NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM02		
BRIEF/WAIST ASSEMBLY, ITEM 104 ---------- 0104-210605- 07/08/09/10/11/12 (1)	2/1R	Loss of primary axial restraint. Non-adjustable Bracket: Defective Material: Bracket, helicoils thread lock adhesive. Missing or loose screw or pin retainer set screw. 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 - Non-Adjustable Primary Bracket (P/N 9674): The body seal closure 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 Body Seal Closure (BSC) the primary axial restraint bracket, which included the pin, exhibited a minimum strength of 3000 lbs., demonstrating a minimum safety factor of 3.3 against a S/AD limit load of 911 lbs. The required S/AD minimum safety factor for LTA hardware is 2.0. The BSC primary restraint bracket attachment screws are fabricated from A-286 stainless steel and are procured to MS or NAS specifications. Loss of the BSC primary restraint bracket screw is precluded by adherence to standard engineering torque requirements for screw installation and the use of thread lock adhesive. A nylon thread insert is specified for the swivel pin retainer set screw to prevent the screw from backing out. Design requirements for proper installation of helicoils are specified in the assembly procedures when the helicoils are installed in the BSC. Testing, during the screw thread engagement study, showed that the thread shear out ultimate safety factor for the primary restraint bracket screws is 4.1. Adjustable Bracket (P/N 10271): The brackets and pins are machined, heat treated, ultrasonic cleaned, and passivated. The primary restraint 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 safety factor of 2.0 without yielding. The required S/AD minimum safety factor for LTA hardware is 2.0 against ultimate and 1.5 against yield. The BSC restraint bracket screws are fabricated from A-286 stainless steel and are procured to MS or NAS specifications. Loss of the BSC 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 - (P/N 9674 and 10271) Acceptance - Component - See Inspection. PDA: Non-Adjustable Bracket (P/N 9674) The following tests are conducted at the LTA assembly level in accordance with ILC Document 0111-70028: Visual examination of the waist primary brackets for structural damage following a proof pressure test at 8.0 + 0.2 - 0.0 psig for a minimum of 5 minutes conducted with the TMG removed. Adjustable Bracket (P/N 10271) The following tests are conducted at the LTA assembly level in accordance with ILC Document 0111-710112: Visual examination of the waist primary brackets for structural damage following a proof pressure test at 8.0 + 0.2 - 0.0 psig for a minimum of 5 minutes

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conducted with the TMG removed.

Certification:
Non-Adjustable Bracket (P/N 9674)
The BSC primary bracket was successfully tested (manned) during SSA certification to duplicate operational usage (Ref. ILC Engineering Memorandum EM-83-1083). The following usage, reflecting requirements of significance to the LTA primary brackets were documented during certification:

Requirement	S/AD	Actual
Hardware Activation	300	1,088
Pressure Cycles	300	2,045
Don/Doff Cycles	98	445
Pressure Hours	458	1,646

Adjustable Bracket (P/N 10271)
The BSC 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
Engagement/Actuation Cycles	98	200
Pressure Cycles	300	604
Don/Doff Cycles	98	204

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

C. Inspection -
(P/N 9674 and 10271)
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 LTA manufacturing process to assure the failure causes are precluded from the fabricated item:
1. Verification of the presence of screws during torquing and thread lock application assembly operation.
2. Helicoil installation is verified during source inspection at the supplier.

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 10271:
1. Inspection for material degradation.

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM02		

2. Inspection for structural damage after proof pressure test.

3. For Adjustable Waist, brackets are pull tested to limit load during manufacture and inspected to verify no visual damage.

D. Failure History -
(P/N 9674)
B-EMU-104-A001 (12/13/85) primary restraint bracket screws did not meet minimum engagement requirement of 5 3/4 turns. Alternate screws were too long and bottomed out. ECO 861-0018 redesigned screw requirement.

B-EMU-104-A002 (8/13/85) see B-104-A001
B-EMU-104-A003 (11/13/85) see B-104-A001
B-EMU-104-A004 (10/21/85) see B-104-A001
B-EMU-104-A005 (1/13/86) see B-104-A001
B-EMU-104-A006 (10/23/85) see B-104-A001
B-EMU-104-A007 (10/30/85) see B-104-A001
B-EMU-104-A008 (10/29/85) see B-104-A001
B-EMU-104-A009 (8/13/85) see B-104-A001
B-EMU-104-A010 (10/30/85) see B-104-A001
B-EMU-104-A011 (4/11/85) see B-104-A001
B-EMU-104-A012 (10/30/85) see B-104-A001
B-EMU-104-A013 (5/6/86) see B-104-A001
B-EMU-104-A014 (10/30/85) see B-104-A001
B-EMU-104-A015 (10/1/85) see B-104-A001

(P/N 10271):
None.

E. Ground Turnaround -
None.
(P/N 9674 and 10271)
Every four years or 229 hours of manned pressurized time during BSC maintenance the primary restraint brackets are removed and reinstalled during which time loctite and screw torque are verified.

F. 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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