

| NAME P/N QTY | CRIT | FAILURE MODE & CAUSES | FAILURE EFFECT | RATIONALE FOR ACCEPTANCE |
|--|------|--|--|---|
| WAIST BEARING, ITEM 104 ----- A/L 10057-03 (1) OR ----- A/L 10043-04 (1) | 2/2 | 104FM21 Physical binding or jamming. Contamination foreign matter, or corrosion. Defective ball bearings inner/outer race. Dislodged environmental seal. | END ITEM: Binding or jamming of bearing. Bearing torque increased. GFE INTERFACE: Hampered mobility. MISSION: Terminate EVA. CREW/VEHICLE: None. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: N/A TIME REQUIRED: N/A REDUNDANCY SCREENS: A-N/A B-N/A C-N/A | A. Design - Environmental seals preclude contamination or foreign materials entering the bearing. Two environmental seals are utilized, one facing the pressurized side and the other facing the non-pressurized side of the bearing. The seals are made of teflon and keep contaminants and foreign material from entering the bearing to cause it to jam. Bearing races are made of 17-4H1050 stainless steel and the ball bearings are made of 440C stainless, both of which resist corrosion. The pressure seal is made from polyester polyurethane and is lightly lubricated with Brayco 8142 oil. Vespel balls act as bearing ball separator/spares. They are smaller than the steel balls to preclude compressive loading. The environmental seals are trapped in grooves in the races to preclude inadvertent dislodging which could lead to binding/jamming of the bearing assembly. In use, no forces act on the seal to dislodge it from the grooves. B. Test - Acceptance: The waist bearing is subjected to testing per ATP 10043 at Airlock with ILC source verification. The assembly is pressurized to 5.3 psig (+0.2 - 0.0) and subjected to cycle rotation. Following cycle rotation the assembly is disassembled, cleaned, lubricated and reassembled. The assembly is pressurized in the test fixture to 8.0 (+.02 - 0.0) psig for a 5 minute duration and leakage tested to 4.3 +/- 0.1 psig. The assembly is rotated a minimum of twenty complete turns. PDA: The following tests are conducted at LTA assembly level in accordance with ILC Document 0111-70028J. Waist bearing torque to be less than 110in-lbs. at 4.3 +/- 0.1 psig. Certification: The dual seal waist bearing successfully passed SSA certification testing (manned) to duplicate operational life (Ref. "1153 Hour Cert Report for Redesigned Dual Seal Waist Bearing, ILC Doc 0111-719428). The following usage, reflecting requirements of significance to the waist bearing, was documented during certification: |

| Requirement | S/AD | Actual |
|-----------------|------|--------|
| ----- | ---- | ----- |
| Pressure Hours | 458 | 1200 |
| Pressure Cycles | 300 | 1080 |
| Waist Rotations | 2466 | 7200 |
| Walking Steps | 4320 | 77760* |

* The walking steps were accomplished during the Enhanced Certification Testing (Ref. ILC Doc 0111-711330).

In addition, the bearing has been subjected to screening tests where the bearing is bench cycled to a crew familiarization test profile with constant leakage monitoring. The bearing passed this test with both seals functioning and with

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| | | 104FM21 | | <p>one seal intentionally disabled.</p> <p>Both seals in the cert bearing have been subjected to a proof pressure tested at 8.0 psi.</p> <p>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 materials 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.</p> <p>The following MIP's are performed during the LTA assembly manufacturing process to assure the failure cause is precluded from the fabricated item:</p> <ol style="list-style-type: none">1. Verficiation/inspection of ball bearings for proper size.2. Visual inspection of races for corrosion, foreign matter or contamination.3. Dimensional inspection of the bearing to drawing requirements. <p>During PDA, the following inspection points are performed at the LTA assembly level in accordance with ILC Document 0111-70028J: Inspection for cleanliness to VC level. Inspection for material degradation. Verification of waist bearing torque. Not to exceed 110 in lbs. at 4.3 +/- .01 psig. Visual inspection for damage following proof pressure test.</p> <p>D. Failure History - None.</p> <p>E. Ground Turnaround - Inspected for non-EET processing per FEMU-R-001, Waist Bearing Torque. None for EET processing. Additionally, every 4 years or 229 hours of manned pressurized time the bearing is disassembled, cleaned, inspected, lubricated, reassembled and subjected to bearing level quantitative torque tests and structural and leakage tests.</p> <p>F. Operational Use - Crew Response - Pre/post-EVA : Troubleshoot problem, if no success, consider spare LTA if available. Otherwise continue EVA operations. EVA: If waist mobility is reduced appreciably, terminate EVA. Special Training - No training specifically covers this failure mode. Operational Considerations - Not applicable.</p> |

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-104 LOWER TORSO ASSEMBLY (LTA)
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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