

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NAME/ATURE: SERVO POWER AMPLIFIER

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

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2790	1	TIMING AND LOGIC CONTROL QTY 6 SCHEMATIC 2563719	<p>MODE: LOSS OF RATE COMPARATOR TIMING CONTROL.</p> <p>CAUSE(S):                      (1) PRESET COUNTER.                      (2) COUNTER LOGIC. EEE PARIS, WIRING, OR P.C. BOARD.</p>	<p>JOINT RATE DATA WILL BE LOST OR INCORRECT. ARM MAY RUNAWAY. CONSISTENCY CHECK EACH DATA WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE                      -----                      UNEXPECTED MOTION, JOINT RUNAWAY, AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING                      -----                      AUTOBRAKES</p>	<p>DESIGN FEATURES                      -----</p> <p>THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING CMOS LOGIC DEVICES.</p> <p>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.</p> <p>THE CIRCUIT BOARD DESIGN HAS BEEN REVIEWED TO ENSURE ADEQUATE CONDUCTOR WIDTH AND SEPARATION AND TO CONFIRM APPROPRIATE DIMENSIONS OF SOLDER PADS AND OF COMPONENT HOLD PROVISIONS. PARTS MOUNTING METHODS ARE CONTROLLED IN ACCORDANCE WITH NSFC-STD-154A, NSFC-STD-136 AND SASD 2573751. THESE DOCUMENTS REQUIRE APPROVED MOUNTING METHODS, STRESS RELIEF AND COMPONENT SECURITY.</p>

RMS/ELEC - 507

PREPARED BY: MFUG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 1

**CRITICAL ITEM LIST**

PROJECT: SPM5  
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT (W) END ITEM	HOW / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2700	1	TIMING AND LOGIC CONTROL QTY: 6 SCHEMATIC 2563719	<p>MODE: LOSS OF RATE COMPARATOR TIMING CONTROL.</p> <p>CAUSE(S):                      (1) PRESET COUNTER.                      (2) COUNTER LOGIC. EEE PARTS, WIRING, OR P.C. BOARD.</p>	<p>JOINT RATE DATA WILL BE LOST OR INCORRECT. ARM MAY RUNAWAY. CONSISTENCY CHECK EACH DATA WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE                      UNEXPECTED MOTION, JOINT RUNAWAY, AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING                      AUTOBRAKES</p>	<p>ACCEPTANCE TESTS                      -----                      THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>O 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 (1P510 RMS STRONGBACK AND 1P552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>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.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>O SHOCK: 200/11 MS/3 AXES (6 DIRECTIONS)</p> <p>O THERMAL VAC: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1K10*6 TORR</p> <p>O HUMIDITY: TESTED WITH THE SHOULDER JOINT</p> <p>O ENC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01)</p> <p>FLIGHT CHECKOUT                      -----                      PDOS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

RMS/ELEC - 508

PREPARED BY: MIWG

SUPERCEDING DATE: 11 SEP 86

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

DATE: 24 JUL 91

CIL REV: 1

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2790	1	TIMING AND LOGIC CONTROL QTY: 6 SCHEMATIC 2563719	<p>MODE: LOSS OF RATE COMPARATOR FINING CONTROL.</p> <p>CAUSE(S): (1) PRESET COUNTER. (2) COUNTER LOGIC. EEE PARTS, WIRING, OR P.C. BOARD.</p>	<p>JOINT RATE DATA WILL BE LOST OR INCORRECT. ARM MAY RUNAWAY. CONSISTENCY CHECK TACH DATA WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	<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 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 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 HNB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 00800A.</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>

RMS/ELEC - 509

PREPARED BY: MWG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 1



**CRITICAL ITEMS LIST**

PROJECT: SRMS

ASS'Y NUMERATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y P/N: 51140F1177

SHEET: 5

IHEA REF.	IHEA 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
2790	1	TIMING AND LOGIC CONTROL QTY: 6 SCHEMATIC 2563719	<p>MODE: LOSS OF RATE COMPARATOR TIMING CONTROL.</p> <p>CAUSE(S): (1) PRESET COUNTER. (2) COUNTER LOGIC. EEE PARTS, WIRING, OR P.C. BOARD.</p>	<p>JOINT RATE DATA WILL BE LOST OR INCORRECT. ARM MAY RUNAWAY. CONSISTENCY CHECK TACH DATA WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	<p>FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

RMS/ELEC - 511

PREPARED BY: MFVG

SUPERCEDING DATE: 11 SEP 86

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

DATE: 26 JUL 91

CIL REV: 1

**CRITICAL ITEM LIST**

PROJECT: SRMS  
 ASS'Y NAME/FUNCTION: SERVO MOTOR AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/R: 5114DF1177

SHEET: 6

IMEA REF.	IMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOUR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2790	1	TIMING AND LOGIC CONTROL QTY-6 SCHEMATIC 2563719	MODE: LOSS OF RATE COMPARATOR TIMING CONTROL.  CAUSE(S): (1) PRESET COUNTER.  (2) COUNTER LOGIC. EEE PARTS, WIRING, OR P.C. BOARD.	JOINT RATE DATA WILL BE LOST OR INCORRECT. ARM MAY RUNAWAY. CONSISTENCY CHECK TACH DATA WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.  WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. AUTO BRAKES.  REDUNDANT PATHS REMAINING AUTOBRAKES	OPERATIONAL EFFECTS JOINT RUNAWAY. AUTOBRAKES. CANNOT USE COMPUTER SUPPORTED MODES. DIRECT DRIVE AND BACKUP AVAILABLE. ARM WILL NOT STOP AUTOMATICALLY IF AN UNDETECTED FAILURE OF THE AUTO BRAKES SYSTEM HAS PREVIOUSLY OCCURRED. BRAKES CAN BE APPLIED MANUALLY.  CREW ACTION APPLY BRAKES. USE DIRECT DRIVE.  CREW TRAINING THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.  MISSION CONSTRAINT OPERATE UNDER VERMIER RATES WITHIN 10 FT OF STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM/PAYLOAD IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS.  OMRSD OFFLINE DRIVE EACH JOINT. VERIFY THAT MOTOR RATE AGREES WITH THE ENCODER CHANGE.  OMRSD ONLINE INSTALLATION NONE  OMRSD ONLINE TURNAROUND IN SINGLE MODE, DRIVE EACH JOINT. VERIFY TACHOMETER SIGNATURE.

RMS/ELEC - 512