

TIMEA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RISK / FUNC. 2/1RD CRITICALITY RATIONALE FOR ACCEPTANCE
2970	0	CURRENT LIMITER QTY: 6 SCHEMATIC 256571B	MODE: IWD/BKD FLAG FAILS HIGH. CAUSE(S): (1) INTERNAL PARTS FAILURE.	FLAG FAILS TO BKO. CONSISTENCY CHECK ENVELOPE TEST INHIBITED. WORST CASE ----- LOSS OF AUTO BRAKES. UNANNOUNCIATED. REDUNDANT PATHS REMAINING ----- SINGLE JOINT RUNAWAY FAILURE	DESIGN FEATURES ----- THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING CMOS LOGIC DEVICES. CMOS DEVICES OPERATE AT LOW POWER AND HENCE DO NOT EXPERIENCE SIGNIFICANT OPERATING STRESSES. THE TECHNOLOGY IS MATURE, AND DEVICE RELIABILITY HISTORY IS WELL DOCUMENTED. ALL STRESSES ARE ADDITIONALLY REDUCED BY DERATING THE APPROPRIATE PARAMETERS IN ACCORDANCE WITH SPAR-RMS-PA.003. SPECIAL HANDLING PRECAUTIONS ARE USED AT ALL STAGES OF MANUFACTURE TO PRECLUDE DAMAGE/STRESS DUE TO ELECTROSTATIC DISCHARGE. COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003. 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 - 658

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51140PT177

SHEET: 2

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	MODE / FUNC. 2/100 CRITICALITY	RATIONALE FOR ACCEPTANCE
2970	0	CURRENT LIMITER QTY-6 SCHEMATIC 2563710	MODE: FLD/BXD FLAG FAILS HIGH. CAUSE(S): (1) INTERNAL PARTS FAILURE.	FLAG FAILS TO BKD. CONSISTENCY CHECK ENVELOPE TEST INHIBITED. WORST CASE LOSS OF AUTO BRAKES. UNANNUNCIATED. REDUNDANT PATHS REMAINING SINGLE JOINT RUNAWAY FAILURE	2/100 CRITICALITY	<p>ACCEPTANCE TESTS</p> <p>THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <ul style="list-style-type: none"> 0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 0 THERMAL: PLUS 70 DEGREES C TO -25 DEGREES C DURATION - 1 1/2 CYCLES <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 (TP510 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS</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"> 0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 0 SHOCK: 20G/11 MS/3 AXES (6 DIRECTIONS) 0 THERMAL VAC: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1X10⁻⁶ TORR 0 HUMIDITY: TESTED WITH THE SHOULDER JOINT 0 EMC: MIL-STD-461 AS MODIFIED BY SL:E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/A), RS01) <p>FLIGHT CHECKOUT</p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16907</p>

RMS/ELEC - 659

PREPARED BY: MFG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

ITEM REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOUR / FUNC. Z/YRD CRITICALITY RATIONALE FOR ACCEPTANCE
2970	0	CURRENT LIMITER QTY-6 SCHEMATIC 256371B	MODE: FWD/BKD FLAG FAILS HIGH. CAUSE(S): (1) INTERNAL PARTS FAILURE.	FLAG FAILS TO BKD. CONSISTENCY CHECK ENVELOPE TEST INHIBITED. WORST CASE LOSS OF AUTO BRAKES. UNANNUNCIATED. REDUNDANT PATHS REMAINING SINGLE JOINT RUNAWAY FAILURE	<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 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 3 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 JSC0000 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 MHB 5300.6(3A) STANDARD, AS MODIFIED BY JSC 0000A.</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 BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC., (MANDATORY INSPECTION POINT).</p>

PREPARED BY: N1MG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE:

RMS/ELEC - 660

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 4

YREA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/TRR CRITICALITY RATIONALE FOR ACCEPTANCE
2970	0	CURRENT LIMITER QTY-6 SCHEMATIC 2563718	MODE: FWD/BKD FLAG FAILS HIGH. CAUSE(S): (1) INTERNAL PARTS FAILURE.	FLAG FAILS TO BDK. CONSISTENCY CHECK ENVELOPE TEST INHIBITED. WORST CASE ----- LOSS OF AUTO BRAKES. UNANNUNCIATED. REDUNDANT PATHS REMAINING ----- SINGLE JOINT RUNAWAY FAILURE	<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 - 661

CRITICAL ITEMS LIST

PROJECT: SRMS

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 5114071177

SHEET: 5

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1RB CRITICALITY RATIONALE FOR ACCEPTANCE
2970	0	CURRENT LIMITER QTY-6 SCHEMATIC 2563718	MODE: FWD/BKD FLAG FAILS HIGH. CAUSE(S): (1) INTERNAL PARIS FAILURE.	FLAG FAILS TO BKD. CONSISTENCY CHECK ENVELOPE TEST INHIBITED. WORST CASE LOSS OF AUTO BRAKES. UNANNUNCIATED. REDUNDANT PATHS REMAINING SINGLE JOINT RUNAWAY FAILURE	FAILURE HISTORY THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

RMS/ELEC - 662

PREPARED BY: NFMG

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: 51140FT137

SHEET: 6

P/N & REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1RB CRITICALITY	RATIONALE FOR ACCEPTANCE
2970	1-	CURRENT LIMITER QTY-6 SCHEMATIC 256371B	MODE: FWD/BKD FLAG FAILS HIGH. CAUSE(S): (1) INTERNAL PARTS FAILURE.	FLAG FAILS TO BKD. CONSISTENCY CHECK ENVELOPE TEST INHIBITED. WORST CASE LOSS OF AUTO BRAKES. UNANNUNCIATED. REDUNDANT PATHS REMAINING SINGLE JOINT RUNAWAY FAILURE		<p>OPERATIONAL EFFECTS</p> <p>NONE. ARM WILL NOT STOP AUTOMATICALLY AFTER A SUBSEQUENT FAILURE. UNANNUNCIATED.</p> <p>CREW ACTION</p> <p>APPLY BRAKES TO STOP ARM AFTER RUNAWAY OCCURS.</p> <p>CREW TRAINING</p> <p>THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.</p> <p>MISSION CONSTRAINT</p> <p>OPERATE UNDER VERMIER RATES WITHIN 10 FT OF STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT ARM IS RESPONDING TO COMMANDS VIA WINDOW AND/OR CCTV DURING ALL ARM OPERATIONS. IF FAILURE OF FUNCTION IS DETECTED COMPUTER SUPPORTED MODES SHOULD NOT BE USED. AUTO-TRAJECTORIES MUST BE DESIGNED TO COME NO CLOSER THAN 5 FT FROM STRUCTURE.</p> <p>SCREEN FAILURES</p> <p>B: NO ORBITER ANNUNCIATION OR DISPLAY.</p> <p>OMRSD OFFLINE</p> <p>IN COMPUTER CONTROLLED MODE VERIFY THAT THE FWD/BKD FLAG CHANGES STATE WHEN JOINTS ARE DRIVEN.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND</p> <p>FOR EACH JOINT DRIVE IN SINGLE MODE. VERIFY FWD/BKD FLAG CHANGES STATE.</p>

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