NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM11		
WAIST RESTRAINT AND BLADDER, ITEM 104 --- 0104-82347-131 (1) --- 0104-84811-05/10 (1) WAIST RESTRAINT AND BLADDER, ADJUSTABLE, ITEM 104 --- 0104-812355-01 (1)	2/1R	Loss of primary axial restraint webbing. Defective Material, thread or webbing. Wear or abrasion.	END ITEM: Loss of primary axial restraint. GFE INTERFACE: Axial load will be transferred to secondary restraint. MISSION: None. CREW/VEHICLE: None with loss of primary webbing. Loss of crewman with loss of secondary restraint webbing. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Hours. REDUNDANCY SCREENS: A-PASS B-N/A C-PASS	A. Design - (P/N 0104-82347, 0104-84811) The waist primary axial restraints are fabricated from 1" wide polyester webbing having 1000 lb. minimum tensile strength. Size "F" and "FF" polyester thread conforming to V-T-285D, Type II, Class I, is used to fabricate the primary axial restraint with Type 301 lock stitching conforming to FED-STD-751A. Seams are terminated by back tack and searing of thread ends. Axial restraints pulled to destruction during design verification testing exhibited ultimate strengths of 1940 lbs. demonstrating a safety factor of 2.13 against S/AD limit load of 911 lbs. S/AD minimum safety factor for LTA softgoods is 2.0 at normal operating pressure. Worn stitching is precluded by abrasion protection afforded to the waist primary axial restraint by the TMG. Worn webbing is precluded by looping the webbing over a bushing which swivels on the pin that secures the bushing to the bracket. This prevents wear by limiting relative movement between the webbing and the bracket. Adjustable Waist Assembly (P/N 0104-812355) The adjustable primary axial restraints are fabricated from 7/8" wide polyethelyene (Spectra 1000) webbing having 2700 lb. minimum strength. Size "F" and "FF" polyester thread conforming to V-T-285D, Type II, Class I is used to fabricate the primary axial restraint with Type 301 lock stitching conforming to FED-STD-751A. Seams are terminated by back tack and searing of thread ends. Axial restraints pulled to destruction during verification testing exhibited minimum ultimate strengths of 4187 lbs. Demonstrating a safety factor of 4.6 against a S/AD limit load of 911 lbs. Worn stitching is precluded by abrasion protection afforded to the waist primary axial restraint by the TMG. Worn webbing is precluded by looping the webbing over a bushing which swivels with the bracket pins limiting relative movement between the webbing and the bracket. B. Test - Acceptance: (P/N 0104-82347, 0104-84811) The waist primary and secondary axial restraints are subjected to 929 pounds during fabrication of each waist restraint. (P/N 0104-812355) The adjustable waist primary and secondary axial restraints are subjected to 966 lbs. during fabrication of each adjustable waist restraint. PDA: (P/N 0104-82347, 0104-84811, 0104-812355) Visual inspection of webbing for structural damage after pressurization of waist restraint and bladder to proof pressure. Certification: (P/N 0104-82347, 0104-84811) The waist axial restraints were successfully tested (manned) during SSA

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certification to duplicate six years operational life (Ref: Cert. Test Report for the SSA, ILC Document 0111-70027).

The following usage, reflecting requirements of significance to the waist restraint was documented during certification:

Primary Axial Restraint

Requirement	S/AD	Actual
Waist Flexion/Extension	1234	2800
Waist Rotations	2466	6000
Pressure Cycles	300	600
Don/Doff Cycles	98	400
Pressure Hours	458	916
Walking Steps	4320	77760

Per EM # 93-1131:
Secondary Axial Restraint

Requirement	S/AD	Actual
Waist Cycles	617	1400
Waist Rotations	1233	3000
Pressure Cycles	150	300

The waist restraint was 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.

Certification:
(P/N 0104-812355)
The adjustable waist assembly was successfully tested (manned) to duplicate operational life (Ref ILC Document 0111-712381). The following use, reflecting requirements of significance to the waist assembly, was documented during certification:

Requirements	S/AD	Actual
Flexion/Extension	1234	2600
Rotations	2466	5000
Walking Steps	4320	8640
Pressure Cycles	300	604
Don/Doff Cycles	98	204

Secondary Axial Restraints

Requirements	S/AD	Actual
Flexion/Extension	617	1300
Rotations	1233	2500
Pressure Cycles	150	300
Don/Doff Cycles	N/A	103

The waist assembly was successfully subjected to a BTA ultimate pressure of 13.2

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psid during certification testing (Ref. ILC Doc. 0111-712381). This is 1.5 times the maximum BTA operating pressure of 8.8 psid.

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.

The following MIP's are performed during the waist assembly manufacturing process to assure that the failure causes are precluded from the fabricated item. The restraint is visually inspected upon completion of the primary restraint webbing pull test for signs of defective thread and material. During PDA, the following inspection points are performed at the LTA assembly level in accordance with ILC Document 0111-70028 (ILC Document 0111-710112 for Adjustable Waist):

1. Visual inspection for fabric or material degradation.
2. Verification of load test during fabrication.
3. Visual inspection for damage following proof pressure test.

D. Failure History -
P/N 0104-82347, 01040-84811
B-EMU-104-A028 (10/15/88). Left lower loop of primary waist restraint frayed due to contact with restraint bracket screwhead during handling and stowage when unsupported.

B-EMU-104-T011 (7/7/99) -
Tracked by B-EMU-104-T010.

B-EMU-104-T010 (5/10/99) - Broken stitching on LTA waist assembly primary and secondary restraint webbing. Most probable cause is stitch was exposed to a point load due to installation of a twisted waist axial restraint. USA's processing procedures revised to screen for twisted restraint webbing.

B-EMU-104-T012 (7/7/99) -
Tracked by B-EMU-104-T010.

I-EMU-104-C009 (11/16/99) - Left and right BSC secondary webbings abraded across their width. Caused by interface between webbings and bracket while primary is unloaded. Production brackets will have all secondary webbing surfaces blended smoothly to minimize abrasion.

P/N 0104-812355
B-EMU-104-A066 (8/13/00)- Broken stitches found on Waist Restraint during initial assembly processing of LTA 2033. Anomaly on crewmember's right side primary long loop restraint, inboard, on backside of primary restraint bracket. Most Probable cause is contact by a screwdriver tip after it stripped the screw head and slipped out of the groove, or by catching edge of web in screw threads. No C/A. Detectable per Pre-flight inspections per FEMU-R-001 paragraph 7.1.1.3.5. Paragraph 7.1.1.6.1 inspects for burred/damaged screw threads.

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				B-EMU-104-A071 (8/24/01) - Not PRACA reportable. No discrepancy exists. E. Ground Turnaround - Every 229 hrs. of manned pressurized time the waist restraint and bladder is removed from the LTA and completely inspected for signs of degradation or damage. 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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5/14/02
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