

CRITICAL ITEMS LIST

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

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 5174071177

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
3075	0	ELECTRICAL POWER SWITCH QTY-6 PER SPA 36 PER RMS SCHEMATIC 2563712	<p>MODE: NO OUTPUT FROM ONE OR MORE SWITCHES.</p> <p>CAUSE(S): (1) LOSS OF +15V (2) OPEN OR SHORTED DIODES. (3) TRANSFORMER FAILURE. (4) TRANSISTOR FAILURE. (5) MOTOR CURRENT SENSE CIRCUIT FAILS OPEN.</p>	<p>JOINT MOTOR WILL PRODUCE REDUCED TORQUE AND WILL EITHER NOT DRIVE OR IF IT IS IN MOTION WILL SLOWLY COME TO REST OR DRIVE SLOWLY. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. AN SPA FUSE MAY BE INTERRUPTED AND AUTOBRAKES WILL BE APPLIED.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION. FREE JOINT UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>	<p>DESIGN FEATURES</p>	<p>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.</p> <p>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.</p> <p>TRANSFORMERS AND INDUCTORS ARE DESIGNED SPECIFICALLY FOR THE APPLICATION. THESE ARE TOROID - WOUND AND UTILIZE A FERRITE CORE MATERIAL, CHOICE OF WIRE SIZE AND OF INSULATION MATERIALS ENSURE THAT THE DERATING REQUIREMENTS OF SPAR-RMS-PA.003 ARE MET.</p> <p>COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003.</p>

RMS/ELEC - 739

PREPARED BY:

MEMG

SUPERCEDING DATE: NONE

DATE: 11 JUN 91

CR REV: 0

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 ATTACHMENT
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CRITICAL ITEMS LIST

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

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

SHEET: 2

IMEA REF.	IMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
3075	0	ELECTRICAL POWER SWITCH QTY 6 PER SPA 36 PER RMS SCHEMATIC 2563712	<p>MODE: NO OUTPUT FROM ONE OR MORE SWITCHES.</p> <p>CAUSE(S): (1) LOSS OF +15V (2) OPEN OR SHORTED DIODES. (3) TRANSFORMER FAILURE. (4) TRANSISTOR FAILURE. (5) MOTOR CURRENT SENSE CIRCUIT FAILS OPEN.</p>	<p>JOINT MOTOR WILL PRODUCE REDUCED TORQUE AND WILL EITHER NOT DRIVE OR IF IT IS IN MOTION WILL SLOWLY COME TO REST OR DRIVE SLOWLY. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. AN SPA FUSE MAY BE INTERRUPTED AND AUTOBRAKES WILL BE APPLIED.</p> <p>WORST CASE UNEXPECTED MOTION. FREE JOINT UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>	<p>ACCEPTANCE TESTS</p> <p>THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>0 THERMAL: PLUS 70 DEGREES C TO -25 DEGREES C DURATION - 1 1/2 CYCLES</p> <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> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>0 SHOCK: 20G/11 MS/3 AXES (6 DIRECTIONS)</p> <p>0 THERMAL VAC: +01 DEGREES C TO -36 DEGREES C (6 CYCLES) 1X10**6 TORR</p> <p>0 HUMIDITY: TESTED WITH THE SHOULDER JOINT</p> <p>0 EMC: MIL-SID-461 AS MODIFIED BY SI-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01)</p> <p>FLIGHT CHECKOUT</p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

RMS/ELEC - 740

PREPARED BY:

MIMG

SUPERSEDING DATE: NONE

DATE: 11 JUL 91

CPL REV: 0

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 ATTACHMENT
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CRITICAL ITEMS LIST

PROJECT: SRMS (1-5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 3

RMS/ELEC - 741

FMEA REF.	FMEA REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
3075	0	ELECTRICAL POWER SWITCH QTY-6 PER SPA 36 PER RMS SCHEMATIC 2563712	<p>MODE: NO OUTPUT FROM ONE OR MORE SWITCHES.</p> <p>CAUSE(S): (1) LOSS OF +15V (2) OPEN OR SHORTED DIODES. (3) TRANSFORMER FAILURE. (4) TRANSISTOR FAILURE. (5) MOTOR CURRENT SENSE CIRCUIT FAILS OPEN.</p>	<p>JOINT MOTOR WILL PRODUCE REDUCED TORQUE AND WILL EITHER NOT DRIVE OR IF IT IS IN MOTION WILL SLOWLY COME TO REST OR DRIVE SLOWLY. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. AN SPA FUSE MAY BE INTERRUPTED AND AUTOBRAKES WILL BE APPLIED.</p> <p>WORST CASE UNEXPECTED MOTION, FREE JOINT UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	QA/INSPECTIONS	<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 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-81181 AND INSPECTED AND TESTED TO NASA JSCM0080 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 WHB 5300.4(3A) 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.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:

MEWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIT REV: 0

EXP. ADJ. PROFESSION

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 ATTACHMENT
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CRITICAL ITEM LIST

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

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 511C0P1177

SHEET: 4

IMEA REF.	IMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. / I / CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
3075	0	ELECTRICAL POWER SWITCH QTY 6 PER SPA 36 PER RMS SCHEMATIC 2563712	<p>MODE: NO OUTPUT FROM ONE OR MORE SWITCHES.</p> <p>CAUSE(S): (1) LOSS OF +15V (2) OPEN OR SHORTED DIODES. (3) TRANSFORMER FAILURE. (4) TRANSISTOR FAILURE. (5) MOTOR CURRENT SENSE CIRCUIT FAILS OPEN.</p>	<p>JOINT MOTOR WILL PRODUCE REDUCED TORQUE AND WILL EITHER NOT DRIVE OR IF IT IS IN MOTION WILL SLOWLY COME TO REST OR DRIVE SLOWLY. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. AN SPA FUSE MAY BE INTERRUPTED AND AUTOBRAKES WILL BE APPLIED.</p> <p>WORST CASE UNEXPECTED MOTION. FREE JOINT UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>	1/1	<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 IIR 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>SAMS 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 - 742

PREPARED BY:

MEWG

SUPERCEDING DATE: NONE

DATE: 17 JUL 91

CRIT REV: 0

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 ATTACHMENT

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CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MC1U INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: N/A
3075	0	ELECTRICAL POWER SWITCH QTY-6 PER SPA 36 PER RMS SCHEMATIC 2563712	MODE: NO OUTPUT FROM ONE OR MORE SWITCHES. CAUSE(S): (1) LOSS OF +15V (2) OPEN OR SHORTED DIODES. (3) TRANSFORMER FAILURE. (4) TRANSISTOR FAILURE. (5) MOTOR CURRENT SENSE CIRCUIT FAILS OPEN.	JOINT MOTOR WILL PRODUCE REDUCED TORQUE AND WILL EITHER NOT DRIVE OR IF IT IS IN MOTION WILL SLOWLY COME TO REST OR DRIVE SLOWLY. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. AN SPA FUSE MAY BE INTERRUPTED AND AUTOBRAKES WILL BE APPLIED. 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 - 743

PREPARED BY:

MMWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CFI REV: 0

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 ATTACHMENT
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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: 51140P1177

SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: N/A
3075	0	ELECTRICAL POWER SWITCH QTY 6 PER SPA 36 PER RMS SCHEMATIC 2563712	<p>MODE: NO OUTPUT FROM ONE OR MORE SWITCHES.</p> <p>CAUSE(S): (1) LOSS OF +15V (2) OPEN OR SHORTED DIODES. (3) TRANSFORMER FAILURE. (4) TRANSISTOR FAILURE. (5) MOTOR CURRENT SENSE CIRCUIT FAILS OPEN.</p>	<p>JOINT MOTOR WILL PRODUCE REDUCED TORQUE AND WILL EITHER NOT DRIVE OR IF IT IS IN MOTION WILL SLOWLY COME TO REST OR DRIVE SLOWLY. ARM MAY TAKE AN UNEXPECTED TRAJECTORY. AN SPA FUSE MAY BE INTERRUPTED AND AUTOBRAKES WILL BE APPLIED.</p> <p>WORST CASE UNEXPECTED MOTION. FREE JOINT UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	<p>OPERATIONAL EFFECTS ARM DOES NOT RESPOND PROPERLY TO HAND CONTROLLER COMMANDS OR AUTO SEQUENCES. CREW INHERENTLY COMPENSATES FOR ANY UNDESIRED ARM TRAJECTORY IN MANUAL AUGMENTED MODES. IF AUTOBRAKES ARE APPLIED, CREW CAN OVERRIDE A SINGLE FAILURE.</p> <p>CREW ACTION APPLY BRAKES. SELECT BACKUP.</p> <p>CREW TRAINING 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 OPERATE UNDER VERMIER 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>OMRSD OFFLINE IN COMPUTER CONTROLLED MODE VERIFY JOINT RATES FOR EACH JOINT</p> <p>OMRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND FOR EACH JOINT IN SINGLE MODE VERIFY TACHO SIGNATURE</p>

RMS/ELEC - 744

PREPARED BY: MFWG SUPERSEDING DATE: NONE

DATE: 13 JUL 91 CIL REV: 0

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