NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		103FM12		
FABRIC ATTACHMENT RING ITEM 103 (1) LEFT (1) RIGHT ---------- 10145-05 (2)	2/1RB	Loss of primary cam bracket and secondary bracket retention screws. Defective Material; Screw, helicoil or thread lock adhesive.	END ITEM: One of two screws missing on one side of bracket. GFE INTERFACE: Load is transferred to second screw. MISSION: None for single failure. CREW/VEHICLE: None with single failure. Loss of crewman with loss of second screw on same side of bracket and primary and secondary restraint brackets. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Days. REDUNDANCY SCREENS: A-PASS B-FAIL C-PASS	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 the brackets 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 helicoils are specified in the assembly procedures when the helicoils are installed. With one of the four screws missing, testing has demonstrated that the bracket system exhibited a minimum strength of 1540 lbs. At 4.4 psid (normal operating pressure), this load results in a minimum ultimate safety factor of 7.0 against a S/AD load of 219 lbs. At 5.5 psid (max. failure pressure) and 8.8 psid (max. BTA operating pressure) the minimum ultimate safety factors are 7.5 and 9.7 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 - PDA Test - The following test is conducted at the 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 Test - The Fabric Attachment Ring (FAR) primary and secondary 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 FAR primary and secondary brackets, was documented during certification: Requirement / S/AD / Actual Shoulder Rotations 29348 60000 Elbow Cycles 49660 102000 Engage/Disengage 300 800 Don/Doff 98 400 Pressure Hours 458 916 The fabric Attachment Ring lower primary secondary axial restraint brackets were successfully subjected to an ultimate pressure of 13.2 psig during SSA certification (Ref. Document 0111-711330). This is 1.5 times maximum BTA operating pressure based on 8.8 psi. The baseline arm assembly has passed shock, vibration and acceleration testing without loss of screw torque (Ref. Hamilton Standard Test Reports, TER 3067, 3048, 3043 and 3076). The enhanced arm is certified by similarity to the baseline arm assembly. C. Inspection - Components and material manufactured to ILC requirements at an approved supplier are documented from precurement through shipping by the supplier. ILC incoming

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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.

The bracket casting are radiographically inspected to detect the presence of flaws prior to machining and magnetic particle inpsected after machining. Brackets machined from bar stock are magnetic particle inspected to detect the presence of flaws.

The following MIPs are performed during the arm assembly manufacturing process to assure that the failure causes are precluded from the fabricated item:

1. Verification of loctite application.

2. Helicoil installation is verified during source inspection at the supplier.

3. Verification of minimum engagement of 4 1/2 screw threads during screw thread engagement procedures prior to torquing and thread locking assembly operation of the primary restraint bracket.

During PDA
The following inspection points are performed at the arm assembly level in accordance with ILC document 0111-710112:
1. Visual inspection for structural damage to the primary restraint bracket after proof pressure test.
2. Inspect for cleanliness to VC level, damage, wear and material degradation.

D. Failure History -
None.

E. Ground Turnaround -
None for every component which is within its limited life requirements.

Also, every 4 years 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.

F. Operational Use -
Crew Response -
Pre EVA: No response, single failure undetectable by crew. Continue EVA prep.
EVA: No response, single failure undetectable by crew. Continue EVA.
Special Training - No training specifically covers this failure mode.
Operational Considerations - Not applicable.

EXTRAVEHICULAR MOBILITY UNIT

SYSTEMS SAFETY REVIEW PANEL REVIEW

FOR THE

I-103 ARM ASSEMBLY

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: _____
HS - Project Engineering

Approved by: _____
NASA - SSA/SSM

_____
HS - Reliability

_____
NASA - EMU/SSM

_____ 4/24/02
HS - Engineering Manager

_____ 6/26/02
NASA - S&MA

_____ 6/27/02
NASA - MOD

_____ 7/1/02
NASA - Crew

_____ 7-1-02
NASA - Program Manager