN ANOTHER JOINT IS COMMANDED. WORST CASE UNEXPECTED MOTION. TWO JOINTS DRIVE. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A		OPERATIONAL EFFECTS WHEN ATTEMPTING TO DRIVE A SINGLE JOINT IN DIRECT DRIVE, THE JOINT SELECTED PLUS ONE OTHER JOINT WILL DRIVE. COMPUTER SUPPORTED MODES AND BACKUP AVAILABLE. CREW ACTION REMOVE THE DRIVE COMMAND. SELECT ANY OTHER MODE. MISSION CONSTRAINT THE CREW SHOULD BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES. MISSION CONSTRAINT THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS. SCREEN FAILURES N/A OMRSD OFFLINE DRIVE ANY TWO JOINTS IN DIRECT VERIFY THAT ONLY THE COMMANDED JOINT MOVES. OMRSD ONLINE INSTALLATION NONE OMRSD ONLINE MAINTENANCE DRIVE ANY TWO JOINTS IN DIRECT VERIFY ABSENSE OF EACH SIGNATURE ON ALL OTHER JOINTS

RMS/ELEC - 574