

**CRITICAL ITEMS LIST**

PROJECT: SRMS

ASS'Y NOMENCLATURE: BACK-UP

SYSTEM: BACK-UP

ASS'Y P/N: \_\_\_\_\_

SHEET: 1

PWA REF.	REV.	NAME QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4520	0	BOA POWER CONDITIONER QTY-1 SCHEMATIC 2559044 2563735 2563739	MODE: DEGRADED OUTPUT ON ONE OR MORE OUTPUT LINES.  CAUSE(S): (1) OPEN CAPACITOR IN OUTPUT LINE. (2) EEE PARTS FAILURE.	HIGH RIPPLE IN OUTPUT MAY CAUSE ERRATIC OPERATION OF IC'S RESULTING IN ERRATIC ARM RESPONSE IF BAD ENOUGH O.V. OR O.C. MAY TURN OFF BOA POWER CONDITIONER.  WORST CASE ----- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ----- N/A	1/1	DESIGN FEATURES ----- 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.  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.  DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE TX 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.

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SHEET: 2

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE
4520	0	BDA POWER CONDITIONER QTY-1 SCHEMATIC 2559044 2563735 2563739	<p>MODE: DEGRADED OUTPUT ON ONE OR MORE OUTPUT LINES.</p> <p>CAUSE(S): (1) OPEN CAPACITOR IN OUTPUT LINE. (2) EEE PARTS FAILURE.</p>	<p>HIGH RIPPLE IN OUTPUT MAY CAUSE ERRATIC OPERATION OF IC'S RESULTING IN ERRATIC ARM RESPONSE IF BAD ENOUGH D.V. OR D.C. MAY TURN OFF BDA POWER CONDITIONER.</p> <p>WORST CASE UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	<p>ACCEPTANCE TESTS ----- THE BDA IS ACCEPTANCE TESTED FOR THE FOLLOWING ENVIRONMENTS AS AN SRU.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>O THERMAL: +70 DEGREES C TO - 25 DEGREES C (1 1/2 CYCLES)</p> <p>THE BDA IS INTEGRATED INTO THE SHOULDER JOINT AND EXPOSED TO THE JOINT ACCEPTANCE ENVIRONMENTS (VIBRATION AND THERMAL VACUUM).</p> <p>THE SHOULDER JOINT IS THEREAFTER TESTED AS PART OF THE RMS SYSTEM TESTS (TP510 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS ----- THE BDA HAS BEEN QUALIFICATION TESTED TO THE FOLLOWING ENVIRONMENTS AS AN SRU. THE BDA IS FURTHER TESTED ON THE SHOULDER JOINT QUALIFICATION TESTING.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>O SHOCK: 20G/11MS - 3 AXES (6 DIRECTIONS)</p> <p>O THERMAL: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10**6 TORR.</p> <p>O HUMIDITY: TEST IN SHOULDER JOINT HUMIDITY TEST</p> <p>O ENC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01)</p> <p>FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>

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SHEET: 3

PWA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FULC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4520	0	BDA POWER CONDITIONER QTY-1 SCHEMATIC 2559044 2563735 2563739	<p>MODE: DEGRADED OUTPUT ON ONE OR MORE OUTPUT LINES.</p> <p>CAUSE(S): (1) OPEN CAPACITOR IN OUTPUT LINE. (2) EEE PARTS FAILURE.</p>	<p>HIGH RIPPLE IN OUTPUT MAY CAUSE ERRATIC OPERATION OF IC'S RESULTING IN ERRATIC ARM RESPONSE IF BAD ENOUGH D.V. OR D.C. MAY TURN OFF BDA POWER CONDITIONER.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNOUNCED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>		<p>QA/INSPECTIONS</p> <p>-----</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 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 JSCM8080 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>

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SHEET: 4

P/REA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
4520	0	BDA POWER CONDITIONER QTY-1 SCHEMATIC 2559044 2563735 2563739	MODE: DEGRADED OUTPUT ON ONE OR MORE OUTPUT LINES.  CAUSE(S): (1) OPEN CAPACITOR IN OUTPUT LINE. (2) EEE PARTS FAILURE.	HIGH RIPPLE IN OUTPUT MAY CAUSE ERRATIC OPERATION OF IC'S RESULTING IN ERRATIC ARM RESPONSE IF BAD ENOUGH O.V. OR O.C. MAY TURN OFF BDA POWER CONDITIONER.  WORST CASE ..... UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ..... N/A		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).  ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).  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.  JOINT LEVEL PRE-ACCEPTANCE TEST INSPECTION, INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC.  JOINT LEVEL ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).  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.  SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)

PREPARED BY: MFMG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

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SHEET: 5

FREA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RISK / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
4528	2	BDA POWER CONDITIONER QTY-1 SCHEMATIC 2569844 2563735 2563739	<p>NOTE: DEGRADED OUTPUT ON ONE OR MORE OUTPUT LINES.</p> <p>CAUSE(S): (1) OPEN CAPACITOR IN OUTPUT LINE. (2) EEE PARTS FAILURE.</p>	<p>HIGH RIPPLE IN OUTPUT MAY CAUSE ERRATIC OPERATION OF IC'S RESULTING IN ERRATIC ARM RESPONSE IF BAD ENOUGH O.V. OR O.C. MAY TURN OFF BDA POWER CONDITIONER.</p> <p>WORST CASE UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING</p> <p>N/A</p>	FAILURE HISTORY	<p>THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT:</p> <p>FAR 3329: S/N 202/AT APR 86</p> <p>DESCRIPTION 10 V RAIL NOISY</p> <p>CORRECTING ACTION REPLACE CAPACITOR</p>

PREPARED BY: NMLG

SUPERSEDING DATE: 12 NOV 87

APPROVED BY:

DATE:

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SHEET: 6

PHEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 1/1 CRITICALITY RATIONALE FOR ACCEPTANCE
4520	0	BDA POWER CONDITIONER QTY-1 SCHEMATIC 2559044 2563735 2563739	MODE: DEGRADED OUTPUT ON ONE OR MORE OUTPUT LINES.  CAUSE(S): (1) OPEN CAPACITOR IN OUTPUT LINE. (2) EEE PARTS FAILURE.	HIGH RIPPLE IN OUTPUT MAY CAUSE ERRATIC OPERATION OF IC'S RESULTING IN ERRATIC ARM RESPONSE IF BAD ENOUGH O.V. OR O.C. MAY TURN OFF BDA POWER CONDITIONER.  WORST CASE ..... UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ..... N/A	<p>OPERATIONAL EFFECTS                      -----                      WHEN ATTEMPTING TO DRIVE A JOINT IN BACKUP, THE JOINT DRIVE DIRECTION IS OPPOSITE FROM WHAT IS COMMANDED.</p> <p>CREW ACTION                      -----                      REMOVE THE DRIVE COMMAND.</p> <p>CREW TRAINING                      -----                      THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, THE COMMAND SHOULD BE REMOVED.</p> <p>MISSION CONSTRAINT                      -----                      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> <p>SCREEN FAILURES                      -----                      N/A</p> <p>OMRSD OFFLINE                      -----                      OPERATE ANY JOINT IN BACKUP. VERIFY THAT JOINT DRIVES.</p> <p>OMRSD ONLINE INSTALLATION                      -----                      NONE</p> <p>OMRSD ONLINE TURNAROUND                      -----                      OPERATE WRIST ROLL JOINT IN BACKUP. VERIFY CORRECT OPERATION.</p>

PREPARED BY: MFWG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: