## CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: MECHANICAL ARM
SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1565
SHEET: 1

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY | RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|---|
| 3990 | 0 | TYPICAL JOINT (MECHANICAL) QTY-3 SHOULDER (1) P/N 51140J1219 ELBOW (1) P/N 51140E711 WRIST (1) P/N 51140J754 | MODE: LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S): (1) HOUSING FAILURE, SEIZED OR JAMMED. (2) BEARING SEIZED. (3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>.....<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>.....<br>N/A | | DESIGN FEATURES<br>.....<br><br>MATERIALS SELECTION AND USAGE CONFORMS TO SPAR-SG.368 WHICH IS EQUIVALENT TO THE NASA MATERIALS USAGE REQUIREMENTS.<br><br>THE SHOULDER AND ELBOW JOINTS ARE STIFFNESS DESIGNED. THE WRIST JOINT IS STRENGTH DESIGNED. THE STRUCTURAL ANALYSIS PERFORMED ON ALL THREE JOINTS IS CONSERVATIVE WITH ALL MARGINS OF SAFETY BEING POSITIVE. REF. STRUCTURAL ANALYSIS OF SRMS SPAR-TN.1531 AND SPAR-R.646. ALL ITEMS OF THE JOINT STRUCTURE HAVE BEEN INSPECTED FOR CRACKS, WHERE THE LIFE ANALYSIS HAS CALLED FOR A SPECIAL INSPECTION, THIS HAS BEEN PERFORMED AND WHERE NECESSARY ALL CRACK LIKE INDICATIONS HAVE BEEN REMOVED.<br><br>THE FRACTURE ANALYSIS, WHICH ASSUMES AN INITIAL CRACK LENGTH OF .05 INCHES TO .15 INCHES, .75 OF THE JOINT COMPONENTS SHOW THAT ALL ITEMS ARE CAPABLE OF PERFORMING OVER 400 MISSIONS WITHOUT COMPLETE FAILURE. FRACTURE ANALYSES ARE CONTAINED IN SPAR-TN.1531 AND SPAR-R.646.<br><br>THE BEARINGS ARE PROCURED BY SPAR AND MEET, OR EXCEED THE REQUIREMENTS OF SPECIFICATION SPAR-SG.393.<br><br>THE BEARING ANALYSIS USES ULTIMATE LOADS TO DETERMINE THE MARGINS OF SAFETY OF THE LUBRICANT. THE FACTOR BETWEEN WORKING LOADS AND ULTIMATE IS 1.4. THE LUBRICANT FAILURE STRESSES ARE LOWER THAN THE BRINELLING STRESS. LIFE FOR ALL BEARINGS IS GREATER THAN 400 MISSIONS BASED UPON THE ABOVE CRITERIA.<br><br>THE ALLOWABLE CONTACT STRESS FOR THE LUBRICANT IS ABOUT 1/5TH THE ALLOWABLE CONTACT STRESS FOR THE BEARING, THEREFORE THE LUBRICANT PROPERTIES DICTATE THE DESIGN, THE BEARINGS AS A RESULT ARE LIGHTLY LOADED AND SURFACE FATIGUE IN THE BEARING MATERIAL IS NOT A VIABLE FAILURE MODE.<br><br>THE MAIN BEARINGS ROTATIONAL VELOCITY IS LOW AND HENCE LIFE IS MUCH GREATER THAN FOR THOSE BEARINGS ROTATING AT HIGH SPEEDS. SEIZURE AND STRUCTURAL FAILURE OF THE BEARING ELEMENTS IS HIGHLY UNLIKELY.<br><br>THE SOLID FILM LUBRICANT SYSTEM USED IS LUBECO 905. THIS COMPRISES A SPRAY AND CURE (400 DEGREES F) APPLICATION OF MOLYDENUM DISULPHIDE, IN AN IN ORGANIC BINDER APPLIED PER PPS:28:11 AND 28:13. BURNISHING AND RUN IN PER SPAR PPS 28:14. THE LUBRICATED BEARING IS TORQUE TRACED TO ENSURE ACCEPTABILITY PER SPAR PPS.28:14.<br><br>THE LIFE OF THE BEARING LUBRICATION HAS BEEN ANALYZED USING ULTIMATE LOADS TO EVALUATE HERTZIAN STRESSES. ULTIMATE LOAD = 1.4 X WORKING LOAD. THE LUBRICANT ON ALL BEARINGS IS GOOD FOR OVER 400 MISSIONS USING THE ULTIMATE LOADS.<br><br>ALL SRMS GEARS ARE DESIGNATED IN ACCORDANCE WITH AGMA STANDARDS TO GIVE A MINIMUM OF INFINITE LIFE. THE DEFINITION OF INFINITE LIFE IS THE CONDITION WHERE 10**7 MESH CYCLES OR MORE AT THE APPLIED LOAD WILL NOT RESULT IN TOOTH FAILURE.<br><br>THE APPLIED LOADS DERIVED FOR THIS (THESE) GEAR (S) WERE |

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SUPERCEDING DATE: 11 SEP 86
APPROVED BY:

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SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1565
SHEET: 2

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY | RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|---|
| 3990 | D | TYPICAL JOINT (MECHANICAL) QTY-3 SHOULDER (1) P/N 51140J1219 ELBOW (1) P/N 51140E711 WRIST (1) P/N 51140J754 | MODE: LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S): (1) HOUSING FAILURE, SEIZED OR JAMMED. (2) BEARING SEIZED. (3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>----------<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>----------<br>N/A | | CATERED TO IN THE SIZING OF THE GEAR MESH. THE MATERIAL ALLOWABLES WERE DERATED BY SPAR AS CONSISTENT FOR FINE PITCH GEARING APPLIED TO POWER TRANSMISSIONS. THE RESULTING MESH DESIGN WAS CHECKED AGAINST THE INFINITE LIFE CRITERIA. |

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PROJECT: SRMS
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SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1565
SHEET: 3

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY | RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|---|
| 3990 | 0 | TYPICAL JOINT (MECHANICAL) QTY-3<br>SHOULDER (1) P/N 51140J1219<br>ELBOW (1) P/N 51140E711<br>WRIST (1) P/N 51140J754 | MODE:<br>LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S):<br>(1) HOUSING FAILURE, SEIZED OR JAMMED.<br>(2) BEARING SEIZED.<br>(3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>---<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>---<br>N/A | | ACCEPTANCE TESIS<br>---<br>THE SHOULDER, ELBOW AND WRIST JOINTS ARE SUBJECTED TO THE FOLLOWING ACCEPTANCE ENVIRONMENTAL TESTING.<br><br>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLES 9, 10 AND 11.<br><br>O THERMAL: +70 DEGREES C TO -25 DEGREES C (2 CYCLES) 1 X 10**6 TORR.<br><br>THE JOINTS ARE INTEGRATED INTO THE RMS SYSTEM (PER TP532) WHICH IS FURTHER TESTED IN (1P518 RMS STRONGBACK AND TP552 FLAT FLOOR). THESE TESTS VERIFIES THE ABSENCE OF THE FAILURE MODE.<br><br>QUALIFICATION TESTS<br>---<br>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.<br><br>O VIBRATION: LEVEL AND DURATION REFERENCE TABLES 9 AND 10<br><br>O SHOCK: 20G/11 MS - 3 AXES ( 6 DIRECTIONS)<br><br>O THERMAL VACUUM: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1 X 10**6 TORR.<br><br>O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TESTS CE01, CE03, CS01, CS02, CS06, RE02 (N/B).<br><br>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.<br><br>O LOAD TEST: SHOULDER JOINT STRUCTURAL LOAD TEST REFERENCE TABLE 12.<br><br>NOTE:<br><br>ELBOW JOINT (S/N 302 AND UP) INCORPORATES NON-WELDED TRANSITIONS WHICH WAS LOAD TESTED TO LOAD IN REFERENCE TABLE TBS.<br><br>FLIGHT CHECKOUT<br>---<br>PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987 |

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SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1565
SHEET: 4

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY — RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|
| 3990 | 0 | TYPICAL JOINT (MECHANICAL) QTY-3<br>SHOULDER (1) P/N 51140J1219<br>ELBOW (1) P/N 51140E711<br>WRIST (1) P/N 51140J754 | MODE:<br>LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S):<br>(1) HOUSING FAILURE, SEIZED OR JAMMED.<br>(2) BEARING SEIZED.<br>(3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>---<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>---<br>N/A | QA/INSPECTIONS<br>---<br><br>JOINTS ARE MANUFACTURED, ASSEMBLED AND TESTED UNDER DOCUMENTED QUALITY CONTROLS TO SPAR AND CUSTOMER REQUIREMENTS. THESE CONTROLS ARE EXERCISED THROUGHOUT DESIGN PROCUREMENT, PLANNING, PROCESSING, FABRICATION, ASSEMBLY AND TESTING OF JOINTS.<br><br>SPAR/GOVERNMENT REPRESENTATIVE MANDATORY INSPECTION POINTS ARE ENVOKED AT ALL LEVELS OF ASSEMBLY AND TEST.<br><br>RECEIVING INSPECTION VERIFIES THAT PARTS, I.E. JOINT HOUSINGS AND BEARINGS RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED IN SHIPMENT AND THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION.<br><br>CARPENTER 455 STEEL USED FOR THE MANUFACTURE OF (E.G. GEARS) RECEIVES ADDITIONAL LABORATORY INSPECTIONS WHICH INCLUDE CHEMICAL ANALYSIS, INCLUSION RATING, HARDNESS AND TENSILE TESTING TO VERIFY THE PROPERTIES OF THE MATERIAL SUPPLIED.<br><br>BEARINGS RECEIVE DIMENSIONAL INSPECTION AT THE SUPPLIER AND VERIFICATION BY SPAR RECEIVING INSPECTION. PRE-ASSEMBLY INSPECTION VERIFIES CIRCULARITY OF BALL TRACKS AND INNER/OUTER RACE DIAMETERS. AFTER ASSEMBLY PRIOR TO LUBRICATION, RADIAL CLEARANCE MEASUREMENTS ARE TAKEN. FOLLOWING LUBRICATION, RUN-IN/BURNISHING AND CLEANING OF DRY LUBE BEARINGS, SPECIALIZED BEARING INSPECTION EQUIPMENT AT SPAR IS USED TO VERIFY QUALITY AND STICTION LEVELS THROUGH STRIP CHART RECORDING OF TORQUE TRACES. BEARINGS ARE THEN RETURNED TO THE SUPPLIER FOR FINAL RADIAL CLEARANCE MEASUREMENTS. GOVERNMENT SOURCE INSPECTION IS ENVOKED ON ALL BEARING PROCUREMENTS.<br><br>POST MACHINING INSPECTION OF THE HOUSING VERIFIES DIMENSIONAL MANUFACTURE TO DRAWING USING CONVENTIONAL MEASURING TECHNIQUES AND A COMPUTERIZED COORDINATE CHECKER.<br><br>FOLLOWING HEAT TREATMENT, STEEL PARTS (E.G. GEARS) ARE SUBJECTED TO A MAGNETIC PARTICLE INSPECTION FOR CRACKS OR IN THE CASE OF ALUMINUM PARTS (E.G. HOUSINGS) ARE DYE PENETRANT INSPECTED USING GROUP V PENETRANTS. WELDING OF GEARS OR HOUSINGS IS SUBJECTED TO DYE PENETRANT (GROUP V) AND RADIOGRAPHIC INSPECTION ON COMPLETION OF STRESS RELIEF TO CHECK FOR CRACKS. QUALIFICATION WELDING TEST SAMPLES FOR STRUCTURAL WELDS ARE SUBJECTED TO DESTRUCTIVE TESTING WHERE POSSIBLE (TENSILE AND BENDING) AS WELL AS METALLAGRAPHIC ANALYSIS TO ENSURE DEFECT FREE WELDS.<br><br>INSPECTION VERIFIES THAT KITTED PARTS ARE CORRECT PRIOR TO ASSEMBLY AND TRACEABILITY INFORMATION RECORDED.<br><br>INSPECTION TO DRAWING IS CONDUCTED THROUGHOUT THE ASSEMBLY PROCESS, INCLUDING INSPECTION OF LOCKING, WITNESSING OF TORQUING AND APPLICATION OF TORQUE STRIPING. |

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# CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: MECHANICAL ARM
SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51150J1585
SHEET: 5

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY | RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|---|
| 3990 | 0 | TYPICAL JOINT (MECHANICAL) QTY-3<br>SHOULDER (1)<br>P/N 51140J1219<br>ELBOW (1)<br>P/N 51140E711<br>WRIST (1)<br>P/N 51140J754 | MODE:<br>LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S):<br>(1) HOUSING FAILURE, SEIZED OR JAMMED.<br>(2) BEARING SEIZED.<br>(3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>----------<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>----------<br>N/A | | JOD LEVEL PRE-ACCEPTANCE TEST INSPECTION INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)<br><br>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).<br><br>JOD LEVEL AMBIENT ACCEPTANCE TESTING (ATP) CONSIST OF CURRENT SIGNATURE AND LIMIT STOP LOAD TEST, JOINT RATE, JOINT ANGULAR TRAVEL AND FORWARD DRIVE THRESHOLD OF MOVEMENT TESTS. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)<br><br>JOINT LEVEL PRE-ACCEPTANCE TEST INSPECTION, INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC.<br><br>JOINT LEVEL ACCEPTANCE TESTING (ATP) INCLUDES AMBINET, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).<br><br>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.<br><br>SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT) |

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SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1565
SHEET: 6

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY — RATIONALE FOR ACCEPTANCE |
|---|---|---|---|---|---|
| 3990 | 0 | TYPICAL JOINT (MECHANICAL) QTY-3<br>SHOULDER (1)<br>P/N 51140J1219<br>ELBOW (1)<br>P/N 51140E711<br>WRIST (1)<br>P/N 51140J754 | MODE:<br>LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S):<br>(1) HOUSING FAILURE, SEIZED OR JAMMED.<br>(2) BEARING SEIZED.<br>(3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>---<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>---<br>N/A | FAILURE HISTORY<br>---<br><br>THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT:<br><br>FAR 2110:<br>S/N 201 JUN 80<br><br>DESCRIPTION<br>---<br>FAILED BACKDRIVE FRICTION, ROLL JOINT DUE TO:INADEQUATE CLEARANCE (AXIAL) FOR PLANETARY GEARS TO OPERATE, DRY LUBE DEBRIS IN OUT-PUT BEARING, IMPACTED DRY LUBE IN GEAR TOOTH SPACES.<br><br>CORRECTIVE ACTION<br>---<br>ECN'S 511402912 TO 2922 TO MODIFY DESIGN TO CORRECT FAULTS.<br><br>FAR 2113:<br>S/N 201 AUG 80<br><br>DESCRIPTION<br>---<br>PITCH JOINT FAILED TO DRIVE. FOUND PLASTIC BAG IN GEAR BOX<br><br>CORRECTIVE ACTION<br>---<br>STRIPPED/CLEANED<br><br>FAR 2317:<br>S/N 301 APR 82<br><br>DESCRIPTION<br>---<br>FAILED TO BREAK-OUT, WIRE DEBRIS JAMMED MOTOR.<br><br>CORRECTIVE ACTION<br>---<br>IMPROVED CLEANINESS REWORKED M/M<br><br>FAR 2324:<br>S/N 301 JUN 82<br><br>DESCRIPTION<br>---<br>PITCH JOINT FAILED TO DRIVE, BRAKE BEARING INSTALLED BACKWARK DESIGN TOLERANCE ON PINION GEAR.<br><br>CORRECTIVE ACTION<br>---<br>CORRECTS TOLERANCE ON PINION. REPLACE BRAKE INSPECTED ALL BRAKE BEARING. |

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SYSTEM: MECHANICAL ARM SUBSYSTEM
ASS'Y P/N: 51140J1565
SHEET: 7

| FMEA REF. | REV. | NAME, QTY, & DRAWING REF. DESIGNATION | FAILURE MODE AND CAUSE | FAILURE EFFECT ON END ITEM | HOUR / FUNC. 1/1 CRITICALITY — RATIONALE FOR ACCEPTANCE |
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| 3990 | D | TYPICAL JOINT (MECHANICAL) QTY-3<br>SHOULDER (1) P/N 51140J1219<br>ELBOW (1) P/N 51140E711<br>WRIST (1) P/N 51140J754 | MODE:<br>LOSS OF JOINT MOVEMENT.<br><br>CAUSE(S):<br>(1) HOUSING FAILURE, SEIZED OR JAMMED.<br>(2) BEARING SEIZED.<br>(3) GEAR FRACTURED OR JAMMED. | LOSS OF MOVEMENT OF JOINT (FROZEN). ARM WILL TAKE AN UNEXPECTED TRAJECTORY.<br><br>WORST CASE<br>UNEXPECTED MOTION. FROZEN JOINT. UNANNUNCIATED. CREW ACTION REQ.<br><br>REDUNDANT PATHS REMAINING<br>N/A | OPERATIONAL EFFECTS<br>ONE JOINT STOPS. ARM DOES NOT RESPOND PROPERLY TO COMMANDS. FOR HAND CONTROLLER COMMANDS CREW INHERENTLY COMPENSATE FOR ANY UNDESIRED TRAJECTORIES.<br><br>CREW ACTION<br>APPLY BRAKES. USE SINGLE MODE ON OTHER JOINTS TO POSITION ARM FOR JETTISON.<br><br>CREW TRAINING<br>THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.<br><br>MISSION CONSTRAINT<br>OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. AUTO TRAJECTORIES MUST BE DESIGNED TO COME NO CLOSER THAN 5 FT FROM STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS. ARM SHOULD NOT BE MANEUVERED TO POSITION WHERE JETTISON CANNOT BE SAFETY PERFORMED.<br><br>SCREEN FAILURES<br>N/A<br><br>OMRSD OFFLINE<br>IN DIRECT DRIVE WITH ELBOW DENATED VERIFY RATES FOR ALL JOINTS<br><br>OMRSD ONLINE INSTALLATION<br>NONE<br><br>OMRSD ONLINE TURNAROUND<br>NONE |

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