

**Critical Items List**

PROJECT: SRMS

SYSTEM: D&C SUBSYSTEM

ASS'Y NOMENCLATURE: D&C PANEL

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. 1/1 CRITICALITY  | RATIONALE FOR ACCEPTANCE<br>SCREENS: N/A |
|-----------|-----------|---|--|--|---|--|
| 260       | 1         | PROCEED/STOP SWITCH.<br>QTY: 1<br>ME 452-0102-7105<br>ED 92020<br>SHEET 2 | <p>MODE: /<br/>CONSTANT PROCEED OR STOP COMMAND.</p> <p>CAUSE(S):<br/>(1) POLE FAILS IN PROCEED OR STOP POSITION.<br/>(2) S/C IN PROCEED OR STOP CONTACTS.</p> | <p>CANNOT ENTER AUTO MODE IF NOT IN ONE. IF IN AN AUTO MODE:<br/>IF FAILED IN PROCEED POSITION, SEQUENCE WILL START WITHOUT COMMAND. ARM WILL NOT STOP AT PAUSE POINTS.<br/>SEQUENCE WILL CONTINUE EVEN IF STOP SELECTED.</p> <p>IF FAILED IN STOP POSITION, AUTO SEQUENCE WILL STOP WITHOUT A COMMAND. CANNOT START AUTO SEQUENCE.</p> <p>FOR CAUSE (2): EXCEPT WHEN STOP CONTACT IS S/C AND PROCEED SELECTED, THE SEQUENCE WILL BEGIN AND IMMEDIATELY STOP.</p> <p>WORST CASE<br/>-----<br/>UNEXPECTED MOTION. AUTO SEQ. PROCEEDS WITHOUT COMMAND. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING<br/>-----<br/>N/A</p> | <p>DESIGN FEATURES<br/>-----</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:

MFWG

SUPERSEDING DATE: 11 SEP 86

DATE: 24 JUL 91

CTL REV: 1

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
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  | HDMR / FUNC. 1/1 CRITICALITY<br>RATIONALE FOR ACCEPTANCE<br>SCREENS: N/A   |
|-----------|-----------|---|--|---|--|
| 260       | 1         | PROCEED/STOP SWITCH, QTY-1<br>WE 452-0102-7105<br>ED 92020<br>SHEET 2 | MODE:<br>CONSTANT PROCEED OR STOP COMMAND.<br><br>CAUSE(S):<br>(1) POLE FAILS IN PROCEED OR STOP POSITION.<br><br>(2) S/C IN PROCEED OR STOP CONTACTS. | CANNOT ENTER AUTO MODE IF NOT IN ONE. IF IN AN AUTO MODE:<br>IF FAILED IN PROCEED POSITION, SEQUENCE WILL START WITHOUT COMMAND. ARM WILL NOT STOP AT PAUSE POINTS. SEQUENCE WILL CONTINUE EVEN IF STOP SELECTED.<br><br>IF FAILED IN STOP POSITION, AUTO SEQUENCE WILL STOP WITHOUT A COMMAND. CANNOT START AUTO SEQUENCE.<br><br>FOR CAUSE (2): EXCEPT WHEN STOP CONTACT IS S/C AND PROCEED SELECTED, THE SEQUENCE WILL BEGIN AND IMMEDIATELY STOP.<br><br>WORST CASE<br>UNEXPECTED MOTION. AUTO SEQ. PROCEEDS WITHOUT COMMAND. UNANNUNCIATED. CREW ACTION REQUIRED.<br><br>REDUNDANT PATHS REMAINING<br>-----<br>N/A | ACCEPTANCE TESTS<br>-----<br>THE HARDWARE ITEM IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTS AS PART OF THE D&C PANEL ASSEMBLY.<br><br>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1<br><br>O THERMAL: +110 DEGREES F TO PLUS 10 DEGREES F (2 CYCLES - 9.5 HRS/CYCLE.)<br><br>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.<br><br>QUALIFICATION TESTS<br>-----<br>THE SWITCH ITEM HAS BEEN QUALIFIED FOR ORBITER USE. THE D&C PANEL ASSEMBLY HAS BEEN SUBJECTED TO THE FOLLOWING QUALIFICATION TEST ENVIRONMENTS.<br><br>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1<br><br>O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS)<br><br>O THERMAL: 130 DEGREES F TO -23 DEGREES F (12 HRS PER CYCLE) (6 CYCLES)<br><br>O HUMIDITY: 95% (120 DEGREES F TO 82 DEGREES F CYCLE IN 16 HRS) 10 CYCLES TOTAL.<br><br>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/M), RS02, RS03, RS04)<br><br>FLIGHT CHECKOUT<br>-----<br>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987 |

PREPARED BY: MFWG SUPERSEDING DATE: 11 SEP 86 APPROVED BY: \_\_\_\_\_ DATE: 26 JUL 91 CIL REV: 1

**CRITICAL ITEMS LIST**

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

SYSTEM: D&C SUBSYSTEM  
ASS'Y P/N: 51170E391

SHEET: 3

| FMEA REF. | FMEA REV. | NAME, QTY, & DRAWING REF. DESIGNATION                                    | FAILURE MODE AND CAUSE   | FAILURE EFFECT ON FND ITEM   | HOW FUNC. I/1 CRITICALITY  | RATIONALE FOR ACCEPTANCE SCREENS: N/A |
|-----------|-----------|--|--|--|--|---------------------------------------|
| 260       | 1         | PROCEED/STOP SWITCH.<br>QTY-1<br>ME 452-0102-7105<br>ED 92020<br>SHEET 2 | <p>MODE: CONSTANT PROCEED OR STOP COMMAND.</p> <p>CAUSE(S):<br/>(1) POLE FAILS IN PROCEED OR STOP POSITION.<br/>(2) S/C IN PROCEED OR STOP CONTACTS.</p> | <p>CANNOT ENTER AUTO MODE IF NOT IN ONE. IF IN AN AUTO MODE: IF FAILED IN PROCEED POSITION, SEQUENCE WILL START WITHOUT COMMAND. ARM WILL NOT STOP AT PAUSE POINTS. SEQUENCE WILL CONTINUE EVEN IF STOP SELECTED.</p> <p>IF FAILED IN STOP POSITION, AUTO SEQUENCE WILL STOP WITHOUT A COMMAND. CANNOT START AUTO SEQUENCE.</p> <p>FOR CAUSE (2): EXCEPT WHEN STOP CONTACT IS S/C AND PROCEED SELECTED, THE SEQUENCE WILL BEGIN AND IMMEDIATELY STOP.</p> <p>WORST CASE<br/>-----<br/>UNEXPECTED MOTION. AUTO SEQ. PROCEEDS WITHOUT COMMAND. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING<br/>-----<br/>N/A</p> | <p>QA/INSPECTIONS<br/>-----</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 HNB 5300.4(3A) STANDARD, AS MODIFIED BY JSC08000A.</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: MTWG

SUPERCEDING DATE: 11 SEP 86

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

DATE: 24 JUL 91

CIL REV: 1

**CRITICAL ITEMS LIST**

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

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 21140E391

SHEET: 4

| FMEA REF. | FMEA REV. | NAME, QTY. & DRAWING REF. DESIGNATION                                    | FAILURE MODE AND CAUSE  | FAILURE EFFECT ON END ITEM  | HWR / FUNC. 1/1 CRITICALITY<br>RATIONALE FOR ACCEPTANCE<br>SCREENS: N/A   |
|-----------|-----------|--|---|---|---|
| 260       | 1         | PROCEED/STOP SWITCH.<br>QTY-1<br>ME 452-0102-7105<br>ED 92020<br>SHEET 2 | <p>MODE: CONSTANT, PROCEED OR STOP COMMAND.</p> <p>CAUSE(S):<br/>                     (1) POLE FAILS IN PROCEED OR STOP POSITION.<br/>                     (2) S/C IN PROCEED OR STOP CONTACTS.</p> | <p>CANNOT ENTER AUTO MODE IF NOT IN ONE. IF IN AN AUTO MODE:<br/>                     IF FAILED IN PROCEED POSITION, SEQUENCE WILL START WITHOUT COMMAND. ARM WILL NOT STOP AT PAUSE POINTS. SEQUENCE WILL CONTINUE EVEN IF STOP SELECTED.</p> <p>IF FAILED IN STOP POSITION, AUTO SEQUENCE WILL STOP WITHOUT A COMMAND. CANNOT START AUTO SEQUENCE.</p> <p>FOR CAUSE (2): EXCEPT WHEN STOP CONTACT IS S/C AND PROCEED SELECTED, THE SEQUENCE WILL BEGIN AND IMMEDIATELY STOP.</p> <p>WORST CASE<br/>                     -----<br/>                     UNEXPECTED MOTION. AUTO SEQ. PROCEEDS WITHOUT COMMAND. UNANNUNCIATED. CREW ACTION REQUIRED.</p> <p>REDUNDANT PATHS REMAINING<br/>                     -----<br/>                     N/A</p> | <p>FAILURE HISTORY<br/>                     -----<br/>                     THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.</p> |

