

**CRITICAL ITEMS LIST**

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

SYSTEM: D&C SUBSYSTEM  
ASS'Y P/N: 51148E391

SHEET: 1

ITEM REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
900	1	SHOULDER BRACE RELEASE SWITCH QTY-1 P/N ME452-0102-7255. ED 92020 SHEET 3	<p>MODE: UNABLE TO DRIVE SHOULDER BRACE TO RELEASE.</p> <p>CAUSE(S): (1) 115V CONTACT O.C.  (2) LOSS OF ORBITER 115V AC POWER INPUT.  (3) 115V POLE OR SWITCH FAIL TO OFF.</p>	<p>UNABLE TO RELEASE SHOULDER BRACE. ARM CANNOT BE UNCRADLED.</p> <p>WORST CASE ----- LOSS OF MISSION. LOSS OF SHOULDER BRACE RELEASE.</p> <p>REDUNDANT PATHS REMAINING ----- N/A</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>

**CRITICAL ITEMS LIST**

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

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

SHEET: 2

FMEA REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	MOM / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
980	1	SHOULDER BRACE RELEASE SWITCH QTY-1 P/N ME452-0102-7255. ED 92020 SHEET 3	MODE: UNABLE TO DRIVE SHOULDER BRACE TO RELEASE.  CAUSE(S): (1) 115V CONTACT O.C.  (2) LOSS OF ORBITER 115V AC POWER INPUT.  (3) 115V POLE OR SWITCH FAIL TO OFF.	UNABLE TO RELEASE SHOULDER BRACE. ARM CANNOT BE UNCRADLED.  WORST CASE ----- LOSS OF MISSION. LOSS OF SHOULDER BRACE RELEASE.  REDUNDANT PATHS REMAINING ----- N/A	2/2	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: MFWG

SUPERSEDING DATE: 01 OCT 86

APPROVED BY:

DATE:

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
ASSY NOMENCLATURE: D&C PANEL

SYSTEM: D&C SUBSYSTEM  
ASSY P/N: 51140E301

SHEET: 3

INER REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOW / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
980	1	SHOULDER BRACE RELEASE SWITCH QTY-1 P/N ME452-0102-7255. ED 92020 SHEET 3	<p>MODE: UNABLE TO DRIVE SHOULDER BRACE TO RELEASE.</p> <p>CAUSE(S): (1) 115V CONTACT O.C.  (2) LOSS OF ORBITER 115V AC POWER INPUT.  (3) 115V POLE OR SWITCH FAIL TO OFF.</p>	<p>UNABLE TO RELEASE SHOULDER BRACE. ARM CANNOT BE UNCRADLED.</p> <p>WORST CASE</p> <p>LOSS OF MISSION. LOSS OF SHOULDER BRACE RELEASE.</p> <p>REDUNDANT PATHS REMAINING</p> <p>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 NHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC08800A.</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: 01 OCT 86

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

E: \_\_\_\_\_

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

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

SHEET: 4

P/N REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RISK / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
980	1	SHOULDER BRACE RELEASE SWITCH QTY-1 P/N HE452-0102-7255, ED 92020 SHEET 3	MODE: UNABLE TO DRIVE SHOULDER BRACE TO RELEASE.  CAUSE(S): (1) 115V CONTACT O.C.  (2) LOSS OF ORBITER 115V AC POWER INPUT.  (3) 115V POLE OR SWITCH FAIL TO OFF.	UNABLE TO RELEASE SHOULDER BRACE. ARM CANNOT BE UNCRADLED.  WORST CASE ----- LOSS OF MISSION. LOSS OF SHOULDER BRACE RELEASE.  REDUNDANT PATHS REMAINING ----- N/A	FAILURE HISTORY	----- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

PREPARED BY: MFMG      SUPERSEDING DATE: 01 OCT 86      APPROVED BY: \_\_\_\_\_      DATE: \_\_\_\_\_

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

SYSTEM: D&C SUBSYSTEM  
 ASS'Y P/N: 51148E191

SHEET: 5

P/N REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/2 CRITICALITY	RATIONALE FOR ACCEPTANCE
980	2	SHOULDER BRACE RELEASE SWITCH QTY-1 P/N ME452- D102-7255. ED 92020 SHEET 3	MODE: UNABLE TO DRIVE SHOULDER BRACE TO RELEASE.  CAUSE(S): (1) 115V CONTACT O.C.  (2) LOSS OF ORBITER 115V AC POWER INPUT.  (3) 115V POLE OR SWITCH FAIL TO OFF.	UNABLE TO RELEASE SHOULDER BRACE. ARM CANNOT BE UNCRADLED.  WORST CASE ----- LOSS OF MISSION. LOSS OF SHOULDER BRACE RELEASE.  REDUNDANT PATHS REMAINING ----- N/A		<p>OPERATIONAL EFFECTS -----</p> <p>CANNOT RELEASE SHOULDER BRACE. CANNOT UNCRADLE ARM TO PERFORM MISSION.</p> <p>CREW ACTION -----</p> <p>USE EVA OR RMS D&amp;C IFH KIT TO RELEASE SHOULDER BRACE.</p> <p>CREW TRAINING -----</p> <p>NONE</p> <p>MISSION CONSTRAINTS -----</p> <p>RELEASE THE BRACE AS EARLY IN THE MISSION AS POSSIBLE TO AVOID ANY THERMALLY INDUCED FAILURES TO RELEASE.</p> <p>SCREEN FAILURES -----</p> <p>N/A</p> <p>OMRSD OFFLINE -----</p> <p>OPERATE SHOULDER BRACE RELEASE SWITCH. VERIFY VOLTAGE AT D&amp;C PANEL OUTPUT.</p> <p>OMRSD ONLINE INSTALLATION -----</p> <p>OPERATE SHOULDER BRACE RELEASE SWITCH. VERIFY VOLTAGE AT LONGERON INTERFACE.</p> <p>OMRSD ONLINE TURNAROUND -----</p> <p>VERIFY SHOULDER BRACE CAN BE RELEASED.</p>