

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE												
UPPER ARM ASSEMBLY, ITEM 103 ----- 0103-212113-05/08 (2)	2/1R	103FM08 Loss of primary axial restraint bracket, upper. Defective material: bracket pin, missing or loose pin.	END ITEM: Loss of primary axial restraint. GFE INTERFACE: Axial load will be transferred to secondary restraint. MISSION: None. CREW/VEHICLE: None with single failure. Loss of crewman with loss of secondary restraint. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Days.	A. Design - The upper arm bearing primary bracket is fabricated from 17-4 stainless steel bar stock. The brackets and primary restraint pins are machined, ultrasonic cleaned, passivated and either electropolished or dry hone finished. Analysis of the primary bracket has shown a minimum ultimate strength of 2022 lbs and a yield strength of 1833 lbs. At 4.4 psid (normal operating pressure), the S/AD limit load is 288 lbs, giving the bracket a safety factor of 7.0 for ultimate and 6.4 for yield. At 5.5 psid (max failure pressure) and 8.8 psid (max BTA operating pressure) the bracket provides safety factors for ultimate of 7.0 and 6.9 against limit loads of 290 lbs and 295 lbs respectively. The S/AD minimum safety factor for hardware at 4.4 psid is 2.0 for ultimate and 1.5 for yield. At both 5.5 psid and 8.8 psid, the S/AD minimum safety factor for hardware is 1.5 for ultimate. B. Test - Acceptance - Component - See Inspection. PDA - The following tests are conducted at Arm Assembly level in accordance with ILC Document 0111-710112: 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 brackets were successfully tested (manned) during SSA certification to duplicate 458 hours operational usage (Ref. ILC Report 0111-711330). The following usage, reflecting requirements of significance to the arm bearing primary bracket, 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> REUNDANCY SCREENS: A-PASS B-N/A C-PASS The arm bearing upper primary restraint brackets were successfully subjected to an ultimate pressure of 13.2 psid during SSA certification testing (Ref. ILC Report 0111-711330). This is 1.5 times maximum BTA operating pressure based on 8.8 psid. C. Inspection - Components and material manufactured to ILC requirements at an Approved Supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the hardware received are as identified in the procurement documents, that no damage has occurred during shipment and that supplier certifications have been received which provide traceability information. During PDA, the following inspection points are performed at the arm assembly level in accordance with ILC Document 0111-710112:	Requirement	S/AD	Actual	Elbow Cycles	49660	102000	Don/Doff Cycles	98	400	Pressure Hours	458	916
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		103FM08		<p>Visual inspection for damage, wear or material degradation. Visual inspection for structural damage to the primary restraint bracket after proof pressure test.</p> <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 or 229 hours of manned pressurized time the arm restraint and bladder assemblies are removed from the arm assembly and subjected to a complete visual inspection (interior and exterior surfaces) for material damage and degradation.</p> <p>F. Operational Use - Crew Response - Pre EVA: No response. Single failure is not likely to be detected. If problem detected tactually or audibly, trouble shoot. If no success, consider 3rd EMU if available. Otherwise terminate EVA prep. EVA: No response. Single failure undetectable by crew. Continue EVA. Training - No training specifically covers this failure mode. 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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