CRITICAL ITEMS LIST

PROJECT: SRMS SYSTEM: D&C SUBSYSTEM
ASS'Y NOMENCLATURE: D&C PANEL ASS'Y P/N: 51T40E391 SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY — RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
170	1	SAFING SW. QTY-1 P/N CAE 87836 ED 92020 SHEET 2	MODE: PERMANENT SWITCH HARDWIRE SAFING. CAUSE(S): (1) SWITCH FAILS TO SAFE. (2) 28V POLE FAIL TO SAFE. (3) 28V AUTO CONTACT O/C.	HARDWIRE SAFING INITIATED. ARM STOPS. COMPUTER SUPPORTED MODES LOST. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. SAME AS ABOVE BUT MODE LIGHT REMAINS ON. SAME AS ABOVE. WORST CASE --- LOSS OF MISSION. LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING --- DIRECT AND BACKUP	DESIGN FEATURES --- 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. THE SWITCHES ARE CONTROLLED BY ROCKWELL INTERNATIONAL SPECIFICATION MC 452-0102 AND HAVE BEEN QUALIFIED TO THE REQUIREMENTS OF THIS SPECIFICATION. ELECTRICAL CONNECTIONS TO THE SWITCH ARE ACHIEVED BY MEANS OF SOLDERABLE TERMINALS. 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. THE WIRING HARNESS IS DESIGNED TO BE CAPABLE OF SEPARATE TESTING (FOR INSULATION RESISTANCE, DIELECTRIC STRENGTH, AND CONTINUITY). 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. 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. APPLICATION ANALYSIS HAS CONFIRMED THAT ADEQUATE ELECTRICAL STRESS MARGINS ARE ACHIEVED. 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. 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.

PREPARED BY: MFWG SUPERCEDING DATE: 06 OCT 87 APPROVED BY: _____ DATE: 24 JUL 91 CIL REV: 3

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: ST140E391
SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY — RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
170	1	SAFING SW. QTY-1 P/N CAE 87838 ED 92020 SHEET 2	MODE: PERMANENT SWITCH HARDWIRE SAFING. CAUSE(S): (1) SWITCH FAILS TO SAFE. (2) 28V POLE FAIL TO SAFE. (3) 28V AUTO CONTACT O/C.	HARDWIRE SAFING INITIATED. ARM STOPS. COMPUTER SUPPORTED MODES LOST. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. SAME AS ABOVE BUT MODE LIGHT REMAINS ON. SAME AS ABOVE. WORST CASE ---------- LOSS OF MISSION. LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING ---------- DIRECT AND BACKUP	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 16987

PREPARED BY: MFWG
SUPERCEDING DATE: 06 OCT 87
DATE: 24 JUL 91
CIL REV: 3

CRITICAL ITEMS LIST

PROJECT: SRMS — SYSTEM: D&C SUBSYSTEM
ASS'Y NOMENCLATURE: D&C PANEL — ASS'Y P/N: 5T14DE391 — SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY — RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
170	1	SAFING SW. QTY-1 P/N CAE 87838 ED 92020 SHEET 2	MODE: PERMANENT SWITCH HARDWIRE SAFING. CAUSE(S): (1) SWITCH FAILS TO SAFE. (2) 28V POLE FAIL TO SAFE. (3) 28V AUTO CONTACT O/C.	HARDWIRE SAFING INITIATED. ARM STOPS. COMPUTER SUPPORTED MODES LOST. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. SAME AS ABOVE BUT MODE LIGHT REMAINS ON. SAME AS ABOVE. WORST CASE --- LOSS OF MISSION. LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING --- DIRECT AND BACKUP	QA/INSPECTIONS --- HERMETICALLY SEALED TOGGLE SWITCHES ARE PROCURED TO ROCKWELL SPECIFICATION MC452-0102. AS REQUIRED BY CAE SPECIFICATION PS87838. CAE PART NO. PS87838. QUALIFICATION AND ACCEPTANCE TESTING OF SWITCHES IS PERFORMED TO RI SPECIFICATION MC452-0102. 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. PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE, 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. 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) 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). ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT). 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. SUB-SYSTEM PERFORMANCE TESTING (ATP), INCLUDES AN AMBIENT PERFORMANCE TEST. (MANDATORY INSPECTION POINT). 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. SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)

PREPARED BY: MFWG — SUPERCEDING DATE: 06 OCT 87 — APPROVED BY: _____ — DATE: 24 JUL 91 — CIL REV: 3

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: ST124E351

FMEA REF.	FMEA ITEM	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
170	1	SAFING SW. QTY-1 P/N CAE 87638 ED 92020 SHEET 2	MODE: PERMANENT "1" SWITCH HARDWIRE SAFING. CAUSE(S): (1) SWITCH FAILS TO SAFE. (2) 28V POLE FAIL TO SAFE. (3) 28V AUTO CONTACT O/C.	HARDWIRE SAFING INITIATED. ARM STOPS. COMPUTER SUPPORTED MODES LOST. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. SAME AS ABOVE BUT MODE LIGHT REMAINS ON. SAME AS ABOVE. WORST CASE --- LOSS OF MISSION. LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING --- DIRECT AND BACKUP		FAILURE HISTORY --- THERE HAVE BEEN NO FAILURES ASSOCIATED WITH THIS FAILURE MODE ON THE SRMS PROGRAM.

PREPARED BY: MFWG SUPERCEDING DATE: 06 OCT 87 APPROVED BY: _____ DATE: 24 JUL 91 CIL REV: 3

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: D&C PANEL
SYSTEM: D&C SUBSYSTEM
ASS'Y P/N: 51140E391
SHEET: 5

ITEM REF.	ITEM REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
170	1	SAFING SW. QTY-1 P/N CAE 87838 ED 92020 SHEET 2	MODE: PERMANENT SWITCH - HARDWIRE SAFING. CAUSE(S): (1) SWITCH FAILS TO SAFE. (2) 28V POLE FAIL TO SAFE. (3) 28V AUTO CONTACT O/C.	HARDWIRE SAFING INITIATED. ARM STOPS. COMPUTER SUPPORTED MODES LOST. LOSS OF LIMPING DURING END EFFECTOR CAPTURE. SAME AS ABOVE BUT MODE LIGHT REMAINS ON. SAME AS ABOVE. WORST CASE --- LOSS OF MISSION. LOSS OF COMPUTER SUPPORTED MODES. REDUNDANT PATHS REMAINING --- DIRECT AND BACKUP	OPERATIONAL EFFECTS --- COMPUTER SUPPORTED MODES CANNOT BE USED TO COMPLETE THE MISSION. DIRECT DRIVE AND BACK-UP MODES REMAIN. IF PAYLOAD ATTACHED, THE ARM SHOULD BE MANEUVERED TO A SAFE POSITION FOR PAYLOAD RELEASE. LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO CRADLE ARM. IF WITH SUBSEQUENT FAILURES ALL DRIVE MODES ARE LOST, THE ARM MAY BE JETTISONED. CREW ACTION --- USE DIRECT DRIVE. CREW TRAINING --- NONE MISSION CONSTRAINTS --- NONE OMRSD OFFLINE --- EXERCISE D&C SAFING SWITCH. VERIFY HARDWIRE SAFING VOLTAGE AT D&C PANEL OUTPUT. OMRSD ONLINE INSTALLATION --- EXERCISE D&C SAFING SWITCH. VERIFY HARDWIRE SAFING VOLTAGE AT LONGERON INTERFACE. OMRSD ONLINE TURNAROUND --- OPERATE ONE JOINT IN SINGLE, WITH SAFING IN AUTO. VERIFY TACHOMETER SIGNATURE.

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