

CRITICAL ITEM LIST

PROJECT: RMS (5 MCU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51120F1177

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	MODE / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2575	0	INPUT DATA AND MULTIPLIER QTY 8 REFERENCE SCHEMATIC 2563721 AND 2563722	<p>MODE: ERRONEOUS DATA TRANSMITTED TO SPA.</p> <p>CAUSE(S): (1) SHIFT REGISTER FAILS IN PARALLEL. (2) OPTO ISOLATOR FAILURE. (3) OUTPUT DATA DRIVER FAILURE.</p> <p>WORST CASE UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND END EFFECTOR MANUAL DRIVE MODES. (FOR CONTINUING OPERATIONS).</p>	MCU TO ABE DATA WILL BE IN ERROR. ARM WILL RUNAWAY, BECOME SCRAPLISH IN STOP. "ABE" COMMUNICATION FAILURE WILL CAUSE AUTOBRAKES TO BE INITIATED. ARM WILL STOP. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.	<p>DESIGN FEATURES</p> <p>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/DAT# 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.</p> <p>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.</p> <p>THE DIODE AND TRANSISTOR, WHICH COMPRISE AN OPTO-ISOLATOR, ARE SUBJECTED TO THE SAME QUALITY AND APPLICATION CONTROLS AS APPLIED TO DISCRETE SEMICONDUCTORS.</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>THE WIRING BETWEEN THE BOARDS IS UTILIZED TO ELIMINATE CONNECTOR FAILURES.</p>	

RMS/ELEC - 245

PREPARED BY:

MFUG

SUPERSEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

EXPEDITE PROCESSING

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 ATTACHMENT
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CRITICAL ITEMS LIST

PROJECT: SAMS (S MCIU INSTALLED)
 ASS'Y NUMBER/PLANT: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/R: 51160F1177

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT AND END ITEM	HOWR / FUNC. Z/IR CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2575	0	INPUT DATA AND MULTIPLIER QTY & REFERENCE SCHEMATIC 2563721 AND 2563722	<p>MODE: ERRONEOUS DATA TRANSMITTED TO SPA.</p> <p>CAUSE(S): (1) SHIFT REGISTER FAILS IN PARALLEL. (2) OPTO ISOLATOR FAILURE. (3) OUTPUT DATA DRIVER FAILURE.</p>	<p>MCIU TO ABE DATA WILL BE IN ERROR. ARM WILL RUNAWAY, BEING STOPPED BY STOP. "ABE" COMMUNICATION FAILURE WILL CAUSE AUTOBRAKES TO BE INITIATED. ARM WILL STOP. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND END EFFECTOR MANUAL DRIVE MODES (FOR CONTINUING OPERATIONS).</p>	<p>ACCEPTANCE TESTS THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRH.</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 0 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 (1P518 RMS STRONGBACK AND 1P552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS THE SPA IS SUBJECTED TO THE FOLLOWING SRH QUALIFICATION TEST ENVIRONMENTS. THE SPA WAS ALSO TESTED AS PART OF THE JOINT QUALIFICATION TESTS.</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4 0 SHOCK: 20G/11 MS/3 AXES (6 DIRECTIONS) 0 THERMAL VAC: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1X10**6 TORR 0 HUMIDITY: TESTED WITH THE SHOULDR JOINT 0 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 PDNS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

RMS/ELEC - 246

PREPARED BY: MWG

SUPERSEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

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 ATTACHMENT
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CRITICAL ITEMS LIST

PROJECT: SRMS (5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

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

SHEET: 3

FMEA REF.	FMEA REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. Z/FW CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS QA/INSPECTIONS
2575	0	INPUT DATA AND MULTIPLEXER QTY: 6 REFERENCE SCHEMATIC 2563721 AND 2563722	<p>MODE: ERRONEOUS DATA TRANSMITTED TO SPA.</p> <p>CAUSE(S): (1) SHIFT REGISTER FAILS IN PARALLEL. (2) OPTO ISOLATOR FAILURE. (3) OUTPUT DATA DRIVER FAILURE.</p>	<p>MCIU TO ABE DATA WILL BE IN ERROR. ARM WILL RUNAWAY, BECOME SLOTTISH OR STOP. "ABE" COMMUNICATION FAILURE WILL CAUSE AUTOBRAKES TO BE INITIATED. ARM WILL STOP. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION, SIX JOINT RUNAWAY, AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND END EFFECTOR MANUAL DRIVE MODES. (FOR CONTINUING OPERATIONS).</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. OPA 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 JSCMB080 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 0800A.</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 - 247

