

CRITICAL ITEMS LIST

PROJECT: SRMS (-5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51140E391

SHEET: 1

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
1390	1	+/- 12V D/C AND +10V DC POWER (FROM MCIU). QTY-1 MA 94392. ED 85511	<p>MODE: LOSS OF CONDITIONED POWER.</p> <p>CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.</p>	<p>D&C VOLTAGE DETECTION CIRCUIT PUTS ARM INTO HARDWIRE SAFING. LIMPING LOST DURING EMD EFFECTOR CAPTURE. EMD EFFECTOR AUTO DRIVE MODE IS LOST.</p> <p>WORST CASE ----- LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES.</p> <p>REDUNDANT PATHS REMAINING ----- 1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).</p>	<p>DESIGN FEATURES -----</p> <p>THE +/- 12VDC AND +10 VDC FILTERS ARE COMPRISED OF A FEED THROUGH FILTER (QUALIFIED TO MIL-F-15733) AND AN INDUCTOR (TO MIL-T-27). THESE PARTS ARE ADDITIONALLY CONTROLLED BY CAE PROCUREMENT SPECIFICATIONS TO ENSURE COMPLIANCE WITH THE SCREENING REQUIREMENTS OF SPAR-RMS-PA.003.</p> <p>INTERCONNECTIONS BETWEEN THE D&C INTERFACE CONNECTORS AND ALL MODULE PRINTED BOARD CONNECTORS IS ACHIEVED BY MEANS OF FILM-WIRING. THIS IS SIMILAR TO A FLEXIBLE PRINTED CIRCUIT AND HAS KAPTON INSULATION. THE FILM WIRING PACKAGE IS MANUFACTURED BY HUGHES AIRCRAFT. THE LOWER HALF OF THE ELECTRONICS PACKAGE, THE ELECTRONICS TRAY, AND ALL PCB SOCKET CONNECTORS ARE SUPPLIED AS A KIT. THE FILM WIRING IS INTEGRATED TO THE KIT BY HUGHES. AN ASSEMBLY WAS SUBJECTED TO QUALIFICATION LEVEL VIBRATION AND THERMAL CYCLING TESTS. ALL DELIVERED ASSEMBLIES ARE SUBJECTED TO ACCEPTANCE TESTING WHICH INCLUDES: AVT AND ATT WITH CONTINUOUS AUTOMATIC CONTINUITY. SCAN OF ALL CONTACTS, INSULATION RESISTANCE, AND DIELECTRIC STRENGTH.</p> <p>INTERCONNECTIONS BETWEEN THE ELECTRONICS PACKAGE AND THE PANEL MOUNTED PARTS AND COMPONENTS IS ACHIEVED BY A PRE-FORMED WIRING HARNESS. PRIOR TO INSTALLATION, THIS HARNESS IS SUBJECTED TO TESTING FOR DIELECTRIC STRENGTH (1250 VAC), INSULATION RESISTANCE (500 VDC), AND CONTINUITY.</p> <p>THE TEST PROGRAM FOR THE D&C INCLUDES FUNCTIONAL TESTING OF THE FULLY ASSEMBLED ELECTRONICS PACKAGE AND ACCEPTANCE TESTING OF THE D&C PANEL ASSEMBLY.</p> <p>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 PARTS 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.</p> <p>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.</p>

PREPARED BY: MFWG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 1

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PROJECT: SRMS (-5 MCIU INSTALLED)
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51140E391

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HW/R / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
1390	1	+/- 12V D/C AND +10V DC POWER (FROM MCIU), QTY-1 HA 94392. ED 85511	MODE: LOSS OF CONDITIONED POWER. CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.	D&C VOLTAGE DETECTION CIRCUIT PUTS ARM INTO HARDWARE SAFING. LIMPING LOST DURING END EFFECTOR CAPTURE. END EFFECTOR AUTO DRIVE MODE IS LOST. WORST CASE ----- LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING ----- 1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).		PARTS MOUNTING METHODS ARE CONTROLLED IN ACCORDANCE WITH MSFC-STD-136 AND CAE PD93489. THESE DOCUMENTS REQUIRE 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 REQUIREMENT FOR SOLDERING STANDARDS IN ACCORDANCE WITH MHB 5300.4(3A) AND JSC 08800A.

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CRITICAL ITEMS LIST

PROJECT: MCIU INSTALLER
 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51740E301

SHEET: 3

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
1390	1	+/- 12V D/C AND +10V DC POWER (FROM MCIU). QTY-1 MA 94392. ED 85511	<p>MODE: LOSS OF CONDITIONED POWER.</p> <p>CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.</p>	<p>D&C VOLTAGE DETECTION CIRCUIT PUTS ARM INTO HARDWIRE SAFING. LIMPING LOST DURING END EFFECTOR CAPTURE. END EFFECTOR AUTO DRIVE MODE IS LOST.</p> <p>WORST CASE ----- LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING ----- 1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).</p>	<p>ACCEPTANCE TESTS ----- THE HARDWARE ITEM IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING AS PART OF THE D&C PANEL.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1 O THERMAL: +100 DEGREES F TO +10 DEGREES F 2 CYCLES (9.5 HRS PER CYCLE)</p> <p>THE D&C PANEL ASSEMBLY IS FURTHER TESTED AS PART OF THE RMS SYSTEM (TP518 RMS STRONGBACK TEST AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS ----- THE D&C PANEL HAS BEEN SUBJECTED TO THE FOLLOWING QUALIFICATION TEST ENVIRONMENT:</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1 O SHOCK: 20G/11MS - 3 AXES (6 DIRECTION) O THERMAL: 130 DEGREES F TO -23 DEGREES F (12 HRS PER CYCLE) (6 CYCLES) O HUMIDITY: 95% (120 DEGREES F TO 82 DEGREES F CYCLE IN 16 HRS) 10 CYCLES TOTAL O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01(DC/AC), CS02, CS06, RE02 (B/N), RS02, RS03, RS04) RE02 (B/N) RS02, 03, 04)</p> <p>FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>	

