NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM12		
BRIEF/WAIST ASSEMBLY, ITEM 104 ---------- 0104-210605- 07/08/09/10/11/12 (1)	2/1R	Loss of primary axial restraint bracket, upper. Non-Adjustable Bracket: Defective Material: Bracket, helicoil or thread lock adhesive. Missing or loose screw or pin retaining screw. Broken pin. Adjustable Bracket: Defective material, primary pin, pin retainer screw, or thread lock adhesive.	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: Hours. REDUNDANCY SCREENS: A-PASS B-N/A C-PASS	A. Design - Primary Bracket P/N 9674 (Non-adjustable) The waist bearing upper primary bracket and pin are fabricated from 17-4 stainless steel. The brackets and pins are machined, heat treated ultrasonic cleaned, and passivated. During tensile testing of the waist bearing, the upper primary restraint bracket, which included the pin, exhibited a minimum strength of 3400 lbs., demonstrating a minimum safety factor of 3.9 against a S/AD limit load of 911 lbs. The required S/AD minimum safety factor for waist hardware is 2.0. The waist bearing primary restraint bracket attachment screws are fabricated from A-286 stainless steel and are procured to MS or NAS specifications. Loss of the waist bearing bracket screw is precluded in design by adherence to standard engineering torque requirements for screw installation and the use of thread lock adhesive. Analysis showed that the primary screws have a factor of safety of 3.3 for ultimate tensile failure. Design requirements for proper installation of helicoils are specified in the assembly procedures when the helicoils are installed in the waist bearing. The pin retainer set screw is fabricated from stainless steel and is procured to NAS specifications. A missing or loose retainer screw is precluded by the use of a nylok self-locking screw. Adjustable Bracket (P/N 10273) The waist bearing adjustable primary brackets are fabricated from 15-5 stainless steel heat treated to H1075. The brackets and pins are machined, heat treated, ultrasonic cleaned, and passivated. The primary restraint pin is held in position by a single retention screw. The adjustment pin is held in position by two spring loaded retention pins. Analysis has shown that the bracket exhibits a minimum safety factor of 2.16 against a S/AD limit load of 911 lbs. The bracket successfully completed testing to a factor of safety of 2.0 without yielding. Loss of the waist bearing primary restraint pin bracket screw is precluded by adherence to standard engineering torque requirements for screw installation and the use of thread lock adhesive. B. Test - Acceptance - Component - See Inspection. PDA: (P/N 9674) (Non-adjustable) The following test is conducted at the Lower Torso Assembly level in accordance with ILC Document 0111-70028. Proof pressure test at 8.0 + 0.2 - 0.0 psig to verify no structural damage. (P/N 10273) (Adjustable) The following test is conducted at the Lower Torso Assembly level in accordance with ILC Document 0111-710112. Proof pressure test at 8.0 + 0.2 - 0.0 psig. To verify no structural damage. Certification: (P/N 9674) (Non-adjustable) The waist bearing primary brackets were successfully tested (manned) during SSA

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certification to duplicate operational life (Ref. ILC Document 0111-711330). The following usage, reflecting requirements of significance to the waist primary bracket, were documented during certification.:

Requirement	S/AD	Actual
Waist Flexion/Extension	1234	2800
Waist Rotations	2400	6000
Pressure Cycles	300	600
Don/Doff Cycles	98	400
Pressure Hours	458	916

Adjustable Bracket (P/N 10273)
The waist bearing adjustable primary bracket was successfully tested (manned) to duplicate operational use. (Ref. ILC Document 0111-712381). The following use, reflecting requirements of significance to the brackets, was documented during certification:

Requirement	S/AD	Actual
WaistFlexion/Extension	1234	2600
Waist Rotations	2466	5000
Engagement/Actuation Cycles	98	200
Pressure Cycles	300	604
Don/Doff Cycles	98	204

During certification testing, the bracket successfully completed testing to a factor of safety of 2.0 without yielding against a S/AD limit load of 911 lbs.

C. Inspection -
(P/N 9674 and 10273)
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 provides traceability information.

All cast axial restraint brackets are x-ray inspected. All machined brackets are inspected using either the Dye Penetrant or Magnetic Particle Technique.

The following MIP's are performed during the waist assembly manufacturing process to assure the failure causes are precluded from the fabricated item:

1. Verification of the presence of screws during the primary restraint bracket screw torquing and threadlocking assembly operation.
2. Helicoil installation is verified during source inspection at the supplier. Visual inspection for defective material upon completion of webbing pull test.

During PDA, the following inspection points are performed at the LTA assembly level in accordance with ILC Document 0111-70028 for P/N 9674 and ILC Document 0111-710112 for P/N 10273:

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Visual inspection for material degradation.
Visual inspection for structural damage to the primary restraint bracket after proof pressure test.

D. Failure History -
P/N 9674
I-EMU-104-C007 (6/1/88)
Dual seal waist bearing side primary restraint bracket screw galled due to similarity in material hardness. Added helicoil inserts to improve material interface.

P/N 10273
None.

E. Ground Turnaround -
Every four years or 229 hours or manned pressurized time, during waist bearing maintenance the restraint brackets are removed and reinstalled during which time screw torque and loctite application are verified.

F. Operational Use -
P/N 9674 and 10273
Operational Use Crew Response -
Pre/post-EVA : If not detected, no response. If detected audibly or tactily, troubleshoot problem. If no success, use spare LTA if available or terminate EVA prep.
EVA : Single failure not detectable, no response.
Special Training -
No training specifically covers this failure mode.
Operational Considerations -
Not applicable.

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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