CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SHOULDER

SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51T40312I9

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
4630	2	SHOULDER FUSING. 45 PRIME CHANNEL FUSES. 16 BACK-UP CHANNEL FUSES. WIRING SCHEMATIC 51T40E316 REVISION C.	MODE: LOSS OF POWER FLAG FUSE. CAUSE(S): (1) MECHANICAL SHOCK VIBRATION, MATERIALS. (FUSE 23).	K1 AND K2 D&C RELAYS OPEN. BRAKES COME ON. MCIU WILL NOT SEND DATA TO ABE. ARM WILL STOP. ALL PRIME MODES LOST. HARDWIRED SAFING. EE PRIME MODES LOST. IF CAPTURING PAYLOAD, INCOMPLETE RIGIDIZE. GPC IN TEMP MONITORING MODE. WORST CASE ---------- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ---------- BACKUP EE RELEASE.	DESIGN FEATURES ---------- FUSES USED IN THE SHOULDER FUSE PLUG ASSEMBLIES ARE OF THE DESIGN DEFINED BY MSFC SPECIFICATION 40M38259. FOR SRMS APPLICATION, DESIGN AND PROCESS IMPROVEMENTS HAVE BEEN NEGOTIATED WITH, AND IMPLEMENTED BY, THE MANUFACTURER. THESE INCLUDE: - IMPROVED ATTACHMENT OF END CAPS. - CONTROL OF FUSE ELEMENT LENGTH AND DISPOSITION WITHIN THE FUSE BODY TUBE. - CONTROL SOLDERING BETWEEN FUSE ELEMENT AND THE END CAPS. PRIOR TO ASSEMBLY IN THE FUSE PLUG ASSEMBLY, A CONNECT PIN IS SOLDERED TO EACH OF THE FUSE LEAD WIRES. THIS PROCESS IS CONTROLLED BY ESTABLISHED PROCEDURES WHICH INCLUDE THE REQUIREMENT OF A "METERED" QUALITY OF SOLDER FOR EACH SOLDER JOINT. THE FUSE BODY AND LEAD WIRES ARE SLEEVED TO PRECLUDE SHORT CIRCUITS. EACH FUSE AND ALL SOLDERED JOINTS ARE SUBJECTED TO RADIOGRAPHIC INSPECTION. THE FUSE PLUG ASSEMBLY INCLUDES AN ALUMINUM POTTING SHELL. FOLLOWING INTEGRATION OF THE FUSES, THE CONNECTOR ASSEMBLY IS POTTED USING A SEMI-RESILIENT (RTV) COMPOUND. THE POTTING MEDIUM PROVIDES GOOD HEAT TRANSFER AND ENSURES MECHANICAL STABILITY OF THE INDIVIDUAL FUSES. THE POWER FLAG LINE IS PROTECTED BY A SINGLE, 3 AMP. FUSE.

PREPARED BY: MFWG
SUPERCEDING DATE: 28 OCT 86
APPROVED BY: _____
DATE: 24 JUL 91
CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SHOULDER
SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1219
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
4630	2	SHOULDER FUSING. 45 PRIME CHANNEL FUSES. 16 BACK-UP CHANNEL FUSES. WIRING SCHEMATIC 51140E316 REVISION C.	MODE: LOSS OF POWER FLAG FUSE. CAUSE(S): (1) MECHANICAL SHOCK VIBRATION, MATERIALS. (FUSE 23).	K1 AND K2 D&C RELAYS OPEN. BRAKES COME ON. MCIU WILL NOT SEND DATA TO ABE. ARM WILL STOP. ALL PRIME MODES LOST. HARDWIRED SAFING. EE PRIME MODES LOST. IF CAPTURING PAYLOAD, INCOMPLETE RIGIDIZE. GPC IN TEMP MONITORING MODE. WORST CASE --- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- BACKUP EE RELEASE.	ACCEPTANCE TESTS --- THE SHOULDER, ELBOW AND WRIST JOINTS ARE SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING. O VIBRATION: LEVEL AND DURATION - REFERENCE TABLES 9, 10 AND 11. O THERMAL: +70 DEGREES C TO -25 DEGREES C (2 CYCLES) 1 X 10**6 TORR. THE JOINTS ARE INTEGRATED INTO THE RMS SYSTEM (PER TP532) WHICH IS FURTHER TESTED IN (TP518 RMS STRONGBACK AND TP552 FLAT FLOOR). THESE TESTS VERIFIES THE ABSENCE OF THE FAILURE MODE. QUALIFICATION TESTS --- THE SHOULDER AND WRIST JOINTS WERE SUBJECTED TO THE LISTED BELOW ENVIRONMENTS. THE ELBOW JOINTS WAS NOT EXPOSED THE QUALIFICATION ENVIRONMENTS WAS CERTIFIED BY SIMILARITY TO THE SHOULDER JOINT. O VIBRATION: LEVEL AND DURATION REFERENCE TABLES 9 AND 10 O SHOCK: 20G/11 MS - 3 AXES (6 DIRECTIONS) O THERMAL VACUUM: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10**6 TORR. O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE02 (N/B). O HUMIDITY: ONLY SHOULDER JOINT WAS TESTED, 95% RH (65 DEGREES C MAINTAINED FOR 6 HRS.) (65 DEGREES C TO 30 DEGREES C IN 16 HRS) 10 CYCLES 240 HRS. O LOAD TEST: SHOULDER JOINT STRUCTURAL LOAD TEST REFERENCE TABLE 12. NOTE: ELBOW JOINT (S/N 302 AND UP) INCORPORATES NON-WELDED TRANSITIONS WHICH WAS LOAD TESTED TO LOAD IN REFERENCE TABLE TBS. FLIGHT CHECKOUT --- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987

