

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
 ASS'Y NOMENCLATURE: BACK-UP

SYSTEM: BACK-UP  
 ASS'Y P/N:

SHEET: 1

P/N & REF.	REV.	NAME QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
4460	1	BACKUP JOINT SELECT SWITCH QTY-1 P/N PS-87841-01	MODE: INABILITY TO SELECT ANY JOINT.  CAUSE(S): (1) OPEN WIPER. (2) MECHANICAL FAILURE.	LOSS OF CAPABILITY TO DRIVE JOINT IN BACKUP DRIVE.  WORST CASE  BACKUP INOPERATIVE.  REDUNDANT PATHS REMAINING  SINGLE AND DIRECT	DESIGN FEATURES ----- ROTARY 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 452-0049 AND HAVE BEEN QUALIFIED TO THE REQUIREMENTS OF THIS SPECIFICATION.  ELECTRICAL CONNECTIONS TO THE SWITCH ARE ACHIEVED BY MEANS OF A MATING PAIR OF NB TYPE CIRCULAR CONNECTORS USING CRIMP STYLE CONTACTS. WIRING TO SWITCH CONNECTOR UTILIZES NICKEL PLATED CONDUCTORS WITH A POLYAMIDE INSULATION. THE WIRING HARNESS IS DESIGNED TO BE CAPABLE OF SEPARATE TESTING (FOR INSULATION RESISTANCE DIELECTRIC STRENGTH, AND CONTINUITY).  THIS SWITCH IS MOUNTED TO THE D&C PANEL BY MEANS OF THREE 6-32 FASTENERS. AFTER INSTALLATION AND TORQUING EACH SCREW HEAD IS STAKED TO THE PANEL USING A BLOB OF EPOXY ADHESIVE. A DOWEL PIN, INTEGRAL TO THE SWITCH BODY, ENGAGES WITH THE PANEL TO PROVIDE ROTATION RESTRAINT. 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 MC452-0049. THIS TEST REQUIREMENT INCLUDES: INSULATION RESISTANCE, CONTACT DROP AT RATED CURRENT, RANDOM VIBRATION (48 MINUTES PER AXIS), SHOCK (20G-3 AXES), 25000 CYCLES ACTIVATION AT RATED DC CURRENT, LEAKAGE AT ONE ATMOSPHERE DIFFERENTIAL PRESSURE. FOR SWITCH OPERATIONAL CYCLES REFER TO TABLE 13.  ALL UNITS ARE SUBJECTED TO ACCEPTANCE TESTS WHICH INCLUDE PRE-ACCEPTANCE RUN-IN, DIELECTRIC WITHSTANDING VOLTAGE, CONTACT RESISTANCE, ACCEPTANCE VIBRATION, SEAL TEST, VISUAL EXAMINATION AND FINAL PERFORMANCE TEST.	

PREPARED BY: MFWG

SUPERCEDING DATE: 28 OCT 86

APPROVED BY:

RMS/BACK-UP 26

**CRITICAL ITEMS LIST**

PROJECT: SRMS  
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SYSTEM: BACK-UP  
ASS'Y P/N:

SHEET: 2

P/N & REF.	REV.	NAME, QTY & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWMR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
4460	1	BACKUP JOINT SELECT SWITCH QTY-1 P/N PS-87841-01	<p>MODE: INABILITY TO SELECT ANY JOINT.</p> <p>CAUSE(S): (1) OPEN WIPER. (2) MECHANICAL FAILURE.</p>	<p>LOSS OF CAPABILITY TO DRIVE JOINT IN BACKUP DRIVE.</p> <p>WORST CASE</p> <p>BACKUP INOPERATIVE.</p> <p>REDUNDANT PATHS REMAINING</p> <p>SINGLE AND DIRECT</p>		<p>ACCEPTANCE TESTS</p> <p>THE HARDWARE ITEM IS SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTS AS PART OF THE D&amp;C PANEL ASSEMBLY.</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1</p> <p>0 THERMAL: +110 DEGREES F TO PLUS 10 DEGREES F (2 CYCLES - 9.5 HRS/CYCLE.)</p> <p>THE D&amp;C PANEL ASSEMBLY IS FURTHER TESTED AS PART OF THE RMS SYSTEM TESTS (TP51B RMS STRONGBACK TEST AND TP552 FLAT FLOOR TEST) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS</p> <p>THE SWITCH ITEM HAS BEEN QUALIFIED FOR ORBITER USE. THE D&amp;C PANEL ASSEMBLY HAS BEEN SUBJECTED TO THE FOLLOWING QUALIFICATION TEST ENVIRONMENTS.</p> <p>0 VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 1</p> <p>0 SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS)</p> <p>0 THERMAL: 130 DEGREES F TO -23 DEGREES F (12 HRS PER CYCLE) (6 CYCLES)</p> <p>0 HUMIDITY: 95% (120 DEGREES F TO 82 DEGREES F CYCLE IN 16 HRS) 10 CYCLES TOTAL.</p> <p>0 ENC: 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)</p> <p>FLIGHT CHECKOUT</p> <p>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>

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**CRITICAL ITEMS LIST**

PROJECT: SRMS  
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SYSTEM: BACK-UP  
ASS'Y P/N:

SHEET: 3

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOUR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE
4460	1	BACKUP JOINT SELECT SWITCH QTY-1 P/N PS-87841-01	<p>MODE: INABILITY TO SELECT ANY JOINT.</p> <p>CAUSE(S): (1) OPEN WIPER. (2) MECHANICAL FAILURE.</p>	<p>LOSS OF CAPABILITY TO DRIVE JOINT IN BACKUP DRIVE.</p> <p>WORST CASE ----- BACKUP INOPERATIVE.</p> <p>REDUNDANT PATHS REMAINING ----- SINGLE AND DIRECT</p>	<p>QA/INSPECTIONS -----</p> <p>HERMETICALLY SEALED ROTARY SWITCHES ARE PROCURED TO ROCKWELL SPECIFICATION MC452-0049, AS REQUIRED BY CAE SPEC. PS87841. CAE PART NO. PS87841-1. QUALIFICATION AND ACCEPTANCE TESTING OF SWITCHES IS PERFORMED TO RI. SPEC. MC452-0049.</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 WHB 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>

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SHEET: 4

FMEA REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE
4460	1	BACKUP JOINT SELECT SWITCH QTY-1 P/N PS-87841-01	MODE: INABILITY TO SELECT ANY JOINT.  CAUSE(S): (1) OPEN WIPER. (2) MECHANICAL FAILURE.	LOSS OF CAPABILITY TO DRIVE JOINT IN BACKUP DRIVE.  WORST CASE ----- BACKUP INOPERATIVE.  REDUNDANT PATHS REMAINING ----- SINGLE AND DIRECT	FAILURE HISTORY ----- NO EEE PARTS FAILURES HAVE OCCURRED SUBSEQUENT TO ASSEMBLY OF PARTS.  THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT:  FAR 1010: S/N 201 NOV 81  DESCRIPTION ----- SJ YAW FAILED TO OPERATE IN BACK-UP MODE. FOUND DEFECTIVE D&C PANEL CABLE.  CORRECTIVE ACTION ----- REPAIR CABLE

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SHEET: 5

P/N REF.	REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE
4460	1	BACKUP JOINT SELECT SWITCH QTY-1 P/N PS-87841-01	MODE: INABILITY TO SELECT ANY JOINT.  CAUSE(S): (1) OPEN WIPER. (2) MECHANICAL FAILURE.	LOSS OF CAPABILITY TO DRIVE JOINT IN BACKUP DRIVE.  WORST CASE ----- BACKUP INOPERATIVE.  REDUNDANT PATHS REMAINING ----- SINGLE AND DIRECT	OPERATIONAL EFFECTS ----- LOSS OF NEXT REDUNDANT PATH RESULTS IN BEING ONE FAILURE AWAY FROM INABILITY TO CRADLE ARM. JOINT WILL NOT DRIVE IN BACKUP ONCE PRIMARY MODES HAVE FAILED, THE BACKUP STANDBY SYSTEM WILL NOT PROVIDE THE CAPABILITY TO CRADLE THE ARM. ARM CAN BE JETTISONED.  CREW ACTION ----- PERFORM AN EVA TO STOW THE ARM OR JETTISON.  CREW TRAINING ----- NONE  MISSION CONSTRAINT ----- ARM SHOULD NOT BE MANEUVERED TO POSITION WHERE JETTISON CANNOT BE SAFELY PERFORMED.  SCREEN FAILURES ----- B: N/A ( STANDBY REDUNDANT )  OMRSD OFFLINE ----- OPERATE BACKUP DIRECT DRIVE SWITCH TO + POSITION. VERIFY ENABLE COMMAND VOLTAGE FOR SELECTED JOINT AT O&C PANEL INTERFACE.  OMRSD OFFLINE INSTALLATION ----- OPERATE BACKUP DIRECT DRIVE SWITCH TO + POSITION. VERIFY ENABLE COMMAND VOLTAGE FOR SELECTED JOINT AT LONGERON INTERFACE.  OMRSD OFFLINE TURNAROUND ----- DRIVE WRIST ROLL JOINT IN BACKUP. VERIFY CORRECT JOINT MOTION.	

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RMS/BACK-UP 30