

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 1

TIMEA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3140	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: BOTH N.C. AND N.O. CONTACTS FAIL OPEN. CAUSE(S): (1) MECHANICAL FAILURE OF RELAY.	JOINT FAILS FREE JOINT CANNOT BE DRIVEN IN ANY MODE. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. CONSISTENCY CHECK MAY NOT DETECT AND INITIATE AUTO BRAKES UNLESS FAILED JOINT BACKDRIVEN AND FWD/BKD FLAG IN FWD POSITION. FWD/BKD FLAG DEPENDENT ON MOTOR DIRECTION ONLY. WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A	1/1	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 - 815

PREPARED BY: NFMG

SUPERCEDING DATE: 11 SEP 66

APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 5122071177

SHEET: 2

RMS/ELEC - 816

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOW / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3140	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: BOTH N.C. AND N.O. CONTACTS FAIL OPEN. CAUSE(S): (1) MECHANICAL FAILURE OF RELAY.	JOINT FAILS FREE JOINT CANNOT BE DRIVEN IN ANY MODE. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. CONSISTENCY CHECK MAY NOT DETECT AND INITIATE AUTO BRAKES UNLESS FAILED JOINT BACKDRIVEN AND FWD/BKD FLAG IN FWD POSITION. FWD/BKD FLAG DEPENDENT ON MOTOR. DIRECTION ONLY. WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNOUNCED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ----- N/A	1/1	<p>ACCEPTANCE TESTS</p> <p>THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <ul style="list-style-type: none"> O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 O 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 (1P510 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"> 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) 1X10⁻⁶ TORR O HUMIDITY: TESTED WITH THE SHOULDER JOINT O EMC: NIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01) <p>FLIGHT CHECKOUT</p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>

PREPARED BY: MFMG

SUPERSEDING DATE: 11 SEP 84

APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/W: 5112071177

SHEET: 3

RMS/ELEC - 817

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. Y/I CRITICALITY	RATIONALE FOR ACCEPTANCE
3140	0	MOTOR DRIVE RELAY DTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	<p>MODE: BOTH M.C. AND M.O. CONTACTS FAIL OPEN.</p> <p>CAUSE(S): (1) MECHANICAL FAILURE OF RELAY.</p>	<p>JOINT FAILS FREE JOINT CANNOT BE DRIVEN IN ANY MODE. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. CONSISTENCY CHECK MAY NOT DETECT AND INITIATE AUTO BRAKES UNLESS FAILED JOINT BACKDRIVEN AND FWD/BKD FLAG IN FWD POSITION. FWD/BKD FLAG DEPENDENT ON MOTOR DIRECTION ONLY.</p> <p>WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNOUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	Y/I	<p>QA/INSPECTIONS</p> <p>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 100X 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.</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 5% 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-81301 AND INSPECTED AND TESTED TO NASA JSCM8000 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 NHB 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 BUILT CONFIGURATION</p>

PREPARED BY: MFWG

SUPERCEDING 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: 51140FT177

SHEET: 4

CHK REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOW / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
3140	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	<p>MODE: BOTH N.C. AND N.O. CONTACTS FAIL OPEN.</p> <p>CAUSE(S): (1) MECHANICAL FAILURE OF RELAY.</p>	<p>JOINT FAILS FREE</p> <p>JOINT CANNOT BE DRIVEN IN ANY MODE.</p> <p>ARM MAY TAKE AN UNEXPECTED TRAJECTORY. CONSISTENCY CHECK MAY NOT DETECT AND INITIATE AUTO BRAKES UNLESS FAILED JOINT BACKDRIVEN AND FWD/BKD FLAG IN FWD POSITION. FWD/BKD FLAG DEPENDENT ON MOTOR DIRECTION ONLY.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>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 - 818

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 5

ITEM REF.	REV.	PART, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
3140	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER CONNECTION DIAGRAM 2563716	MODE: BOTH N.C. AND N.O. CONTACTS FAIL OPEN. CAUSE(S): (1) MECHANICAL FAILURE OF RELAY.	JOINT FAILS FREE JOINT CANNOT BE DRIVEN IN ANY MODE. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. CONSISTENCY CHECK MAY NOT DETECT AND INITIATE AUTO BRAKES UNLESS FAILED JOINT BACKDRIVEN AND FWD/BKD FLAG IN FWD POSITION. FWD/BKD FLAG DEPENDENT ON MOTOR DIRECTION ONLY. WORST CASE UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A	1/1	FAILURE HISTORY THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

RMS/ELEC - 819

PREPARED BY: MFWG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y P/N: 51140P1177

SHEET: 6

RMS/ELEC - 820

PMA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RDR / FUNC. / I / CRITICALITY	RATIONALE FOR ACCEPTANCE
3140	0	MOTOR DRIVE RELAY DT1-6 P/M MS27743-1 AND ZENER DIODES. INTER CONNECTION DIAGRAM 2563716	<p>MODE: BOTH N.C. AND N.O. CONTACTS FAIL OPEN.</p> <p>CAUSE(S): (1) MECHANICAL FAILURE OF RELAY.</p>	<p>JOINT FAILS FREE</p> <p>JOINT CANNOT BE DRIVEN IN ANY MODE.</p> <p>ARM MAY TAKE AN UNEXPECTED TRAJECTORY. CONSISTENCY CHECK MAY NOT DETECT AND INITIATE AUTO BRAKES UNLESS FAILED JOINT BACKDRIVEN AND FWD/BKO FLAG IN FWD POSITION. FWD/BKO FLAG DEPENDENT ON MOTOR. DIRECTION ONLY.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION. FREE JOINT. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>	OPERATIONAL EFFECTS	<p>WITH SUBSEQUENT FAILURE ONE JOINT FAILS FREE. THE FAILED JOINT IS ONLY RESTRAINED BY GEARBOX FRICTION. ARM MAY BACKDRIVE IF BRAKES ARE OFF AND ANY OF THE OTHER JOINTS ARE DRIVEN. ARM WILL TAKE AN UNEXPECTED TRAJECTORY IN COMPUTER SUPPORTED MODES. NO DRIVE MODES AVAILABLE FOR FAILED JOINT. ARM MAY BE JETTISONED. OPERATOR WILL INHERENTLY COMPENSATE.</p>
CREW ACTION						<p>APPLY BRAKES. USE DIRECT DRIVE TO POSITION OTHER JOINTS FOR JETTISON.</p>
CREW TRAINING						<p>THE CREW SHOULD BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.</p>
MISSION CONSTRAINT						<p>THE CREW SHOULD BE TRAINED TO OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. AUTO TRAJECTORIES MUST BE DESIGNED TO COME NO CLOSER THAN 5 FT FROM 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.</p>
SCREEN FAILURES						N/A
OHRSD OFFLINE						<p>VERIFY EACH JOINT DRIVES IN COMPUTER CONTROLLED, DIRECT AND BACKUP.</p>
OHRSD ONLINE INSTALLTION						NONE
OHRSD ONLINE TURNAROUND						<p>FOR EACH JOINT, DRIVE IN SINGLE AND DIRECT. VERIFY EACH SIGNATURE. IN BACKUP VERIFY TO KHZ</p>

PREPARED BY: MWG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY: