CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y NOMENCLATURE: JOINT POWER CONDITIONER ASS'Y P/N: 51T40F1176 SHEET: 1

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
5185	0	JOINT POWER CONDITIONER QTY-2 SCHEMATIC DIAGRAM 2563711	MODE: OUTPUT HAS AN OVERVOLTAGE OR AN OVER CURRENT CONDITION. CAUSE(S): (1) INTERNAL PARTS FAILURE.	JPC SHUTS DOWN. MCIU WILL DETECT ABE COMMUNICATIONS FAILURE AND APPLY AUTOBRAKES TO THE ARM. ARM COMES TO REST. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. IF WRIST JPC: END EFFECTOR AUTO DRIVE MODE MAY NOT FUNCTION CORRECTLY. WORST CASE --- UNEXPECTED MOTION. FREE JOINTS. AUTO BRAKES. REDUNDANT PATHS REMAINING --- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) BACK-UP DRIVE AND END EFFECTOR MANUAL DRIVE MODES (TO SECURE ORBITER).	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. EEE PARTS HAVE BEEN SELECTED AND CONTROLLED IN ACCORDANCE WITH SPAR-RMS-PA.003. THIS DOCUMENT DEFINES THE PROGRAM REQUIREMENTS FOR MONITORING AND CONTROLLING EEE PARTS. THE REQUIREMENTS INCLUDE PART SELECTION TO AT LEAST "ESTABLISHED RELIABILITY" LEVELS, AND ADEQUATE DERATING OF PART STRESS LEVELS. PROCEDURES AND ACTIVITIES ARE SPECIFIED TO ENSURE AT LEAST EQUIVALENT QUALITY FOR NONSTANDARD AND IRREGULAR PARTS. RELIABILITY ANALYSIS HAS CONFIRMED NO PARTS WITH GENERICALLY HIGH FAILURE RATES. AEROSPACE DESIGN STANDARDS FOR DETAILING ELECTRONIC PARTS PACKAGING, MOUNTING AND STRUCTURAL/MECHANICAL/INTEGRITY OF ASSEMBLIES ARE APPLIED. SUCH DESIGN HAS BEEN REVIEWED AND FOUND SATISFACTORY THROUGH THE DESIGN AUDIT PROCESS, INCLUDING THE USE OF RELIABILITY, MAINTAINABILITY AND SAFETY CHECKLISTS. MATERIAL SELECTION AND USAGE CONFORMS TO SPAR-SG.368 WHICH IS EQUIVALENT TO THE NASA MATERIALS USAGE REQUIREMENTS. WORST CASE ANALYSIS HAS BEEN CONDUCTED TO ENSURE THAT PERFORMANCE CAN BE MET UNDER WORST CASE TEMPERATURE AND AGING EFFECTS. EEE PARTS STRESS ANALYSIS HAS BEEN COMPLETED AND CONFIRMS THAT THE PARTS MEET THE DERATING REQUIREMENTS. PRINTED CIRCUIT BOARD DESIGNS HAVE BEEN REVIEWED TO ENSURE ADEQUATE CIRCUIT PATH WIDTH AND SEPARATION AND TO CONFIRM APPROPRIATE DIMENSIONS OF CIRCUIT SOLDER PADS AND OF COMPONENT HOLE PROVISIONS. PARTS MOUNTING METHODS ARE CONTROLLED IN ACCORDANCE WITH MSFC-STD-136 WHICH DEFINES APPROVED-MOUNTING METHODS, STRESS RELIEF, AND COMPONENT SECURITY. WHERE APPLICABLE, DESIGN DRAWINGS AND DOCUMENTATION GIVE CLEAR IDENTIFICATION OF HANDLING PRECAUTIONS FOR ESD SENSITIVE PARTS. BOARD ASSEMBLY DRAWINGS INCLUDE THE REQUIREMENTS FOR SOLDERING STANDARDS IN ACCORDANCE WITH NHB 5300.4(3) AND JSC 08800. COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003.

PREPARED BY: MFWG SUPERCEDING DATE: NONE DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
ASS'Y NOMENCLATURE: JOINT POWER CONDITIONER

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51140F1176

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDW / FUNC. CRITICALITY 2/1R	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
3185	0	JOINT POWER CONDITIONER QTY-2 SCHEMATIC DIAGRAM 2563711	MODE: OUTPUT HAS AN OVERVOLTAGE OR AN OVER CURRENT CONDITION. CAUSE(S): (1) INTERNAL PARTS FAILURE.	JPC SHUTS DOWN. MCIU WILL DETECT ABE COMMUNICATIONS FAILURE AND APPLY AUTOBRAKES TO THE ARM. ARM COMES TO REST. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. IF WRIST JPC: END EFFECTOR AUTO DRIVE MODE MAY NOT FUNCTION CORRECTLY. WORST CASE UNEXPECTED MOTION. FREE JOINTS. AUTO BRAKES. REDUNDANT PATHS REMAINING 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) BACK-UP DRIVE AND END EFFECTOR MANUAL DRIVE MODES (TO SECURE ORBITER).		ACCEPTANCE TESTS THE JPC IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TE TING AS AN SRU. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 5 O THERMAL: +70 DEGREES C TO -25 DEGREES C (1 1/2 CYCLES) THE JPC IS FURTHER EXPOSED TO THE JOINTS ACCEPTANCE TESTS VIBRATION THERMAL VACUUM. THE JPC INTEGRATED IN THE JOINT UNDERGOES AMBIENT RMS SYSTEM TESTING (TP 518 RMS STRONGBACK AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE. QUALIFICATION TESTS THE JPC IS SUBJECTED TO THE FOLLOWING SRU QUALIFICATION TEST ENVIRONMENTS: O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 5 O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS) O THERMAL: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10**6 TORR. O HUMIDITY: TESTED ON THE SHOULDER JOINT HUMIDITY TEST. O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B, RS01). FLIGHT CHECKOUT PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: MFWG   SUPERCEDING DATE: NONE   DATE: 11 JUL 91   CIL REV: 0

