

CRITICAL ITEMS LIST

PROJECT: SRMS
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. 2/1RB CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-FAIL, C-PASS
290	1	END EFFECTOR AUTO/OFF/ MANUAL MODE SWITCH QTY-1 P/N ME 452-0102-7306 ED 92020 SHEET 3	MODE: ? LOSS OF MANUAL OR AUTO CAP/REL FUNCTION. CAUSE(S): (1) AUTO OR MAN CAP/REL CONTACT FAIL O/C. (2) CAP/REL POLE FAIL IN AUTO OR MANUAL POSITION.	LOSS OF CAPTURE AND RELEASE IN AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAPTURE SEQ ATTEMPTED. WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/ RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQ. REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS). 2) BACKUP EE RELEASE (TO SECURE ORBITER).	<p>DESIGN FEATURES -----</p> <p>TOGGLE SWITCHES USED ON THE D&C PANEL ARE HERMETICALLY SEALED, AND OF A MATURE AND PROVEN DESIGN. THESE SWITCHES ARE IN COMMON USE ON THE ORBITER VEHICLE.</p> <p>THE SWITCHES ARE CONTROLLED BY ROCKWELL INTERNATIONAL SPECIFICATION MC 452-0102 AND HAVE BEEN QUALIFIED TO THE REQUIREMENTS OF THIS SPECIFICATION.</p> <p>ELECTRICAL CONNECTIONS TO THE SWITCH ARE ACHIEVED BY MEANS OF SOLDERABLE TERMINALS.</p> <p>WIRING TO SWITCH TERMINALS UTILIZES NICKEL PLATED CONDUCTORS WITH A POLYAMID INSULATION. SOLDERING OF THE NICKEL PLATED WIRE TO THE SWITCH TERMINALS IS CONTROLLED BY CAE PROCESS SPECIFICATION PD 91059.</p> <p>THE WIRING HARNESS IS DESIGNED TO BE CAPABLE OF SEPARATE TESTING (FOR INSULATION RESISTANCE, DIELECTRIC STRENGTH, AND CONTINUITY).</p> <p>MOUNTING OF THE SWITCH TO THE D&C PANEL IS BY MEANS OF A 15/32 NUT WHICH ENGAGES A THREADED BUSHING ON THE SWITCH. A KEYED WASHER PROVIDES ROTATION RESTRAINT. AFTER INSTALLATION AND TORQUING, THE NUT IS STAKED TO THE PANEL BY A BLOB OF EPOXY ADHESIVE. A STAINLESS STEEL GUARD PROTECTS THE SWITCH LEVER AGAINST DAMAGE OR INADVERTENT OPERATION.</p> <p>ANALYSIS OF THE BASIC PANEL STRUCTURE HAS DEMONSTRATED THAT THERE ARE NO RESONANCES IN THE RELEVANT VIBRATION FREQUENCY SPECTRUM. THIS ANALYSIS HAS BEEN VERIFIED BY VIBRATION TESTING OF THE D&C PANEL ASSEMBLY.</p> <p>APPLICATION ANALYSIS HAS CONFIRMED THAT ADEQUATE ELECTRICAL STRESS MARGINS ARE ACHIEVED.</p> <p>AT THE PART LEVEL, QUALIFICATION/CERTIFICATION TESTING IS DEFINED BY ROCKWELL INTERNATIONAL SPECIFICATION MC452-0102. THIS TEST REQUIREMENT INCLUDES: INSULATION RESISTANCE, DIELECTRIC STRENGTH, CONTACT RESISTANCE, RANDOM VIBRATION (48 MINUTES PER AXIS), LEAKAGE AT ONE ATMOSPHERE DIFFERENTIAL PRESSURE, TOGGLE STRENGTH. FOR SWITCH OPERATIONAL CYCLES REFER TO TABLE 13.</p> <p>ALL UNITS ARE SUBJECTED TO ACCEPTANCE TESTS WHICH INCLUDE PRE-ACCEPTANCE RUN-IN, DIELECTRIC STRENGTH, INSTALLATION RESISTANCE, CONTACT RESISTANCE, ACCEPTANCE VIBRATION, SEAL TEST, VISUAL EXAMINATION, AND RADIOGRAPHIC INSPECTION.</p>

PREPARED BY: MFWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

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SHEET: 3

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290	1	END EFFECTOR AUTO/OFF/ MANUAL MODE SWITCH QTY-1 P/N ME 452-0102-7306 ED 92020 SHEET 3	<p>MODE: LOSS OF MANUAL OR AUTO CAP/REL FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN CAP/REL CONTACT FAIL O/C. (2) CAP/REL POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF CAPTURE AND RELEASE IN AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAPTURE SEQ ATTEMPTED.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/ RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS). 2) BACKUP EE RELEASE (TO SECURE ORBITER).</p>	<p>QA/INSPECTIONS -----</p> <p>HERMETICALLY SEALED TOGGLE SWITCHES ARE PROCURED TO ROCKWELL SPECIFICATION MC452-0102. ROCKWELL PART NO. ME452-0102-.... QUALIFICATION AND ACCEPTANCE TESTING OF SWITCHES IS PERFORMED TO R.I. SPEC. MC452-0102.</p> <p>RECEIVING INSPECTION VERIFIES THAT SWITCHES RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED TO SWITCHES DURING SHIPMENT, THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION AND ACCEPTANCE TEST DATA IDENTIFIES ACCEPTABLE PARTS.</p> <p>PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE,</p> <p>COMPONENT MOUNTING TO FRONT PANEL INSPECTION, SOLDERING OF WIRES TO SWITCH CONTACTS, WIRE ROUTING, STRESS RELIEF OF WIRES ETC., OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA MHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC08800A.</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, 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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SHEET: 4