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CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SHOULDER

SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1219

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
4630	2	SHOULDER FUSING. 45 PRIME CHANNEL FUSES. 16 BACK-UP CHANNEL FUSES. WIRING SCHEMATIC 51140E316 REVISION C.	MODE: LOSS OF POWER FLAG FUSE. CAUSE(S): (1) MECHANICAL SHOCK VIBRATION, MATERIALS. (FUSE 23).	K1 AND K2 D&C RELAYS OPEN. BRAKES COME ON. MCIU WILL NOT SEND DATA TO ABE. ARM WILL STOP. ALL PRIME MODES LOST. HARDWIRED SAFING. EE PRIME MODES LOST. IF CAPTURING PAYLOAD, INCOMPLETE RIGIDIZE. GPC IN TEMP MONITORING MODE. WORST CASE --- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- BACKUP EE RELEASE.	QA/INSPECTIONS --- FUSES ARE PROCURED AS A EEE PART TO SPAR SPECIFICATION SPAR-SG459/023, WHICH INCORPORATES SPECIFICATION MSFC40M38259 AS REQUIRED BY SPAR-RMS-PA.003. QUALIFICATION, ACCEPTANCE TESTING AND RELIABILITY LIFE TESTING OF FUSE PLUG ASSEMBLIES WAS PERFORMED TO THE REQUIREMENTS OF THE SPAR-RMS-TP.952. EEE PARTS INSPECTION IS PERFORMED AS REQUIRED BY SPAR-RMS-PA.003. EACH EEE PART IS QUALIFIED AT THE PART LEVEL TO THE REQUIREMENTS OF THE APPLICABLE SPECIFICATION. ALL EEE PARTS ARE 100% SCREENED AND BURNED IN, AS A MINIMUM, AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100% RE-SCREENED IN ACCORDANCE WITH REQUIREMENTS, BY AN INDEPENDENT SPAR APPROVED TESTING FACILITY. DPA IS PERFORMED AS REQUIRED BY PA.003 ON A RANDOMLY SELECTED 5% OF PARTS, MAXIMUM 5 PIECES, MINIMUM 3 PIECES FOR EACH LOT NUMBER/DATE CODE OF PARTS RECEIVED. WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-81381 AND INSPECTED AND TESTED TO NASA JSCM8080 STANDARD NUMBER 95A. RECEIVING INSPECTION VERIFIES THAT ALL PARTS RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED TO PARTS DURING SHIPMENT, THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION AND SCREENING DATA CLEARLY IDENTIFIES ACCEPTABLE PARTS. PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE, COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA NHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 08800A. PRIOR TO POTTING, THE SOLDERED CONTACTS OF THE FUSE ASSEMBLY ARE SUBJECTED TO RADIOGRAPHIC INSPECTION TO CHECK FOR POROSITY AND INTERNAL FLAWS. PRE AND POST POTTING INSPECTIONS TO SPAR-1TP 257 VERIFY VOLTAGE DROP (RESISTANCE) AT HIGH AND LOW TEMPERATURE (-38 DEGREES C AND +118 DEGREES C) (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT). FUSES ARE ACCEPTANCE TESTED TO SPAR-1TP 257 WHICH INCLUDES AMBIENT TESTING AND THERMAL CYCLING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT). PRIOR TO MATING FUSE PLUG WITH RECEPTICLE ON SHOULDER CONNECTOR BOX, INSPECTIONS INCLUDE VISUAL, CLEANLINESS, WORKMANSHIP, IDENTIFICATION, CHECK FOR BENT OR PUSHED BACK CONTACTS ETC. JOINT LEVEL PRE-ACCEPTANCE TEST INSPECTION, INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC.

PREPARED BY: MFWG
SUPERCEDING DATE: 28 OCT 86
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CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SHOULDER
SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1219
SHEET: 4

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
4630	2	SHOULDER FUSING. 45 PRIME CHANNEL FUSES. 16 BACK-UP CHANNEL FUSES. WIRING SCHEMATIC 51140E316 REVISION C.	MODE: LOSS OF POWER FLAG FUSE. CAUSE(S): (1) MECHANICAL SHOCK VIBRATION, MATERIALS. (FUSE 23).	K1 AND K2 D&C RELAYS OPEN. BRAKES COME ON. MCIU WILL NOT SEND DATA TO ABE. ARM WILL STOP. ALL PRIME MODES LOST. HARDWIRED SAFING. EE PRIME MODES LOST. IF CAPTURING PAYLOAD, INCOMPLETE RIGIDIZE. GPC IN TEMP MONITORING MODE. WORST CASE ---------- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING ---------- BACKUP EE RELEASE.	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). JOINT LEVEL ACCEPTANCE TESTING (ATP) INCLUDES AMBINET, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - 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)

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SUPERCEDING DATE: 28 OCT 86
DATE: 24 JUL 91
CIL REV: 2

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SHOU

SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1219
SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	MOD... ...NALE FOR ACCEPTANCE CRITICALITY SCREENS: A-PASS, B-PASS, C-PASS
4630	2	SHOULDER FUSING. 45 PRIME CHANNEL FUSES. 16 BACK-UP CHANNEL FUSES. WIRING SCHEMATIC 51140E316 REVISION C.	MODE: LOSS OF POWER FLAG FUSE. CAUSE(S): (1) MECHANICAL SHOCK VIBRATION, MATERIALS. (FUSE 23).	K1 AND K2 D&C RELAYS OPEN. BRAKES COME ON. MCIU WILL NOT SEND DATA TO ABE. ARM WILL STOP. ALL PRIME MODES LOST. HARDWIRED SAFING. EE PRIME MODES LOST. IF CAPTURING PAYLOAD, INCOMPLETE RIGIDIZE. GPC IN TEMP MONITORING MODE. WORST CASE --- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- BACKUP EE RELEASE.	FAILURE HISTORY --- THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT: FAR 2114: S/N 202 JUL 80 DESCRIPTION --- HIGH RESISTANCE FOLLOWING THERMAL CYCLING CAUSED BY MFG. DEFECT. CORRECTIVE ACTION --- MFG TO IMPLEMENT THERMAL TESTING. (FMEA NO. 4590, 4670) FAR 2120: S/N 201 JAN 81 DESCRIPTION --- HIGH RESISTANCE, MFG DEFECT. REFER TO FAR 2114. OUT-PUT DID NOT SWITCH, FOLLOWING HUMIDITY TEST, DUE TO SHORTED LED CORRECTIVE ACTION --- REFER TO FAR 2114 (FMEA NO.4590, 4670) REPLACED LED. FAR 2358: S/N 302 MAY 83 DESCRIPTION --- FUSE FAILED OPEN, CAUSED BY DAMAGED SOLDER CONN DURING REWORK. CORRECTIVE ACTION --- SCRAPPED REWORKED PUSES. ECN S1130 MODIFIED TESTING. (FMEA NO. 4590, 4670) FAR 2370: S/N 304 NOV 83 DESCRIPTION --- VOLTAGE DROP EXCESSIVE, CAUSE DESIGN/MANUFACTURING FAULT. CORRECTIVE ACTION --- SCRAPPED ALL FUSES, PREPARED NEW FUSE SPEC. (FMEA NO. 4590, 4670)

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CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SHOULDER
SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1219
SHEET: 6

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
4630	2	SHOULDER FUSING. 45 PRIME CHANNEL FUSES. 16 BACK-UP CHANNEL FUSES. WIRING SCHEMATIC 51140E316 REVISION C.	MODE: LOSS OF POWER FLAG FUSE. CAUSE(S): (1) MECHANICAL SHOCK VIBRATION, MATERIALS. (FUSE 23).	K1 AND K2 D&C RELAYS OPEN. BRAKES COME ON. MCIU WILL NOT SEND DATA TO ABE. ARM WILL STOP. ALL PRIME MODES LOST. HARDWIRED SAFING. EE PRIME MODES LOST. IF CAPTURING PAYLOAD, INCOMPLETE RIGIDIZE. GPC IN TEMP MONITORING MODE. WORST CASE --- UNEXPECTED PAYLOAD MOTION. INCOMPLETE CAPTURE/RELEASE SEQUENCE. UNABLE TO RELEASE PAYLOAD. CREW ACTION REQUIRED. REDUNDANT PATHS REMAINING --- BACKUP EE RELEASE.	OPERATIONAL EFFECTS --- ALL ARM OPERATIONS STOP. IF PAYLOAD IS BEING CAPTURE, UNEXPECTED PAYLOAD MOTION COULD OCCUR. CREW ACTION --- SELECT BACKUP TO RELEASE PAYLOAD. CREW TRAINING --- CREW WILL BE TRAINED TO MANEUVER ORBITER AWAY FROM FREE FLYING PAYLOAD AT ANY TIME DURING ARM OPERATIONS. MISSION CONTRAINT --- WHEN CAPTURING A FREE FLYING PAYLOAD THE EE MUST BE FAR ENOUGH AWAY FROM STRUCTURE TO PROHIBIT CONTACT REGARDLESS OF PAYLOAD ROTATIONS. OMRSD OFFLINE --- VERIFY POWER FLAG WHEN ARM SELECTED. OMRSD ONLINE INSTALLATION --- NONE OMRSD ONLINE TURNAROUND --- VERIFY POWER FLAG WHEN ARM SELECTED.

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