RMS/ELEC - 882

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y NOMENCLATURE: JOINT POWER CONDITIONER ASS'Y P/N: 5174OF1176 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
3185	0	JOINT POWER CONDITIONER QTY-2 SCHEMATIC DIAGRAM 2563711	MODE: OUTPUT HAS AN OVERVOLTAGE OR AN OVER CURRENT CONDITION. CAUSE(S): (1) INTERNAL PARTS FAILURE.	JPC SHUTS DOWN. MCIU WILL DETECT ABE COMMUNICATIONS FAILURE AND APPLY AUTOBRAKES TO THE ARM. ARM COMES TO REST. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. IF WRIST JPC: END EFFECTOR AUTO DRIVE MODE MAY NOT FUNCTION CORRECTLY. WORST CASE --------- UNEXPECTED MOTION. FREE JOINTS. AUTO BRAKES. REDUNDANT PATHS REMAINING --------- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) BACK-UP DRIVE AND END EFFECTOR MANUAL DRIVE MODES (TO SECURE ORBITER).	SCREENS: A-PASS, B-PASS, C-PASS 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: MFWG SUPERCEDING DATE: NONE DATE: 11 JUL 91 CIL REV: 0

RMS/ELEC - 883

S04-237A
ATTACHMENT -
PAGE 164 OF 471

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y NOMENCLATURE: JOINT POWER CONDITIONER ASS'Y P/N: 5114071176 SHEET: 4

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
3185	0	JOINT POWER CONDITIONER QTY-2 SCHEMATIC DIAGRAM 2563711	MODE: OUTPUT HAS AN OVERVOLTAGE OR AN OVER CURRENT CONDITION. CAUSE(S): (1) INTERNAL PARTS FAILURE.	JPC SHUTS DOWN. MCIU WILL DETECT ABE COMMUNICATIONS FAILURE AND APPLY AUTOBRAKES TO THE ARM. ARM COMES TO REST. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. IF WRIST JPC: END EFFECTOR AUTO DRIVE MODE MAY NOT FUNCTION CORRECTLY. WORST CASE --- UNEXPECTED MOTION. FREE JOINTS. AUTO BRAKES. REDUNDANT PATHS REMAINING --- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) BACK-UP DRIVE AND END EFFECTOR MANUAL DRIVE MODES (TO SECURE ORBITER).	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 AMBINET, 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: NONE DATE: 11 JUL 91 CIL REV: 0

RMS/ELEC - 884

SCSS237A
ATTACHMENT
PAGE 165 OF 477

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y NOMENCLATURE: JOINT POWER CONDITIONER ASS'Y P/N: 51T40F1176 SHEET: 5

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
3185	0	JOINT POWER CONDITIONER QTY-2 SCHEMATIC DIAGRAM 2563711	MODE: OUTPUT HAS AN OVERVOLTAGE OR AN OVER CURRENT CONDITION. CAUSE(S): (1) INTERNAL PARTS FAILURE.	JPC SHUTS DOWN. MCIU WILL DETECT ABE COMMUNICATIONS FAILURE AND APPLY AUTOBRAKES TO THE ARM. ARM COMES TO REST. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. IF WRIST JPC: END EFFECTOR AUTO DRIVE MODE MAY NOT FUNCTION CORRECTLY. WORST CASE ---------- UNEXPECTED MOTION. FREE JOINTS. AUTO BRAKES. REDUNDANT PATHS REMAINING ---------- 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) BACK-UP DRIVE AND END EFFECTOR MANUAL DRIVE MODES (TO SECURE ORBITER).	FAILURE HISTORY ---------- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

PREPARED BY: MEWG SUPERCEDING DATE: NONE

DATE: 11 JUL 91 CIL REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED) SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y NOMENCLATURE: JOINT POWER CONDITIONER ASS'Y P/N: 5114OF1176 SHEET: 6

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
3185	0	JOINT POWER CONDITIONER QTY-2 SCHEMATIC DIAGRAM 2563711	MODE: OUTPUT HAS AN OVERVOLTAGE OR AN OVER CURRENT CONDITION. CAUSE(S): (1) INTERNAL PARTS FAILURE.	JPC SHUTS DOWN. MCIU WILL DETECT ARE COMMUNICATIONS FAILURE AND APPLY AUTOBRAKES TO THE ARM. ARM COMES TO REST. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. IF WRIST JPC: END EFFECTOR AUTO DRIVE MODE MAY NOT FUNCTION CORRECTLY. WORST CASE UNEXPECTED MOTION. FREE JOINTS. AUTO BRAKES. REDUNDANT PATHS REMAINING 1) AUTOBRAKES (TO SAFE THE SYSTEM). 2) BACK-UP DRIVE AND END EFFECTOR MANUAL DRIVE MODES (TO SECURE ORBITER).	OPERATIONAL EFFECTS 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. CREW ACTION SELECT BACKUP. CREW TRAINING THE CREW WILL BE TRAINED TO OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. 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. OMRSD OFFLINE VERIFY ABE DATA FOR WRAPAROUND. OMRSD ONLINE INSTALLATION NONE OMRSD ONLINE TURNAROUND VERIFY THAT ABE WARNING IS NOT PRESENT.

PREPARED BY: MFWG SUPERCEDING DATE: NONE DATE: 11 JUL 91 CEL REV: 0

RMS/ELEC - 886

SG402237A
ATTACHMENT
PAGE 167 OF 471