CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51ECOF1177
SHEET: 1

ITEM NO.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2580	D	HARDWIRE SAFING CIRCUIT QTY 6 SCHEMATIC 2563722 (2563721)	MODE: LOSS OF OUTPUT TO 16 BIT LATCH CAUSE(S): (1) EEE PARTS FAILURE (2) LOSS OF +28V SAFING SIGNAL.	FAILED JOINT WILL GO INTO HARDWIRED SAFING ANY MOTION MAY RESULT IN AN UNEXPECTED TRAJECTORY. WORST CASE --- UNEXPECTED MOTION. ELECTRICALLY FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- N/A		DESIGN FEATURES --- THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING CMOS LOGIC DEVICES. 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. 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.

PREPARED BY: MEWC
SUPERCEDING DATE: 11 SEP 86
APPROVED
DATE:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51T20177
SHEET: 2

ITEM NO.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2580	D	HARDWIRE SAFING CIRCUIT QTY 6 SCHEMATIC 2563722 (2563721)	MODE: LOSS OF OUTPUT TO 16 BIT LATCH CAUSE(S): (1) EEE PARTS FAILURE (2) LOSS OF +28V SAFING SIGNAL.	FAILED JOINT WILL GO INTO HARDWIRED SAFING ANY MOTION MAY RESULT IN AN UNEXPECTED TRAJECTORY. WORST CASE UNEXPECTED MOTION, ELECTRICALLY FROZEN JOINT, UNANNUNCIATED, CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A	1	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 (TPS1B RMS STRONGBACK AND TPS52 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**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 (H/B), RS01) FLIGHT CHECKOUT PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MFW
SUPERCEDING DATE: 11 SEP 86
APPROVED
DATE:

CRITICAL ITEMS LIST

PROJECT: SRMS — SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER — ASS'Y P/N: 5114DF1177 — SHEET: 3

TREA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
2580	G	HARDWIRE SAFING CIRCUIT QTY-6 SCHEMATIC 2563722 (2563721)	MODE: LOSS OF OUTPUT TO 16 BIT LATCH CAUSE(S): (1) EEE PARTS FAILURE (2) LOSS OF +28V SAFING SIGNAL.	FAILED JOINT WILL GO INTO HARDWIRED SAFING ARM MOTION MAY RESULT IN AN UNEXPECTED TRAJECTORY. WORST CASE ..... UNEXPECTED MOTION. ELECTRICALLY FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ..... N/A		QA/INSPECTIONS ..... 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. 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. WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSCM8080 STANDARD NUMBER 95A. 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. PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE, PRINTED CIRCUIT BOARD INSPECTION FOR TRACK SEPARATION, DAMAGE AND ADEQUACY OF PLATED THROUGH HOLES, COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA NHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A. CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES. POST P.C. BD. INSTALLATION INSPECTION, CLEANLINESS AND WORKMANSHIP (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT) P.C. BD. INSTALLATION INSPECTION, CHECK FOR CORRECT BOARD INSTALLATION, ALIGNMENT OF BOARDS, PROPER CONNECTOR CONTACT MATING, WIRE ROUTING, STRAPPING OF WIRES ETC., PRE CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT) PRE ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC., (MANDATORY INSPECTION POINT).

PREPARED BY: MEWL — SUPERSEDING DATE: 11 SEP 86 — APPROVED BY

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: SE1ADF1177
SHEET: 4

THEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2580	0	HARDWIRE SAFING CIRCUIT QTY-6 SCHEMATIC 2561722 (2561728)	MODE: LOSS OF OUTPUT TO 16 BIT LATCH CAUSE(S): (1) EEE PARTS FAILURE (2) LOSS OF +28V SAFING SIGNAL.	FAILED JOINT WILL GO INTO HARDWIRED SAFING ARM MOTION MAY RESULT IN AN UNEXPECTED TRAJECTORY. WORST CASE UNEXPECTED MOTION. ELECTRICALLY FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A	1	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: MFWG
SUPERSEDING DATE: 11 SEP 86
APPROVED BY:
DATE:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 5115OF1177
SHEET: 5

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2580	0	HARDWIRE SAFING CIRCUIT QTY 6 SCHEMATIC 2563722 (2563728)	MODE: LOSS OF OUTPUT TO 16 BIT LATCH CAUSE(S): (1) EEE PARTS FAILURE (2) LOSS OF +28V SAFING SIGNAL.	FAILED JOINT WILL GO INTO HARDWIRED SAFING ARM MOTION MAY RESULT IN AN UNEXPECTED TRAJECTORY. WORST CASE ..... UNEXPECTED MOTION, ELECTRICALLY FROZEN JOINT, UNANNUNCIATED, CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ..... N/A		FAILURE HISTORY ..... THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

PREPARED BY: MEUG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY
IF:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 5111DF1177
SHEET: 6

TAIA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
2580	1	HARDWIRE SAFING CIRCUIT QTY 6 SCHEMATIC 2561222 (2561229)	MODE: LOSS OF OUTPUT TO IG BIT LATCH CAUSE(S): (1) EEE PARTS FAILURE (2) LOSS OF +28V SAFING SIGNAL.	FAILED JOINT WILL GO INTO HARDWIRED SAFING ARM MOTION MAY RESULT IN AN UNEXPECTED TRAJECTORY. WORST CASE UNEXPECTED MOTION. ELECTRICALLY FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A		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. CREW ACTION APPLY BRAKES. SELECT DIRECT DRIVE. 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. SCREEN FAILURES N/A OMRSD OFFLINE OPERATE EACH JOINT IN COMPUTER SUPPORTED MODE. VERIFY JOINT MOTION OMRSD ONLINE INSTALLATION NONE OMRSD ONLINE TURNAROUND OPERATE EACH JOINT IN SINGLE VERIFY TACHOMETER SIGNATURE.
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PREPARED BY: MWG
SUPERCEDING DATE: 06 OCT 87
APPROVED BY
DATE: