

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51160/1177

SHEET: 1

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOUR / FUNC. / 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3110	0	MOTOR DRIVE RELAY QTY-8 P/M MS27743-1 AND ZENER DIODES. INTER CONNECTION DIAGRAM 2563716	MODE: ONE OR MORE N.C. CONTACTS FAILS OPEN.  CAUSE(S): (1) MECHANICAL FAILURE OF ARMATURE. (2) DEBRIS BETWEEN CONTACTS. (3) CONTACTS STUCK IN N.O. POSITION.	MOTOR WILL NOT DRIVE IN ANY PRIME MODES. ARM MAY TAKE AN UNEXPECTED TRAJECTORY.  WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING N/A		DESIGN FEATURES RELAYS ARE HERMETICALLY SEALED TYPES, CONFORMING TO MIL R 39016 OR MIL R 6106 AS DICTATED BY THE DESIGN APPLICATION. IN ADDITION, ALL RELAYS ARE SCREENED TO NASA ST-R-0001 REQUIREMENTS. CONTACT CURRENT AND VOLTAGE STRESSES ARE REDUCED IN ACCORDANCE WITH THE DERATING REQUIREMENTS OF SPAR-RMS-PA-003. IN THE PACKAGING DESIGN, EMPHASIS HAS BEEN PLACED UPON RELAY MOUNTING TO ENSURE GOOD HEAT TRANSFER AND IMMUNITY FROM VIBRATION.

RMS/ELEC - 785

PREPARED BY: MFG

SUPPLEMENTING DATE: 11 SEP 66

APPROVED BY:

DATE:

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51740F1177

SHEET: 1

FMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOW? FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3110	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: ONE OR MORE N.C. CONTACTS FAILS OPEN.  CAUSE(S): (1) MECHANICAL FAILURE OF ARMATURE. (2) DEBRIS BETWEEN CONTACTS. (3) CONTACTS STUCK IN N.O. POSITION.	MOTOR WILL NOT DRIVE IN ANY PRIME MODES. ARM MAY TAKE AN UNEXPECTED TRAJECTORY.  WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING N/A	1/1	<p><b>ACCEPTANCE TESTS</b></p> <p>THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <ul style="list-style-type: none"> <li>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</li> <li>O THERMAL: PLUS 70 DEGREES C TO -25 DEGREES C DURATION 1 1/2 CYCLES</li> </ul> <p>THE SPA IS THEN TESTED AS PART OF THE JOINTS ACCEPTANCE TESTS (VIBRATION AND THERMAL VACUUM TEST).</p> <p>THE SPA'S/JOINTS UNDERGO RMS SYSTEM TESTS (TPS18 RMS STRONGBACK AND TPSS2 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p><b>QUALIFICATION TESTS</b></p> <p>THE SPA IS SUBJECTED TO THE FOLLOWING SRU QUALIFICATION TEST ENVIRONMENTS. THE SPA WAS ALSO TESTED AS PART OF THE JOINT QUALIFICATION TESTS.</p> <ul style="list-style-type: none"> <li>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</li> <li>O SHOCK: 20G/11 MS/3 AXES (6 DIRECTIONS)</li> <li>O THERMAL VAC: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1K10**6 TORR</li> <li>O HUMIDITY: TESTED WITH THE SHOULDER JOINT</li> <li>O EMC: MIL-STD-461 AS MODIFIED BY SI-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01)</li> </ul> <p><b>FLIGHT CHECKOUT</b></p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 169B7</p>

RMS/ELEC - 786

CRITICAL ITEMS LIST

PROJECT: SAMS  
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 512071177

SHEET: 3

ITEM REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RDR / TUNE: 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3110	0	MOTOR DRIVE RELAY QTY 6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: ONE OR MORE N.C. CONTACTS FAILS OPEN.  CAUSE(S): (1) MECHANICAL FAILURE OF ARMATURE. (2) DEBRIS BETWEEN CONTACTS. (3) CONTACTS STUCK IN N.O. POSITION.	MOTOR WILL NOT DRIVE IN ANY PRIME MODES. ARM MAY TAKE AN UNEXPECTED TRAJECTORY.  WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING  N/A		QA/INSPECTIONS  MOTOR DRIVE RELAYS ARE PROCURED AS A EEE QUALIFIED PRODUCT IN ACCORDANCE WITH THE REQUIREMENTS OF SPECIFICATION MIL-R-39016 AS REQUIRED BY SPAR-RMS PA.003. ADDITIONALLY ALL RELAYS ARE 100% SCREENED TO THE REQUIREMENTS OF JSC SPECIFICATION ST-R.001 AS REQUIRED BY SPAR-RMS PA.003. SCREENING TESTING CONSIST OF THERMAL SHOCK, HIGH AND LOW TEMPERATURE OPERATION, INSULATION RESISTANCE, CONTACT RESISTANCE, OPERATING VOLTAGES, RADIOGRAPHIC INSPECTION AND PIND TEST.  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 100% SCREENED AND BURNED IN, AS A MINIMUM, AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100% 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 5% OF PARTS, MAXIMUM 5 PIECES, MINIMUM 3 PIECES FOR EACH LOT NUMBER/DATE CODE OF PARTS RECEIVED.  WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSC8000 STANDARD NUMBER 95A.  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.  PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE,  PRINTED CIRCUIT BOARD INSPECTION FOR TRACK SEPARATION, DAMAGE AND ADEQUACY OF PLATED THROUGH HOLES,  COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA M88 5300.4(3A) STANDARD, AS MODIFIED BY JSC 00800A.  CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES.  POST P.C. BD. INSTALLATION INSPECTION, CLEANLINESS AND WORKMANSHIP (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT)  P.C. BD. INSTALLATION INSPECTION, CHECK FOR CORRECT BOARD INSTALLATION, ALIGNMENT OF BOARDS, PROPER CONNECTOR CONTACT MATING, WIRE ROUTING, STRAPPING OF WIRES ETC.,  PRE-CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT)  PRE-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION

