

**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	HOUR / FUNC. 2/1RB CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-FAIL, C-PASS
300	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 RIG/DERIG FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN RIG/DERIG CONTACT FAIL O/C. (2) RIG/DERIG POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF RIG. AND DERIG. FUNCTION IN EITHER AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAP. SEQ. ATTEMPTED.</p> <p>WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE RIGIDIZATION. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS). 2) BACKUP EE RELEASE (TO SECURE ORBITER).</p>	<p>DESIGN FEATURES -----</p> <p>TOGGLE SWITCHES USED ON THE D&amp;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&amp;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&amp;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:

MFVG

SUPERSEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

Critical Items List

PROJECT: RMS  
ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
ASS'Y P/N: 51140E301

SHEET: 2

FMEA REF.	FMEA REV.	NAME QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/TRB CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-FAIL, C-PASS
300	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 RIG/DERIG FUNCTION.  CAUSE(S): (1) AUTO OR MAN RIG/DERIG CONTACT FAIL O/C. (2) RIG/DERIG POLE FAIL IN AUTO OR MANUAL POSITION.	LOSS OF RIG. AND DERIG. FUNCTION IN EITHER AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAP. SEQ. ATTEMPTED.  WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE RIGIDIZATION. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS).  2) BACKUP EE RELEASE (TO SECURE ORBITER).		ACCEPTANCE TESTS ----- THE HARDWARE ITEM IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTS AS PART OF THE D&C PANEL ASSEMBLY.  O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1  O THERMAL: +110 DEGREES F TO PLUS 10 DEGREES F (2 CYCLES - 9.5 HRS/CYCLE.)  THE D&C PANEL ASSEMBLY IS FURTHER TESTED AS PART OF THE RMS SYSTEM TESTS (TP518 RMS STRONGBACK TEST AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.  QUALIFICATION TESTS ----- THE SWITCH ITEM HAS BEEN QUALIFIED FOR ORBITER USE. THE D&C PANEL ASSEMBLY HAS BEEN SUBJECTED TO THE FOLLOWING QUALIFICATION TEST ENVIRONMENTS.  O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1  O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS)  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, CE02, CE03, CS01 (DC/AC), CE03, CS01 (DC/AC), CS02, CS06, RE02 (B/N), RS02, RS03, RS04)  FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16907

PREPARED BY: MFWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 26 JUL 91

CIL REV: 2

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASS'Y NOMENCLATURE: D&C PANEL

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

SHEET: 3

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
300	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 RIG/DERIG FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN RIG/DERIG CONTACT FAIL O/C. (2) RIG/DERIG POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF RIG. AND DERIG. FUNCTION IN EITHER AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAP. SEQ. ATTEMPTED.</p> <p>WORST CASE</p> <p>UNEXPECTED PAYLOAD MOTION. INCOMPLETE RIGIDIZATION. CREW ACTION REQUIRED.</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>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 NHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC08B00A.</p> <p>PRE-TEST INSPECTION OF D&amp;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&amp;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>	

PREPARED BY: MFWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 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	HDWR / FUNC. 2/1RB CRITICALITY	RATIONALE FOR ACCEPTANCE DEFENS: A-PASS, B-FAIL, C-PASS
300	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 RIG/DERIG FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN RIG/DERIG CONTACT FAIL O/C. (2) RIG/DERIG POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF RIG. AND DERIG. FUNCTION IN EITHER AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAP. SEQ. ATTEMPTED.</p> <p>WORST CASE -----                      UNEXPECTED PAYLOAD MOTION. INCOMPLETE RIGIDIZATION. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING -----</p> <p>1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS).                      2) BACKUP EE RELEASE (TO SECURE ORBITER).</p>		<p>FAILURE HISTORY -----</p> <p>THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

PREPARED BY: MFVG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY: \_\_\_\_\_

DATE: 24 JUL 91

CIL REV: 2

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASS'Y NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
ASS'Y P/N: 51140E301

