

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 511201177

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3010	1	CURRENT LIMITER QTY-6 SCHEMATIC 256371B	MODE: FAILURE OF CURRENT LIMIT CCT.  CAUSE(S): (1) EEE PARTS FAILURE. (UO FAILURE).	JOINT RUNAWAY WILL OCCUR. FWD/SKO FLAG WILL BE SET TO BKD. BUT MDA BITE WILL BE SET. CONSISTENCY CHECK (ENVELOPE) WILL DETECT. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.  WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.  REDUNDANT PATHS REMAINING ----- AUTOBRAKES	DESIGN FEATURES ----- COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003.  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.

RMS/ELEC - 695

PREPARED BY: MFVG SUPERSEDING DATE: 11 SEP 86

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: 51140F1177

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3010	1	CURRENT LIMITER QTY-6 SCHEMATIC 2563718	MODE: FAILURE OF CURRENT LIMIT CCT.  CAUSE(S): (1) EEE PARTS FAILURE. (UB FAILURE).	JOINT RUNAWAY WILL OCCUR. FWD/BKD FLAG WILL BE SET TO BKD. BUT MDA BITT WILL BE SET. CONSISTENCY CHECK (ENVELOPE) WILL DETECT. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.  WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.  REDUNDANT PATHS REMAINING AUTOBRAKES	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 (TP516 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: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1X10 <sup>-6</sup> 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 (W/B), RS01)  FLIGHT CHECKOUT ----- PORS OPS CHECKLIST (ALL VEHICLES) JSC 16987

RMS/ELEC - 696

**CRITICAL ITEMS LIST**

PROJECT: SRMS

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y P/N: 51140FF177

SHEET: 3

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
3010	1	CURRENT LIMITER QTY-6 SCHEMATIC 2563710	<p>MODE: FAILURE OF CURRENT LIMIT CCT.</p> <p>CAUSE(S): (1) EEE PARTS FAILURE. (UB FAILURE).</p>	<p>JOINT RUNAWAY WILL OCCUR. FWD/BKD FLAG WILL BE SET TO BKD. BUT MDA BITE WILL BE SET. CONSISTENCY CHECK (ENVELOPE) WILL DETECT. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION, JOINT RUNAWAY, AUTOBRAKES.</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-81361 AND INSPECTED AND TESTED TO NASA JSC8000 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(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>	

RMS/ELEC - 697

PREPARED BY: MFWG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 1

CR11) ITEM LIST

SRMS  
ASSY NAME/RELATION: SYNO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
ASSY P/N: 51140FT177

SHEET: 4

FMEA REF.	FMEA DIV.	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
3010	1	CURRENT LIMITER QTY-6 SCHEMATIC 256371B	<p>MODE: FAILURE OF CURRENT LIMIT CCT.</p> <p>CAUSE(B): (1) EEE PARTS FAILURE. (UB FAILURE).</p>	<p>JOINT RUNAWAY WILL OCCUR. FWD/BKD FLAG WILL BE SET TO BKD. BUT MDA BITE WILL BE SET. CONSISTENCY CHECK (ENVELOPE) WILL DETECT. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	<p>HOWR / FUNC. 2/1R CRITICALITY</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 - 698

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASS'Y P/N: 5140F1177

SHEET: 5

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
3010	1	CURRENT LIMITER DT-6 SCHEMATIC 256371B	MODE: FAILURE OF CURRENT LIMIT CCT.  CAUSE(S): (1) EEE PARTS FAILURE. (UB FAILURE).	JOINT RUNAWAY WILL OCCUR. FWD/BKD FLAG WILL BE SET TO BKD. BUT MDA BITE WILL BE SET. CONSISTENCY CHECK (ENVELOPE) WILL DETECT. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.  WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.  REDUNDANT PATHS REMAINING ----- AUTOBRAKES	FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

RMS/ELEC - 699

PREPARED BY: MFVG

SUPERCEDING DATE: 11 SEP 86

DATE: 26 JUL 91 CIL REV: 1

**CRITICAL ITEM LIST**

PROJECT: SAMS  
 ASSY NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM  
 ASSY P/N: 51140F1177 SHEET: 6

IMEA REF.	ZMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY	RATIONALE COMPLIANCE SCREENS: A-PASS, B-PASS, C-PASS
3010	1	CURRENT LIMITER QTY-6 SCHEMATIC 2563710	<p>MODE: FAILURE OF CURRENT LIMIT CCT.</p> <p>CAUSE(S): (1) EEE PARTS FAILURE. (UB FAILURE).</p>	<p>JOINT RUNAWAY WILL OCCUR. FWD/RKD FLAG WILL BE SET TO BKD. BUT MDA BITE WILL BE SET. CONSISTENCY CHECK (ENVELOPE) WILL DETECT. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>AUTOBRAKES</p>		<p>OPERATIONAL EFFECTS</p> <p>ARM DOES NOT RESPOND PROPERLY TO HAND CONTROLLER COMMANDS OR AUTO SEQUENCES. AUTOBRAKES. CANNOT USE PRIMARY MODES OF OPERATION. ARM WILL NOT STOP AUTOMATICALLY IF AN UNDETECTED FAILURE OF THE AUTOBRAKES SYSTEM HAS PREVIOUSLY OCCURRED. BRAKES CAN BE APPLIED MANUALLY.</p> <p>CREW ACTION</p> <p>APPLY BRAKES. SELECT BACKUP.</p> <p>CREW TRAINING</p> <p>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</p> <p>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.</p> <p>OMRSD OFFLINE</p> <p>IN COMPUTER CONTROLLED MODE VERIFY MOTOR MOTION FOR EACH JOINT IN BOTH DIRECTIONS.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND</p> <p>FOR EACH JOINT IN SINGLE MODE VERIFY TACHO SIGNATURE FOR BOTH DIRECTIONS.</p>

RMS/ELEC - 700