

CRITICAL ITEMS LIST

PROJECT: SRMS (-S MCJU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HQWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3135	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: SHORT CIRCUIT OF MOTOR PHASE TO GROUND. CAUSE(S): (1) DIODE FAILURE.	MOTOR WILL NOT BE DRIVEN FOR 4 OUT OF 6 COMMUTATION CAUSES. SPA FUSE AT SHOULDER WILL BE INTERRUPTED AND AUTO BRAKES WILL BE APPLIED. ARM COMES TO REST. LOSS OF ALL MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE UNEXPECTED MOTION. FREE JOINT. AUTOBRAKES. REDUNDANT PATHS REMAINING 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) JETTISON (TO SECURE ORBITER).		DESIGN FEATURES DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE IX 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.

RMS/ELEC - 809

EXPEDITE PROCESSING

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PREPARED BY: MFVG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51T40FT177

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3135	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: SHORT CIRCUIT OF MOTOR PHASE TO GROUND. CAUSE(S): (1) DIODE FAILURE.	MOTOR WILL NOT BE DRIVEN FOR 4 OUT OF 6 COMMUTATION CAUSES. SPA FUSE AT SHOULDER WILL BE INTERRUPTED AND AUTO BRAKES WILL BE APPLIED. ARM COMES TO REST. LOSS OF ALL MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE UNEXPECTED MOTION. FREE JOINT. AUTOBRAKES. REDUNDANT PATHS REMAINING 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) JETTISON (TO SECURE ORBITER).		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: +01 DEGREES C TO -36 DEGREES C (6 CYCLES) 1X10 ⁻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), RS01) FLIGHT CHECKOUT ----- PDAS OPS CHECKLIST (ALL VEHICLES) JSC 16987

RMS/ELEC - 810

PREPARED BY: MTWG SUPERSEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

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CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 517401177

SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3135	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: SHORT CIRCUIT OF MOTOR PHASE TO GROUND. CAUSE(S): (1) DIODE FAILURE.	MOTOR WILL NOT BE DRIVEN FOR 4 OUT OF 6 COMMUTATION CAUSES. SPA FUSE AT SHOULDER WILL BE INTERRUPTED AND AUTO BRAKES WILL BE APPLIED. ARM COMES TO REST. LOSS OF ALL MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE UNEXPECTED MOTION. FREE JOINT. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) JETTISON (TO SECURE ORBITER).	QA/INSPECTIONS	<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 VOLIAGES, 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-81381 AND INSPECTED AND TESTED TO NASA JSC8080D 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 5300.4(C3A) STANDARD, AS MODIFIED BY JSC 08800A.</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... 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>

RMS/ELEC - 811

PREPARED BY: MFMG SUPERSEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

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CRITICAL ITEMS LIST

PROJECT: SRMS (5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 4

I/MEA REV.	I/MEA REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3135	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	<p>MODE: SHORT CIRCUIT OF MOTOR PHASE TO GROUND.</p> <p>CAUSE(S): (1) DIODE FAILURE.</p>	<p>MOTOR WILL NOT BE DRIVEN FOR 4 OUT OF 6 COMMUTATION CAUSES. SPA FUSE AT SHOULDER WILL BE INTERRUPTED AND AUTO BRAKES WILL BE APPLIED. ARM COMES TO REST. LOSS OF ALL MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. FREE JOINT. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (TO SAVE THE SYSTEM). 2) JETTISON (TO SECURE ORBITER).</p>	<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>

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PREPARED BY: MMG SUPERSEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

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CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCJU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51140FT1177

SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3135	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: SHORT CIRCUIT OF MOTOR PHASE TO GROUND. CAUSE(S): (1) DIODE FAILURE.	MOTOR WILL NOT BE DRIVEN FOR 4 OUT OF 6 COMMUTATION CAUSES. SPA FUSE AT SHOULDER WILL BE INTERRUPTED AND AUTO BRAKES WILL BE APPLIED. ARM COMES TO REST. LOSS OF ALL MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE ----- UNEXPECTED MOTION. FREE JOINT. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) JETTISON (TO SECURE ORBITER).	FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

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PREPARED BY: NFMG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/R: 51140FT177

SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3135	0	MOTOR DRIVE RELAY QTY-6 P/N MS27743-1 AND ZENER DIODES. INTER-CONNECTION DIAGRAM 2563716	MODE: SHORT CIRCUIT OF MOTOR PHASE TO GROUND. CAUSE(S): {1} DIODE FAILURE.	MOTOR WILL NOT BE DRIVEN FOR 4 OUT OF 6 COMMUTATION CAUSES. SPA FUSE AT SHOULDER WILL BE INTERRUPTED AND AUTO BRAKES WILL BE APPLIED. ARM COMES TO REST. LOSS OF ALL MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. WORST CASE ----- UNEXPECTED MOTION. FREE JOINT. AUTOBRAKES. REDUNDANT PATHS REMAINING ----- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) JETTISON (TO SECURE ORBITER).	OPERATIONAL EFFECTS ----- COMPUTER SUPPORTED MODES CANNOT BE USED TO COMPLETE THE MISSION. DIRECT DRIVE AND BACK-UP MODES REMAIN. IF PAYLOAD ATTACHED, THE ARM SHOULD BE MANEUVERED TO A SAFE POSITION FOR PAYLOAD RELEASE. LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO CRADLE ARM. IF WITH SUBSEQUENT FAILURES ALL DRIVE MODES ARE LOST, THE ARM MAY BE JETTISONED. CREW HAS ABILITY TO OVERRIDE A SINGLE FAILURE. CREW ACTION ----- APPLY BRAKES. USE DIRECT DRIVE TO POSITION OTHER JOINTS FOR JETTISON. CREW TRAINING ----- THE CREW WILL BE TRAINED TO OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T APPLY BRAKES. MISSION CONSTRAINT ----- 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. OMRSD OFFLINE ----- VERIFY SPA 28V FAIL FLAG IN THE ABE DATA IN COMPUTER CONTROLLED MODE VERIFY EACH JOINT DRIVES OMRSD ONLINE INSTALLATION ----- NONE OMRSD ONLINE TURNAROUND ----- VERIFY SPA 28V FAIL FLAG IN ABE DATA. FOR EACH JOINT IN SINGLE MODE VERIFY TACHO SIGNATURE.	

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COMPLETE MISSING

PREPARED BY: MFVG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

RMS/ELEC - 814