RMS/ELEC - 787

PREPARED BY: MFMG

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: 511C071177

SHEET: 4

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / TIME. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3110	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER CONNECTION DIAGRAM 2563716	<p>MODE: ONE OR MORE M.C. CONTACTS FAILS OPEN.</p> <p>CAUSE(S): (1) MECHANICAL FAILURE OF ARMATURE. (2) DEBRIS BETWEEN CONTACTS. (3) CONTACTS STUCK IN N.O. POSITION.</p>	<p>MOTOR WILL NOT DRIVE IN ANY PRIME MODES. ARM MAY TAKE AN UNEXPECTED TRAJECTORY.</p> <p>WORST CASE ..... UNEXPECTED MOTION. FREE JOINT. UNANNOUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ..... N/A</p>	1/1	<p>VERIFICATION TO AS DESIGN ETC., (MANDATORY INSPECTION POINT).</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 - 788

ICAL ITEMS LIST

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: SERVO PUMP AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 51120FT177

SHEET: 5

ITEM REF.	REV.	PART QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDDR / FUNC. / CRITICALITY	RATIONALE FOR ACCEPTANCE
3110	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: ONE OR MORE N.C. CONTACTS FAILS OPEN.  CAUSE(S): (1) MECHANICAL FAILURE OF ARMATURE. (2) DEBRIS BETWEEN CONTACTS. (3) CONTACTS STUCK IN N.O. POSITION.	MOTOR WILL NOT DRIVE IN ANY PRIME MODES. ARM MAY TAKE AN UNEXPECTED TRAJECTORY.  WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING  N/A	1/1 CRITICALITY	FAILURE HISTORY  THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

RMS/ELEC - 789

PREPARED BY: MEWG

SUPCEDING DATE: 11 SEP 86

APPROVED BY:

DATE:

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: SRMS POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 511401177

SHEET: 6

P/N REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
3110	1	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER- CONNECTION DIAGRAM 2563716	MODE: ONE OR MORE N.C. CONTACTS FAILS OPEN.  CAUSE(S): (1) MECHANICAL FAILURE OF ARMATURE. (2) DEBRIS BETWEEN CONTACTS. (3) CONTACTS STUCK IN N.O. POSITION.	MOTOR WILL NOT DRIVE IN ANY PRIME MODES. ARM MAY TAKE AN UNEXPECTED TRAJECTORY.  WORST CASE ----- UNEXPECTED MOTION. FREE JOINT. UNANNOUNCED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ----- N/A		<p>OPERATIONAL EFFECTS</p> <p>-----</p> <p>ARM DOES NOT RESPOND PROPERLY TO HAND CONTROLLER COMMANDS OR              AUTO SEQUENCES. CREW INHERENTLY COMPENSATES FOR ANY UNDESIRABLE              ARM TRAJECTORY IN MANUAL AUGMENTED MODES.</p> <p>CREW ACTION</p> <p>-----</p> <p>APPLY BRAKES. SELECT BACKUP.</p> <p>CREW TRAINING</p> <p>-----</p> <p>THE CREW WILL BE TRAINED TO OBSERVE WHETHER THE ARM IS              RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.</p> <p>MISSION CONSTRAINT</p> <p>-----</p> <p>OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. 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.              AUTO TRAJECTORIES MUST BE DESIGNED TO COME NO CLOSER THAN 5 FT              FROM STRUCTURE.</p> <p>SCREEN FAILURES</p> <p>-----</p> <p>N/A</p> <p>OMRSD OFFLINE</p> <p>-----</p> <p>IN COMPUTER CONTROLLED MODE VERIFY THAT EACH JOINT              DRIVES.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>-----</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND</p> <p>-----</p> <p>DRIVE EACH JOINT IN SINGLE MODE              VERIFY THE TACHO SIGNATURE</p>

RMS/ELEC - 790