

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE												
UPPER ARM ASSEMBLY, ITEM 103 ----- 0103-212113-05/08 (2)	2/1RB	103FM08Z  Loss of primary and secondary bracket retention screws, upper.  Defective material. Screws, helicoils or thread lock adhesive.	END ITEM: One of two screws missing on one side of primary bracket.  GFE INTERFACE: Load is transferred to second screw.  MISSION: None for single failure.  CREW/VEHICLE: None with loss of one primary bracket screw. Loss of crewman with loss of second primary bracket screw on same side of bracket, causing loss of primary and secondary restraint brackets.  TIME TO EFFECT /ACTIONS: Minutes.	A. Design - The primary and secondary axial restraint brackets are installed with a single set of four screws fabricated from A-286 stainless steel and are procured to MS or NAS specifications. Loss of bracket screws is precluded in design by adherence to standard engineering torque requirements for screw installation and the use of thread lock adhesive.  Design requirements for proper installation of the helicoils are specified in the assembly procedures when helicoils are installed in the dual seal arm bearing.  With one of four screws missing, testing has demonstrated that the bracket system exhibits a minimum strength of 1000 lbs. at 4.4 psid. This load results in a minimum ultimate safety factor of 3.5 against a S/AD limit load of 288 lbs. At 5.5 psid (max failure pressure) and 8.8 psid (max BTA operating pressure), the minimum ultimate safety factors are 3.4 and 3.4 respectively. The S/AD minimum ultimate safety factor requirement for hardware is 2.0 at 4.4 psid, 1.5 at both 5.5 psid and 8.8 psid.  B. Test - Acceptance - The arm bearing assembly is acceptance tested per A/L ATP 10209.  PDA - The following test is conducted at the arm assembly level in accordance with ILC Document 0111-710112: 1. Proof pressure test at 8.0 + 0.2 - 0.0 psig for a minimum of 5 minutes conducted with the TMG removed.  Certification - The arm bearing primary and secondary axial restraint brackets were successfully tested (manned) during SSA certification to duplicate 458 hours operational life (Ref. ILC Report 0111-711330). The following usage, reflecting requirements of significance to the arm bearing primary and secondary brackets, was documented during certification:  <table border="1"> <thead> <tr> <th>Requirement</th> <th>S/AD</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>Elbow Cycles</td> <td>49660</td> <td>102000</td> </tr> <tr> <td>Don/Doff Cycles</td> <td>98</td> <td>400</td> </tr> <tr> <td>Pressure Hours</td> <td>458</td> <td>916</td> </tr> </tbody> </table>	Requirement	S/AD	Actual	Elbow Cycles	49660	102000	Don/Doff Cycles	98	400	Pressure Hours	458	916
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		REDUNDANCY SCREENS: A-PASS B-FAIL C-PASS		C. Inspection - Components and material manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming												

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		103FM08Z		<p>receiving inspection verifies that the hardware received is as identified in the procurement documents, that no damage has occurred during shipment and that supplier certifications have been received which provide traceability information.</p> <p>The following MIPs are performed during the arm assembly manufacturing process to assure that the failure causes are precluded from the fabricated item:</p> <ol style="list-style-type: none"><li>1. Verification of loctite application.</li><li>2. Verification of presence of screws during torquing operations.</li><li>3. Helicoil installation is verified during source inspection at the supplier.</li><li>4. Verification of minimum engagement of 4 1/2 screw threads during screw thread engagement procedures.</li></ol> <p>During PDA, the following inspection points are performed at the arm assembly level in accordance with ILC Document 0111-710112:</p> <ol style="list-style-type: none"><li>1. Inspection for cleanliness to VC level, damage, wear and material degradation.</li><li>2. Verify, by visual inspection, no structural damage following proof pressure test.</li></ol> <p>D. Failure History - None.</p> <p>E. Ground Turnaround - None for every component which is within its limited life requirements.</p> <p>Also, every 4 years chronological time or 229 hours of manned pressurized time, during arm bearing maintenance, the primary and secondary restraint brackets are removed and reinstalled during which time loctite application and screw torque are verified.</p> <p>F. Operational Use - Crew Response - Pre EVA: No response. Single failure not detectable. EVA: No response. Single failure not detectable.</p> <p>Training - No EMU training specifically covers this failure mode.</p> <p>Operational Considerations - Not applicable.</p>

EXTRAVEHICULAR MOBILITY UNIT  
SYSTEMS SAFETY REVIEW PANEL REVIEW  
FOR THE  
I-103 ARM ASSEMBLY  
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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