

CRITICAL ITEMS LIST

PROJECT: SRMS

SYSTEM: ELECTRICAL SUBSYSTEM

SHEET: 1

ASS'Y NAME/DATE: SERVO POWER AMPLIFIER

ASS'Y P/N: 511401177

IHEA REF.	IHEA 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
2630	1	TACHO DIGITAL OUTPUT GENERATOR QTY-6 SCHEMATIC 2563721 (2563719)	<p>MODE: ERRONEOUS DIGITAL TACHOMETER OUTPUT.</p> <p>CAUSE(S): (1) LOSS OF COUNTER CONTROL SIGNAL. (2) FAILURE OF 3 X 4 BIT OUTPUT LATCH. (3) FAILURE IN COUNTER.</p>	<p>ERRONEOUS FEEDBACK IN SPA AND TO GPC.</p> <p>JOINT MAY RUNAWAY. INCORRECT DATA SENT TO GPC. AUTO BRAKES INITIATED. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION, JOINT RUNAWAY, AUTOBRAKES.</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>VCO AND PLL COMPONENTS ARE SCREENED TO THE REQUIREMENTS OF SPAR-RMS-PA.003.</p>

RMS/ELEC - 333

PREPARED BY: MFMG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: SMS
 ASS'Y NAME/TITLE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 511401177

SHEET: 2

IMEA REF.	IMEA REV.	NAME QTY & DRAWING OFF. 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
2630	1	TACHO DIGITAL OUTPUT GENERATOR QTY: 6 SCHEMATIC 2563721 (2563719)	<p>MODE: ERRONEOUS DIGITAL TACHOMETER OUTPUT.</p> <p>CAUSE(S): (1) LOSS OF COUNTER CONTROL SIGNAL. (2) FAILURE OF 3 X 4 BIT OUTPUT LATCH. (3) FAILURE IN COUNTER.</p>	<p>ERRONEOUS FEEDBACK IN SPA AND TO GPC.</p> <p>JOINT MAY RUNAWAY. INCORRECT DATA SENT TO GPC. AUTO BRAKES INITIATED. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION, JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING AUTOBRAKES</p>	<p>ACCEPTANCE TESTS</p> <p>THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 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 (TP510 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS</p> <p>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 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 (N/B), RS01)</p> <p>FLIGHT CHECKOUT</p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

RMS/ELEC - 334

PREPARED BY:

MFG

SUPPLEMENTING DATE: 06 DEC 87

APPROVED BY:

DATE: 26 JUL 91

CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: RMS

ASSY WORK/CONFIGURATION: SERVO POWER AMP/PTER

SYSTEM: ELECTRICAL SUBSYSTEM
ASSY P/N: 517401177

SHEET: 3

ITEM REF.	ITEM 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
2630	1	TACMO DIGITAL OUTPUT GENERATOR QTY 6 SCHEMATIC 2563721 (2563719)	<p>MODE: ERRONEOUS DIGITAL TACHOMETER OUTPUT.</p> <p>CAUSE(S): (1) LOSS OF COUNTER CONTROL SIGNAL. (2) FAILURE OF 3 X 4 BIT OUTPUT LATCH. (3) FAILURE IN COUNTER.</p>	<p>ERRONEOUS FEEDBACK IN SPA AND TO GPC.</p> <p>JOINT MAY RUNAWAY. INCORRECT DATA SENT TO GPC. AUTO BRAKES INITIATED. 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 100X SCREENED AND BURNED IN, AS A MINIMUM, AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100X 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 JSCM8000 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 WHB 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 - 335

PREPARED BY:

NWJ

SUPERSEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

CRITICAL ITEM LIST

PROJECT: SRMS

ASSY NAME/REVISION: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM

ASSY P/R: 51140F1177

SHIFT: 4

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2630	1	TACMO DIGITAL OUTPUT GENERATOR QTY: 6 SCHEMATIC 2563721 (2563719)	<p>MODE: ERRONEOUS DIGITAL TACHMETER OUTPUT.</p> <p>CAUSE(S): (1) LOSS OF COUNTER CONTROL SIGNAL. (2) FAILURE OF 3 X 4 BIT OUTPUT LATCH. (3) FAILURE IN COUNTER.</p>	<p>ERRONEOUS FEEDBACK IN SPA AND TO GPC.</p> <p>JOINT MAY RUNAWAY. INCORRECT DATA SENT TO GPC. AUTO BRAKES INITIATED. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</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 - 336

PREPARED BY:

MTWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: SRMS

ASSEMBLY MANUFACTURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
ASSY P/N: 51120FT177

SHEET: 5

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
2630	1	TACHO DIGITAL OUTPUT GENERATOR QTY-6 SCHEMATIC 2563721 (2563719)	<p>MODE: ERRONEOUS DIGITAL TACHOMETER OUTPUT.</p> <p>CAUSE(S): (1) LOSS OF COUNTER CONTROL SIGNAL.</p> <p>(2) FAILURE OF 3 X 4 BIT OUTPUT LATCH.</p> <p>(3) FAILURE IN COUNTER.</p>	<p>ERRONEOUS FEEDBACK IN SPA AND TO GPC.</p> <p>JOINT MAY RUNAWAY. INCORRECT DATA SENT TO GPC. AUTO BRAKES INITIATED. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	<p>FAILURE HISTORY -----</p> <p>THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

RMS/ELEC - 337

PREPARED BY:

MFVG

SUPERSEDING DATE: 06 OCT 87

DATE: 24 JUL 91

CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: SMS
ASS'Y NAME/CLAYLINE: SERVO POWER AMPLETTER

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 5112071177 SHEET: 6

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
2630	1	TACHO DIGITAL OUTPUT GENERATOR QTY-6 SCHEMATIC 2563721 (25657119)	<p>MODE: ERRONEOUS DIGITAL TACHOMETER OUTPUT.</p> <p>CAUSE(S): (1) LOSS OF COUNTER CONTROL SIGNAL. (2) FAILURE OF 3 X 4 BIT OUTPUT LATCH. (3) FAILURE IN COUNTER.</p>	<p>ERRONEOUS FEEDBACK IN SPA AND TO GPC.</p> <p>JOINT MAY RUNAWAY. INCORRECT DATA SENT TO GPC. AUTO BRAKES INITIATED. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING AUTOBRAKES</p>		<p>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.</p> <p>CREW ACTION APPLY BRAKES. USE DIRECT DRIVE.</p> <p>CREW TRAINING THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.</p> <p>MISSION CONSTRAINT OPERATE UNDER VERNIER 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.</p> <p>OMRSD OFFLINE DRIVE EACH JOINT IN COMPUTER CONTROLLED MODE. VERIFY TACHOMETER RESPONSE.</p> <p>OMRSD ONLINE INSTALLATION NONE</p> <p>OMRSD ONLINE TURNAROUND DRIVE EACH JOINT IN SINGLE MODE. VERIFY TACHOMETER SIGNATURES.</p>

RMS/ELEC - 338

PREPARED BY:

MFVG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2