CRITICAL ITEMS LIST

PROJECT: SHMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 5114DF1177
SHEET: 1

THEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	ROW / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2930	0	POWER SIGNAL CONTROLLER QTY 6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U106 TRANSISTOR FAILS S/C. (2) U101 FAILS H.	CAUSE 1 IF BRAKES OFF, JOINT DRIVES AT DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DETECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. WORST CASE UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A		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. THE DIODE AND TRANSISTOR, WHICH COMPRISE AN OPTO-ISOLATOR, ARE SUBJECTED TO THE SAME QUALITY AND APPLICATION CONTROLS AS APPLIED TO DISCRETE SEMICONDUCTORS. 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. 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: MEWG SUPERSEDING DATE: 11 SEP 86 APPROVED BY:

RMS/ELEC - 621

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51T4DF1177
SHEET: 2

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	FUNC. / FUNC. I/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2930	0	POWER SIGNAL CONTROLLER QTY 6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U104 TRANSISTOR FAILS S/C. (2) U101 FAILS H.	CAUSE 1 IF BRAKES OFF, JOINT DRIVES AT DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DETECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. WORST CASE UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A		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 (TPS18 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 PORS OPS CHECKLIST (ALL VEHICLES) JSC 16987

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

RMS/ELEC - 622

CRITICAL ITEMS LIST

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

ITEM REF.	REV.	PART, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. F/I CRITICALITY	RATIONALE FOR ACCEPTANCE
2930	0	POWER SIGNAL CONTROLLER QTY 6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U106 TRANSISTOR FAILS S/C. (2) U101 FAILS H.	CAUSE 1 IF BRAKES OFF, JOINT DRIVES AT DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DETECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. 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: MEWG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: SS1L0F1177
SHEET: ___

FMEA REF.	REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2930	0	POWER SIGNAL CONTROLLER QTY-6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U104 TRANSISTOR FAILS S/C. (2) U101 FAILS H.	CAUSE 1 IF BRAKES OFF, JOINT DRIVES AT DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DETECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. 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 GOVENMENT 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
SUPERCEDING 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: 51T201 1177
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
2930	0	POWER SIGNAL CONTROLLER QTY:6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U104 TRANSISTOR FAILS S/C. (2) U101 FAILS H.	CAUSE 1 IF BRAKES OFF, JOINT DRIVES AT DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DETECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. WORST CASE --- UNEXPECTED MOTION. WRONG JOINT DIRECTION. 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: MMG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY:

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 511-0F1177
SHEET: 6

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2930	0	POWER SIGNAL CONTROLLER QTY-6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U104 TRANSISTOR FAILS S/C. (2) U101 FAILS H.	CAUSE 1 IF BRAKES OFF, JOINT DRIVES AT DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DETECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. WORST CASE UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING N/A		OPERATIONAL EFFECTS WHEN BRAKES OFF, JOINT WILL DRIVE WITHOUT COMMAND. AUTOBRAKES. SELECT BACKUP. OR WHEN ATTEMPTING TO DRIVE A SINGLE JOINT IN DIRECT, THE JOINT DRIVE DIRECTION IS OPPOSITE FROM WHAT IS COMMANDED. SELECT BACKUP. CREW ACTION APPLY BRAKES. SELECT BACKUP. 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 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. SCREEN FAILURES N/A OMRSD OFFLINE IN COMPUTER CONTROLLED AND DIRECT DRIVE VERIFY FOR EACH JOINT, CORRECT JOINT MOTION OMRSD ONLINE INSTALLATION NONE OMRSD ONLINE TURNAROUND FOR EACH JOINT IN SINGLE AND DIRECT

PREPARED BY: MEWG
SUPERCEDING DATE: 11 SEP 86
APPROVED BY: _____
DATE: _____

CRITICAL ITEMS LIST

PROJECT: SAMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER
SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51T20F1177
SHEET: 7

FMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
2930	D	POWER SIGNAL CONTROLLER Q1Y-6 2563717.	MODE: CONTINUOUS HIGH OUTPUT ON DIRECT DRIVE 2 OUTPUT (CCW). CAUSE(S): (1) U104 TRANSISTOR FAILS S/C. (2) U101 FAILS H.)	CAUSE 1 IF BRAKES OFF, JOINT DRIVES A1 DIRECT DRIVE RATE IN CCW DIRECTION. CONSISTENCY CHECK DEFECTS. AUTO BRAKES. CAUSE (2) JOINT DRIVES CCW WHEN CW COMMANDED IN DIRECT DRIVE MODE. WORST CASE --------- UNEXPECTED MOTION. WRONG JOINT DIRECTION. UNANNUNCIATED. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --------- N/A	1/1	VERIFY CORRECT TACHO SIGNATURE

PREPARED BY: MEUG SUPERSEDING DATE: 11 SEP 86 APPROVED BY:

THIS PAGE INTENTIONALLY LEFT BLANK