PREPARED BY: MFNG SUPERCEDING DATE: 11 SEP 86 APPROVED BY: \_\_\_\_\_ DATE: 24 JUL 91 CIL REV: 1

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASSY Nomenclature: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
 ASSY P/N: 5114DE391

SHEET: 5

| FMEA REF. | FME REV. | QTY, & WING REF. DESIGNATION   | FAILURE MODE AND CAUSE   | FAILURE EFFECT OR END ITEM  | HDWR / FUNC. / CRITICALITY  | RATIONALE FOR ACCEPTANCE<br>SCREENS: N/A |
|-----------|----------|--|--|---|---|--|
| 260       | 1        | PROCEED/STOP SWITCH.<br>QTY-1<br>ME 452-0102-7105<br>ED 92020<br>SHEET 2 | MODE:<br>CONSTANT PROCEED OR STOP COMMAND.<br><br>CAUSE(S):<br>(1) POLE FAILS IN PROCEED OR STOP POSITION.<br><br>(2) S/C IN PROCEED OR STOP CONTACTS. | CANNOT ENTER AUTO MODE IF NOT IN ONE. IF IN AN AUTO MODE:<br>IF FAILED IN PROCEED POSITION, SEQUENCE WILL START WITHOUT COMMAND. ARM WILL NOT STOP AT PAUSE POINTS.<br>SEQUENCE WILL CONTINUE EVEN IF STOP SELECTED.<br><br>IF FAILED IN STOP POSITION, AUTO SEQUENCE WILL STOP WITHOUT A COMMAND. CANNOT START AUTO SEQUENCE.<br><br>FOR CAUSE (2):<br>EXCEPT WHEN STOP CONTACT IS S/C AND PROCEED SELECTED, THE SEQUENCE WILL BEGIN AND IMMEDIATELY STOP.<br><br>WORST CASE<br>UNEXPECTED MOTION. AUTO SEQ. PROCEEDS WITHOUT COMMAND. UNANNUNCIATED. CREW ACTION REQUIRED.<br><br>REDUNDANT PATHS REMAINING<br>-----<br>N/A | OPERATIONAL EFFECTS<br>-----<br>IF FAILURE OCCURS PRIOR TO ENTERING AUTO MODE, CANNOT ENTER MODE. IF FAILURE OCCURS AFTER ENTERING AUTO MODE THE PROCEED/STOP SWITCH WILL NOT STOP THE ARM. THE SEQUENCE WILL STILL FOLLOW ITS PREPROGRAMMED PATH UNTIL THE DESIRED ENDPOINT IS REACHED.<br><br>CREW ACTION<br>-----<br>APPLY BRAKES INSTEAD OF THE PROCEED/STOP SWITCH TO STOP THE ARM.<br><br>CREW TRAINING<br>-----<br>APPLY BRAKES IMMEDIATELY AFTER THE ARM DOESN'T RESPOND PROPERLY TO COMMANDS.<br><br>MISSION CONSTRAINT<br>-----<br>ONLY ENTER AUTO MODE IMMEDIATELY PRIOR TO SELECTING PROCEED. CREW SHOULD NOT ENTER ANY AUTO MODE UNLESS THEY KNOW EXACTLY WHAT TRAJECTORY IT WILL TAKE AND ENSURE THAT THERE ARE NO OBSTACLES IN THE PATH OF THE SEQUENCE. IF ARM DOES NOT RESPOND PROPERLY TO COMMANDS, APPLY BRAKES.<br><br>OMRSD OFFLINE<br>-----<br>EXERCISE D&C PANEL PROCEED/STOP SWITCH<br>VERIFY BITS IN MCIU/D&C PANEL DATA BUS<br><br>OMRSD ONLINE INSTALLATION<br>-----<br>NONE<br><br>OMRSD ONLINE TURNAROUND<br>-----<br>EXERCISE D&C PANEL STOP/PROCEED SWITCH<br>VERIFY CORRECT DATA BITS |  |

PREPARED BY: MEWG

SUPERCEDING DATE: 11 SEP 86

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

DATE: 24 JUL 91

CIL REV: 1