SHEET: 5

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
300	1	END EFFECTOR AUTO/OFF/MANUAL MODE SWITCH QTY-1 P/N WE 452-0102-7306 ED 92020 SHEET 3	<p>MODE: LOSS OF MANUAL OR AUTO RIG/DERIG FUNCTION.</p> <p>CAUSE(S): (1) AUTO OR MAN RIG/DERIG CONTACT FAIL O/C. (2) RIG/DERIG POLE FAIL IN AUTO OR MANUAL POSITION.</p>	<p>LOSS OF RIG. AND DERIG. FUNCTION IN EITHER AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAP. SEQ. ATTEMPTED.</p> <p>WORST CASE</p> <p>UNEXPECTED PAYLOAD MOTION. INCOMPLETE RIGIDIZATION. CREW ACTION REQUIRED.</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>UNABLE TO RIGIDIZE/DERIGIDIZE. IF FAILURE OCCURS DURING RIGIDIZE SEQUENCE, THE CARRIAGE WILL NOT COMPLETELY RIGIDIZE AND ARM WILL REMAIN LIMP. IF IN AUTO MODE, OPERATOR WILL DETECT OFF NOMINAL OPERATION OF THE EE.</p> <p>CREW ACTION</p> <p>THE EE MODE SWITCH SHOULD BE TURNED OFF. CREW SHOULD OBSERVE THE CAPTURE SEQUENCE AND DETERMINE THAT THE GRAPPLE FIXTURE HAS BEEN DRAWN FAR ENOUGH INTO THE EE TO PROHIBIT PAYLOAD ROTATIONS. IF THE INTERFACE DOES NOT APPEAR RIGID, ATTEMPT TO RIGIDIZE IN THE ALTERNATE MODE. IF RIGIDIZE IS UNSUCCESSFUL, ATTEMPT RELEASE USING A PRIMARY EE MODE. IF SNARES OPEN, MANEUVER THE ARM AWAY FROM THE PAYLOAD. IF SNARES DON'T OPEN, ATTEMPT TO RELEASE IN BACKUP MODE. IF SNARES OPEN, MANEUVER ARM AWAY FROM THE PAYLOAD. MANEUVER ORBITER AWAY FROM PAYLOAD. IF SNARES CANNOT BE OPENED IN ANY MODE, THEN THE ARM/PAYLOAD COMBINATION CAN BE JETTISONED.</p> <p>CREW TRAINING</p> <p>CREW TO BE TRAINED TO RECOGNIZE OFF NOMINAL OPERATION OF THE EE AND TO TURN MODE SWITCH TO OFF AFTER SPEC TIME AND 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. 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&amp;C PANEL EE AUTO/OFF MANUAL MODE SWITCH TO BOTH AUTO AND MANUAL. SELECT RIG / DERIG VERIFY CORRECT VOLTAGE AT OUTPUT OF D&amp;C PANEL VERIFY CORRECT BITS IN DATA BUS.</p> <p>OMRSD ONLINE INSTALLATION</p> <p>EXERCISE D&amp;C PANEL EE AUTO/OFF MANUAL MODE SWITCH TO MANUAL. SELECT RIG / DERIG VERIFY CORRECT VOLTAGE AT LONGERON INTERFACE</p>	

PREPARED BY: MFWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2

**CRITICAL ITEMS LIST**

PROJECT: SRMS

ASS'Y 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	HOWR / FUNC. 2/1RB CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-FAIL, C-PASS
300	1	END EFFECTOR AUTO/OFF/ MANUAL MODE SWITCH QTY-1 P/W ME 452-0102- 7306 ED 92020 SHEET 3	MODE: , LOSS OF MANUAL OR AUTO RIG/DERIG FUNCTION.  CAUSE(S): (1) AUTO OR MAN RIG/DERIG CONTACT FAIL O/C. (2) RIG/DERIG POLE FAIL IN AUTO OR MANUAL POSITION.	LOSS OF RIG. AND DERIG. FUNCTION IN EITHER AUTO OR MANUAL MODES. ARM WILL REMAIN LIMP AFTER AUTO CAP. SEQ. ATTEMPTED.  WORST CASE ----- UNEXPECTED PAYLOAD MOTION. INCOMPLETE RIGIDIZATION. CREW ACTION REQUIRED.  REDUNDANT PATHS REMAINING ----- 1) OTHER EE PRIMARY MODE (TO CONTINUE OPERATIONS).  2) BACKUP EE RELEASE (TO SECURE ORBITER).		OMSRSO ONLINE TURNAROUND ----- EXERCISE ALL D&C PANEL EE MODES VERIFY CORRECT OPERATION OF EE AND EE TALKBACK FLAGS

PREPARED BY:

MFWG

SUPERCEDING DATE: 06 OCT 87

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 2