PREPARED BY: MWG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CLC REV: 0

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CRITICAL ITEMS LIST

PROJECT: SRMS (5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 5114071177

SHEET: 4

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
2575	0	INPUT DATA AND MULTIPLEXER QTY-6 REFERENCE SCHEMATIC 2563721 AND 2563722	<p>MODE: ERRONEOUS DATA TRANSMITTED TO SPA.</p> <p>CAUSE(S): (1) SHIFT REGISTER FAILS IN PARALLEL. (2) OPTO ISOLATOR FAILURE. (3) OUTPUT DATA DRIVER FAILURE.</p>	<p>MCIU TO ABE DATA WILL BE IN ERROR. ARM WILL RUNAWAY, BECOME SLUGGISH OR STOP. "ABE" COMMUNICATION FAILURE WILL CAUSE AUTOBRAKES TO BE INITIATED. ARM WILL STOP. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING 1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND END EFFECTOR MANUAL DRIVE MODES. (FOR CONTINUING OPERATIONS).</p>	<p>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 BALK CONTACTS ETC.</p> <p>SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p>

RMS/ELEC - 248

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 APPROVED
 DATE 09 03 91

PREPARED BY:

NIWG

SUPERSEDING DATE: NONE

DATE: 11 JUL 91

REV: 0

CRITICAL ITEMS LIST

PROJECT: SRMS (S MC1U INSTALLED)
 ASS'Y IDENTIFICATION: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51R0PT1177

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	FAILURE HISTORY
2575	0	INPUT DATA AND MULTIPLIER QIT-6 REFERENCE SCHEMATIC 2563721 AND 2563722	<p>MODE: ERRONEOUS DATA TRANSMITTED TO SPA.</p> <p>CAUSE(S): (1) SHIFT REGISTER FAILS IN PARALLEL. (2) OPTO ISOLATOR FAILURE. (3) OUTPUT DATA DRIVER FAILURE.</p>	<p>MC1U TO ABE DATA WILL BE IN ERROR. ARM WILL RUNAWAY, BECOME SLUGGISH OR STOP. "ABE" COMMUNICATION FAILURE WILL CAUSE AUTOBRAKES TO BE INITIATED. ARM WILL STOP. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p>		SCREENS: A PASS, B-PASS, C PASS	THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.
			<p>WORST CASE</p> <p>UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTO BRAKES.</p>				
			<p>REDUNDANT PATHS REMAINING</p> <p>1) AUTOBRAKES (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND END EFFECTOR MANUAL DRIVE MODES. (FOR CONTINUING OPERATIONS).</p>				

RMS/ELEC - 249

PREPARED BY:

MFG

SUPERCEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0

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 ATTACHED
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CRITICAL ITEMS LIST

PROJECT: SRMS (5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 51140F1177

SHEET: 6

IMEA RTJ.	IMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT IN END ITEM	HOW / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2575	0	INPUT DATA AND MULTIPLIER QTY & REFERENCE SCHEMATIC 2563721 AND 2563722	<p>MODE: ERRONEOUS DATA TRANSMITTED TO SPA.</p> <p>CAUSE(S): (1) SHIFT REGISTER FAILS IN PARALLEL.</p> <p>(2) OPTO ISOLATOR FAILURE.</p> <p>(3) OUTPUT DATA DRIVER FAILURE.</p>	<p>MCIU TO ABE DATA WILL BE IN ERROR. ARM WILL RUNAWAY BY TIME SLUGGISH OR STOP. "ABE" COMMUNICATION FAILURE WILL CAUSE AUTOBRAKES TO BE INITIATED. ARM WILL STOP. LOSS OF COMPUTER SUPPORTED MODES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION. SIX JOINT RUNAWAY. AUTO BRAKES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>1) AUTOBRAKES (FOR SAVING THE SYSTEM).</p> <p>2) DIRECT DRIVE AND END EFFECTOR MANUAL DRIVE MODES. (FOR CONTINUING OPERATIONS).</p>	<p>OPERATIONAL EFFECTS BAD DATA, AUTOBRAKES, DIRECT DRIVE AND BACKUP AVAILABLE. CANNOT USE COMPUTER SUPPORTED MODES OF OPERATION. ARM WILL NOT STOP AUTOMATICALLY IF AN UNDETECTED FAILURE OF THE AUTOBRAKING SYSTEM HAS PREVIOUSLY OCCURRED.</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 VERIFY ABE COMMUNICATION.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND VERIFY NO ABE COMMUNICATION FAILURE.</p>	

RMS/ELEC - 250

EXPLOSION
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 ATTACHMENT
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PREPARED BY: MFWG

SUPERSEDING DATE: NONE

DATE: 11 JUL 91

CIL REV: 0