

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 511ZDE391

SHEET: 1

THEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
530	0	SINGLE/DIRECT DRIVE SWITCH QTY-1 P/N MC 452-0102 7205 (3 POLE SWITCH) ED 92020 SHEET 1	<p>MODE: CONSTANT OUTPUT TO EITHER CW OR CCW DRIVE IN EITHER SINGLE OR DIRECT DRIVE.</p> <p>CAUSE(S): (1) 10V CONTACT S/C OR POLE FAILURE. (2) 12/6.4 CONTACT S/C OR POLE FAILURE. (3) DIRECT DRIVE ENABLE CONTACT S/C OR POLE FAILURE.</p>	<p>10V CONTACT, CANNOT SELECT SINGLE MODE SINCE GPC DETECTS A COMMAND. IF IN SINGLE, JOINT WILL DRIVE WITHOUT COMMAND.</p> <p>12/6.4 CONTACTS NO EFFECT UNTIL DIRECT DRIVE MODE SELECTED AND COMMANDED. DRIVE WILL BE ONE WAY ONLY.</p> <p>NO EFFECT. NEXT FAILURE MAY CAUSE RUNAWAY.</p> <p>WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. UNANNUNCIATED CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	<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 (40 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: 11 SEP 86

APPROVED BY: _____

E: _____

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
 ASS'Y P/N: 51740E391

SHEET: 2

THEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOW / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
530	0	SINGLE/DIRECT DRIVE SWITCH QTY-1 P/N ME 452-0102-7205 (3 POLE SWITCH) ED 92020 SHEET 1	MODE: CONSTANT OUTPUT TO EITHER CU OR CCW DRIVE IN EITHER SINGLE OR DIRECT DRIVE. CAUSE(S): (1) 10V CONTACT S/C OR POLE FAILURE. (2) 12/6.4 CONTACT S/C OR POLE FAILURE. (3) DIRECT DRIVE ENABLE CONTACT S/C OR POLE FAILURE.	10V CONTACT, CANNOT SELECT SINGLE MODE SINCE GPC DETECTS A COMMAND. IF IN SINGLE, JOINT WILL DRIVE WITHOUT COMMAND. 12/6.4 CONTACTS NO EFFECT UNTIL DIRECT DRIVE MODE SELECTED AND COMMANDED. DRIVE WILL BE ONE WAY ONLY. NO EFFECT. NEXT FAILURE MAY CAUSE RUNAWAY. WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. UNANNUNCIATED CREW ACTION REQ. REDUNDANT PATHS REMAINING N/A	1/1	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 (TP510 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 (R/N), RS02, RS03, RS04) FLIGHT CHECKOUT PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

PREPARED BY: HFLWG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY: _____

CRITICAL ITEMS LIST

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

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

SHEET: 3

IMEA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HSN / FQNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
530	0	SINGLE/DIRECT DRIVE SWITCH QTY-1 P/N ME 452-0102-7205 (3 POLE SWITCH) ED 92020 SHEET 1	<p>MODE: CONSTANT OUTPUT TO EITHER CW OR CCW DRIVE IN EITHER SINGLE OR DIRECT DRIVE.</p> <p>CAUSE(S): (1) 10V CONTACT S/C OR POLE FAILURE.</p> <p>(2) 12/6.4 CONTACT S/C OR POLE FAILURE.</p> <p>(3) DIRECT DRIVE ENABLE CONTACT S/C OR POLE FAILURE.</p>	<p>10V CONTACT, CANNOT SELECT SINGLE MODE SINCE GPC DETECTS A COMMAND. IF IN SINGLE, JOINT WILL DRIVE WITHOUT COMMAND.</p> <p>12/6.4 CONTACTS NO EFFECT UNTIL DIRECT DRIVE MODE SELECTED AND COMMANDED. DRIVE WILL BE ONE WAY ONLY.</p> <p>NO EFFECT. NEXT FAILURE MAY CAUSE RUNAWAY.</p> <p>WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. UNANNUNCIATED CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING N/A</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 BUILT 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, TMC 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: NFWG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY:

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51120E301

SHEET: 4

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 1/1 CRITICALITY	RATIONALE FOR ACCEPTANCE
530	0	SINGLE/DIRECT DRIVE SWITCH QTY-1 P/N ME 452-0102-7205 (3 POLE SWITCH) ED 92020 SHEET 1	<p>MODE: CONSTANT OUTPUT TO EITHER CW OR CCW DRIVE IN EITHER SINGLE OR DIRECT DRIVE.</p> <p>CAUSE(S): (1) 10V CONTACT S/C OR POLE FAILURE.</p> <p>(2) 12/6.4 CONTACT S/C OR POLE FAILURE.</p> <p>(3) DIRECT DRIVE ENABLE CONTACT S/C OR POLE FAILURE.</p>	<p>10V CONTACT, CANNOT SELECT SINGLE MODE SINCE GPC DETECTS A COMMAND. IF IN SINGLE, JOINT WILL DRIVE WITHOUT COMMAND.</p> <p>12/6.4 CONTACTS NO EFFECT UNTIL DIRECT DRIVE MODE SELECTED AND COMMANDED. DRIVE WILL BE ONE WAY ONLY.</p> <p>NO EFFECT. NEXT FAILURE MAY CAUSE RUNAWAY.</p> <p>WORST CASE UNEXPECTED MOTION, JOINT RUNAWAY. UNANNUNCIATED CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	<p>FAILURE HISTORY</p>	<p>THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p>

PREPARED BY: HFMG

SUPERSEDING DATE: 11 SEP 86

APPROVED BY: _____

RMS/D&C - 142

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: S1140E191

SHEET: 5

AREA REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	HOUR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
S30	1	SINGLE/DIRECT DRIVE SWITCH QTY-1 P/N NE 452-0102 -7205 (3 POLE SWITCH) ED 92020 SHEET 1	<p>MODE: CONSTANT OUTPUT TO EITHER CW OR CCM DRIVE IN EITHER SINGLE OR DIRECT DRIVE.</p> <p>CAUSE(S): (1) 10V CONTACT S/C OR POLE FAILURE.</p> <p>(2) 12/6.4 CONTACT S/C OR POLE FAILURE.</p> <p>(3) DIRECT DRIVE ENABLE CONTACT S/C OR POLE FAILURE.</p>	<p>10V CONTACT. CANNOT SELECT SINGLE MODE SINCE GPC DETECTS A COMMAND. IF IN SINGLE, JOINT WILL DRIVE WITHOUT COMMAND.</p> <p>12/6.4 CONTACTS NO EFFECT UNTIL DIRECT DRIVE MODE SELECTED AND COMMANDED. DRIVE WILL BE ONE WAY ONLY.</p> <p>NO EFFECT. NEXT FAILURE MAY CAUSE RUNAWAY.</p> <p>WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. UNANNUNCIATED CREW ACTION REQ.</p> <p>REDUNDANT PATHS REMAINING N/A</p>	1/1	<p>OPERATIONAL EFFECTS</p> <p>JOINT DOES NOT RESPOND PROPERLY TO COMMANDS OR DRIVES WITHOUT COMMAND IN SINGLE OR DIRECT MODE. IN SINGLE, WHEN THE COMMAND IS REMOVED, THE JOINT CONTINUES TO DRIVE.</p> <p>CREW ACTION</p> <p>APPLY BRAKES.</p> <p>CREW TRAINING</p> <p>THE CREW SHOULD BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, THE COMMAND SHOULD BE REMOVED. IF REMOVAL OF THE COMMAND DOES NOT STOP THE ARM, THE BRAKES SHOULD BE APPLIED.</p> <p>MISSION CONSTRAINT</p> <p>OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS.</p> <p>SCREEN FAILURES</p> <p>N/A</p> <p>OMRSD OFFLINE</p> <p>WITH SINGLE/DD SWITCH IN NEUTRAL POSITION VERIFY ALL HARDWIRED JOINT COMMAND VOLTAGES AT D&C PANEL OUTPUT. VERIFY ENABLE/INHIBIT HARDWIRED VOLTAGE AT D&C PANEL OUTPUT. VERIFY SINGLE/DIRECT DRIVE DATA BITS IN MCIU/D&C PANEL DATA NOT SET</p> <p>OMRSD ONLINE INSTALLATION</p> <p>WITH SINGLE/DD SWITCH IN NEUTRAL POSITION VERIFY ALL HARDWIRED JOINT COMMAND VOLTAGES AT LONGERON INTERFACES. VERIFY ENABLE/INHIBIT HARDWIRED VOLTAGE AT LONGERON INTERFACE</p> <p>OMRSD ONLINE TURNAROUND</p>

PREPARED BY: WMC

SUPERSEDING DATE: 06 OCT 87

APPROVED BY:

CRITICAL ITEMS LIST

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

SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51740E391

SHEET: 6

FMEA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. I/I CRITICALITY	RATIONALE FOR ACCEPTANCE
530	1	SINGLE/DIRECT DRIVE SWITCH QTY-1 P/N ME 452-0102-7205 (3 POLE SWITCH) ED 92020 SHEET 1	MODE: CONSTANT OUTPUT TO EITHER CM OR CCM DRIVE (IN EITHER SINGLE OR DIRECT DRIVE. CAUSE(S): (1) 10V CONTACT S/C OR POLE FAILURE. (2) 12/6.4 CONTACT S/C OR POLE FAILURE. (3) DIRECT DRIVE ENABLE CONTACT S/C OR POLE FAILURE.	10V CONTACT. CANNOT SELECT SINGLE MODE SINCE GPC DETECTS A COMMAND. IF IN SINGLE, JOINT WILL DRIVE WITHOUT COMMAND. 12/6.4 CONTACTS NO EFFECT UNTIL DIRECT DRIVE MODE SELECTED AND COMMANDED. DRIVE WILL BE ONE WAY ONLY. NO EFFECT. NEXT FAILURE MAY CAUSE RUNAWAY. WORST CASE ----- UNEXPECTED MOTION, JOINT RUNAWAY. UNANNUNCIATED CREW ACTION REQ. REDUNDANT PATHS REMAINING ----- N/A		WITH MODE SWITCH IN SINGLE AND DIRECT EXERCISE SINGLE/DIRECT DRIVE SWITCH VERIFY CORRECT JOINT MOTION VERIFY SINGLE/DIRECT DRIVE DATA BITS

PREPARED BY: WMC

SUPERCEDING DATE: 06 OCT 07

APPROVED BY: _____

RMS/D&C - 144

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