NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		103FM09Z		
DUAL SEAL ARM BEARING ITEM 103 (1) LEFT (1) RIGHT ---------- 10209-04 ()	2/1R	Arm Bearing Seal gas leakage. Contamination wear or deterioration of the pressure seals. Inadequate seal squeeze.	END ITEM: None for single failure, for dual seal failure suit gas leakage to ambient. GFE INTERFACE: None for single failure. For dual seal failure depletion of primary O2 supply and SOP. Rapid depressurizatio n of SSA beyond SOP makeup capability. MISSION: None for single failure. CREW/VEHICLE: None for single failure. Loss of crewman with loss of primary and secondary seals. TIME TO EFFECT /ACTIONS: Seconds. TIME AVAILABLE: Minutes. TIME REQUIRED: Immediate. REDUNDANCY SCREENS: A-PASS	A. Design - Contamination is precluded from entering the arm bearing assembly by two teflon environmental seals, one on each side of the bearing assembly. These seals fit into mating grooves in the inner and outer races and form a barrier to preclude introduction of contamination into the pressure seals and ball raceway areas. The pressure seals are made from polyester polyurethane and are lightly lubricated with Brayco 814Z oil to preclude wear. Vespel balls act as a ball separator/spacers. Each seal cross section provides minimum of .014 inch seal squeeze to maintain positive operatinal presure. When pressurized, the seals expand to seal firmly against the bearing races to ensure a maximum bearing leak of 4.0 sccm and a torque that will not exceed 15.0 in-lbs. B. Test - Acceptance: The arm bearing is subjected to testing per Airlock ATP 10209 at Airlock with ILC source verification. The primary and secondary seals are proof pressure tested with the bearing in the test fixture. The fixture is pressurized to 8.0 (+0.2-0.0) psig and held for 5 minutes. Following proof pressure testing, the bearing is pressurized to 4.3 +/- 0.1 psig, testing the primary and secondary seals separately, and subjected to cycle rotation. Leakage is verified to be less than 4.0 scc/min. Testing both seals separately, torque is verified to be less than 15.0 in-lbs. PDA: The following tests are conducted at the Arm Bearing level in accordance with ILC Document 0111-710112: 1. Initial lak test at 4.3 +/- 0.1 psig to verify leakage less than 4.0 scc/min. 2. Proof pressure test at 8.8 + 2.0 - 0.0 psig to verify no structural damage. 3. Post-proof pressure leak test at 4.3 +/- 0.1 psig to verify leakage less than 4.0 scc/min. 4. Final leak test at 4.3 +/- 0.1 psig to verify leakage less than 4.0 scc/min. 5. Arm bearing (in arm assembly) torque to be less than 15.0 in-lbs at 4.3 +/- 0.1 psig which is an indication that the pressure seals are acceptable. Certification: The dual seal arm bearing successfully passed SSA certification testing (manned) to duplicate 458 hours of operational usage (Ref. ILC Report 0111-711330). The following usage, reflecting requirements of significance to the dual seal arm bearings, was documented during certification. Requirement / S/AD / Actual Shoulder Rotation: 29348 / 30000* Don/Doff Cycles: 98 / 400 Pressure Hours: 458 / 916 * The "actuals" reflect the stainles steel arm bearing rotations applicable to this failure mode (Ref. ILC Report 0111-711529). The arm bearing primary and secondary axial restraint brackets were successfully subjected to an ultimate pressure of 13.2 psi during SSA certification (Ref. ILC Report 0111-711330). This is 1.5 times BTA maximum operating pressure based on

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			B-N/A C-PASS	8.8 psi. The baseline arm assembly had passed shock, vibration and acceleration tests without loss of screw torque (Ref. Hamilton Standard Test Reports LTER 3067, 3048, 3043 and 3076). The Enhanced Arm Assembly has been certified by similarity to the baseline arm. 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 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 following MIPs are performed during the arm bearing assembly manufacturing process to assure that the failure causes are precluded from the fabricated item: 1. Visually inspect pressure seals and environmental seals for gouges, nicks, tears, and mold imperfection. 2. Verification of cleanliness to VC level. During PDA, the following inspection points are performed at the arm assembly level in accordance with ILC Document 0111-710112: 1. Inspection for cleanliness to VC level. 2. Visual inspection for damage after proof-pressure test. D. Failure History - None. E. Ground Turnaround - Tested for non-EET processing per FEMU-R-001, Pre-Flight Test Requirements, Final Gas Structural and Leakage Tests. None for EET processing. Every 4 years chronological time or 229 hours of manned pressurized time the bearing is disassembled, cleaned, inspected, lubricated and reassembled. Following reinstallation to the arm, the bearing is subjected to structural and leakage test and quantitative torque measurement. F. Operational Use - Crew Response - Pre EVA: No response. Single failure not detectable. EVA: No response. Single failure not detectable. Training - No training covers this failure mode. Operational Considerations - Flight rules define go/no go creteria related to EMU pressure integrity and regulation. Real Time Data System allows ground monitoring of EMU systems.

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: _____ 5/27/02
HS - Project Engineering

Approved by: _____
NASA - SSA/SSM

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HS - Reliability

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NASA - Crew

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NASA - Program Manager