FMEA REF.	FMEA REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOWR / FUNC. 2/1RB CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-FAIL, C-PASS
290	1	END EFFECTOR AUTO/OFF/MANUAL MODE SWITCH QTY-1 P/N ME 452-0102-7306 ED 92020 SHEET 3	<p>MODE: LOSS OF MANUAL OR AUTO CAP/REL FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN CAP/REL CONTACT FAIL O/C.</p> <p>(2) CAP/REL POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF CAPTURE AND RELEASE IN AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAPTURE SEQ ATTEMPTED.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS). 2) BACKUP EE RELEASE (TO SECURE ORBITER).</p>	<p>FAILURE HISTORY ----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

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SHEET: 5

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290	1	END EFFECTOR AUTO/OFF/MANUAL MODE SWITCH QTY-1 P/N ME 452-0102-7306 ED 92020 SHEET 3	<p>MODE: LOSS OF NOMINAL OR CAP/REL FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN CAP/REL CONTACT FAIL O/C.</p> <p>(2) CAP/REL POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF CAPTURE AND RELEASE IN AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAPTURE SEQ ATTEMPTED.</p> <p>WORST CASE</p> <p>UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING</p> <p>1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS).</p> <p>2) BACKUP EE RELEASE (TO SECURE ORBITER).</p>	<p>OPERATIONAL EFFECTS</p> <p>EE DOES NOT OPERATE NOMINALLY WHEN COMMANDED. ARM REMAINS LIMP UNTIL EE MODE SWITCH IS TURNED OFF DURING AN AUTO CAPTURE SEQUENCE.</p> <p>CREW ACTION</p> <p>FOR ANY OFF NOMINAL OPERATION OF THE EE, THE EE MODE SWITCH SHOULD BE TURNED OFF. ATTEMPT TO CAPTURE IN THE ALTERNATE MODE. IF THE SHARES REMAIN OPEN, MANEUVER ARM AWAY FROM PAYLOAD. IF THE SHARES ARE PARTIALLY CLOSED, ATTEMPT RELEASE USING A PRIMARY EE MODE. IF SHARES OPEN, MANEUVER THE ARM AWAY FROM THE PAYLOAD. IF SHARES DON'T OPEN, ATTEMPT TO RELEASE IN BACK-UP MODE. IF SHARES OPEN, MANEUVER ARM AWAY FROM THE PAYLOAD. MANEUVER ORBITER AWAY FROM PAYLOAD. IF SHARES CANNOT BE OPENED IN ANY MODE, THEN EVA CAN BE USED TO RELEASE THE PAYLOAD OR THE ARM/PAYLOAD COMBINATION CAN BE JETTISONED.</p> <p>CREW TRAINING</p> <p>CREW WILL BE TRAINED TO RECOGNIZE OFF NOMINAL EE OPERATIONS AND TO MANEUVER THE ORBITER AWAY FROM A FREE FLYING PAYLOAD AT ANY TIME DURING ARM OPERATIONS.</p> <p>MISSION CONSTRAINT</p> <p>WHEN CAPTURING A FREE FLYING PAYLOAD, THE EE MUST BE FAR ENOUGH AWAY FROM STRUCTURE TO PROHIBIT CONTACT REGARDLESS OF PAYLOAD ROTATIONS. THE EE MODE SWITCH SHOULD BE RETURNED TO THE OFF POSITION IMMEDIATELY AFTER SPEC DRIVE TIME HAS ELAPSED.</p> <p>OMRSD OFFLINE</p> <p>EXERCISE D&C PANEL EE AUTO/MANUAL MODE SWITCH TO BOTH AUTO AND MANUAL. SELECT CAPTURE / RELEASE. VERIFY VOLTAGE AT D&C PANEL OUTPUT. VERIFY CORRECT BITS IN DATA BUS.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>EXERCISE D&C PANEL EE AUTO/MANUAL MODE SWITCH TO BOTH AUTO AND MANUAL. SELECT CAPTURE / RELEASE. VERIFY VOLTAGE AT LONGERON INTERFACE.</p> <p>OMRSD ONLINE TURNAROUND</p>	

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SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HDWR / FUNC. 2/1RB CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-FAIL, C-PASS
290	1	END EFFECTOR AUTO/OFF/MANUAL MODE SWITCH QTY-1 P/N ME 452-0102-7306 ED 92020 SHEET 3	<p>MODE: LOSS OF MANUAL OR AUTO CAP/REL FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN CAP/REL CONTACT FAIL O/C.</p> <p>(2) CAP/REL POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF CAPTURE AND RELEASE IN AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAPTURE SEQ ATTEMPTED.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS). 2) BACKUP EE RELEASE (TO SECURE ORBITER).</p>	<p>EXERCISE ALL D&C PANEL EE MODES. VERIFY CORRECT OPERATION OF EE AND EE TALKBACK FLAGS.</p>

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