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 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51140E391

SHEET: 4

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
1390	1	+/-12V D/C AND +10V DC POWER (FROM MCIU), QTY-1 MA 94392. ED 85511	<p>MODE: LOSS OF CONDITIONED POWER.</p> <p>CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.</p>	<p>D&C VOLTAGE DETECTION CIRCUIT PUTS ARM INTO HARDWARE SAFING. LIMPING LOST DURING END EFFECTOR CAPTURE. END EFFECTOR AUTO DRIVE MODE IS LOST.</p> <p>WORST CASE ----- LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES.</p> <p>REDUNDANT PATHS REMAINING ----- 1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).</p>	<p>QA/INSPECTIONS -----</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 JSCMB000 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 MHB 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-TEST INSPECTION OF D&C PANEL ASSY INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILD CONFIGURATION VERIFICATION TO AS DESIGN ETC. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</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,</p>	

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MFVG

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 ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51140E391

SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HW/R / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
1390	1	+/-12V D/C AND +10V DC POWER (FROM MCIU), QTY-1 MA 94392. ED 85511	<p>MODE: LOSS OF CONDITIONED POWER.</p> <p>CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.</p>	<p>D&C VOLTAGE DETECTION CIRCUIT PUTS ARM INTO HARDWARE SAFING. LIMPING LOST DURING END EFFECTOR CAPTURE. END EFFECTOR AUTO DRIVE MODE IS LOST.</p> <p>WORST CASE ----- LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES.</p> <p>REDUNDANT PATHS REMAINING ----- 1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).</p>	<p>THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>INTEGRATION OF D&C PANEL, RHC, THC AND MCIU, INSPECTIONS ARE PERFORMED AT EACH STAGE OF INTEGRATION, WHICH INCLUDES GROUNDING CHECKS, INTER CONNECT CABLE VERIFICATION, CONNECTOR INSPECTION FOR BENT OR PUSHBACK CONTACTS ETC.</p> <p>SUB-SYSTEM PERFORMANCE TESTING (ATP), INCLUDES AN AMBIENT PERFORMANCE TEST. (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>

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CRITICAL ITEMS LIST

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 NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51140E391

SHEET: 6

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
1390	1	+/-12V D/C AND +10V DC POWER (FROM MCIU). QTY-1 MA 94392. ED 85511	MODE: LOSS OF CONDITIONED POWER. CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.	D&C VOLTAGE DETECTION CIRCUIT PUTS ARM INTO HARDWARE SAFING. LIMPING LOST DURING END EFFECTOR CAPTURE. END EFFECTOR AUTO DRIVE MODE IS LOST. WORST CASE ----- LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING ----- 1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).	FAILURE HISTORY ----- THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT: FAR 4005:

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SHEET: 7

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
1390	1	+/-12V D/C AND +10V DC POWER (FROM MCIU). QTY-1 MA 94392. ED 85511	<p>MODE: LOSS OF CONDITIONED POWER.</p> <p>CAUSE(S): (1) INPUT FILTER FAILURES. (2) MCIU TO DC POWER LINE FAILURE. (3) SWITCH SHORT CIRCUIT TO CASE.</p>	<p>D&C VOLTAGE DETECTION CIRCUIT PUIS ARM INTO HARDWIRE SAFING. LIMPING LOST DURING END EFFECTOR CAPTURE. END EFFECTOR AUTO DRIVE MODE IS LOST.</p> <p>WORST CASE</p> <p>LOSS OF MISSION LOSS OF COMPUTER SUPPORTED MODES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>1) AUTOSAFING (FOR SAFING THE SYSTEM). 2) DIRECT DRIVE AND EE MANUAL MODES (FOR CONTINUING OPERATIONS).</p>		<p>OPERATIONAL EFFECTS</p> <p>COMPUTER SUPPORTED MODES CANNOT BE USED TO COMPLETE THE MISSION. DIRECT DRIVE AND BACK-UP MODES REMAIN. IF PAYLOAD ATTACHED, THE ARM SHOULD BE MANEUVERED TO A SAFE POSITION FOR PAYLOAD RELEASE. LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO CRADLE ARM. IF WITH SUBSEQUENT FAILURES ALL DRIVE MODES ARE LOST, THE ARM MAY BE JETTISONED.</p> <p>CREW ACTION</p> <p>USE DIRECT DRIVE</p> <p>CREW TRAINING</p> <p>NONE</p> <p>MISSION CONSTRAINT</p> <p>NONE</p> <p>OMRSD OFFLINE</p> <p>WITH SAFING SWITCH IN 'AUTO' VERIFY SAFING FLAG IS GRAY.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>NONE</p> <p>OMRSD ONLINE TURNAROUND</p> <p>WITH SAFING SWITCH IN 'AUTO' SELECT SINGLE AND DRIVE ANY JOINT. VERIFY TACHOMETER SIGNATURE.</p>

PREPARED BY:

MFWG

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DATE: 26 JUL 91

CIL REV: 1