

12/24/93 SUPERSEDES 12/26/91

ANALYST:

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
<p>WAIST RESTRAINT AND BLADDER, ITEM 104 ----- D104-82347-117 (1) ----- D104-84811-05 (1)</p>	2/1NB	<p>104FM10: Loss of fabric restraint.</p> <p>CAUSE: Separation of seam in restraint or hole in fabric. Defective thread or fabric.</p>	<p>END ITEM: Opening in fabric restraint exposing bladder. Loss of restraint circumferential load carrying capability.</p> <p>GPE INTERFACE: Loading and abrading of bladder. Loss of bladder protection. Bladder exposed to TMO.</p> <p>MISSION: None.</p> <p>CREW/VEHICLE: None with single failure. Loss of cresman with loss of bladder.</p>	<p>A. Design - The waist restraint is fabricated from 6.4 ounce dacron fabric which exhibits a minimum tensile strength of 300 lbs. (warp) and 250 lbs. (fill). Material strength is 7.1 (warp) and 8.5 (fill) times greater than the hoop load of 35.2 lbs. predicted for the LIA waist at normal operating pressure.</p> <p>The basic seam employed in waist construction is one row of join stitching and two rows of top stitching. Seams are formed using size #8 polyester thread per V-T-2B50 type II, class I with a lock stitch type 301 per F00-S10-751A. Seams are terminated by backtacking and searing of thread ends. Seam strength, as determined by testing, is equal to or better than the restraint material.</p> <p>The waist TMO serves to protect the restraint fabric and stitching from abrasion and puncture.</p> <p>Testing has shown that the bladder fabric can sustain loads of 105 lbs./inch (fill) and 140 lbs./inch (warp) and 3.5 lbs./in. in fill and 6.0 lbs./in. in warp, tearing strength. The bladder fabric is aligned with the warp parallel to the hoop load that would be sustained by the bladder in the event of a restraint fabric failure. Based on a calculated hoop load of 30.5 lbs. the minimum safety factor for hoop stress is 3.6. Testing has demonstrated that the tensile strength of the bladder seams meets or exceeds that of the bladder fabric.</p> <p>B. Test - Acceptance: Component - see inspection.</p> <p>PDA: The following test is conducted at the LIA level in accordance with ILC Document 0111-7002B1.</p> <p>Proof pressure test at 0.0 + 0.2 - 0.0 psig with the TMO removed to verify no structural damage.</p> <p>Certification: The waist bladder assembly was successfully tested (manned) during SSA certification to duplicate six years operational life (Ref: Cert. Test Report for the SSA, ILC Document</p>

NAME P/N OFF	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
	2/100	104FM10:		0111-70027).

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

Requirement	S/AD	Actual	Equiv. Life (yrs)
Waist Cycles	3,227	12,208	22.7
Waist Rotations	2,766	10,906	23.7
Pressure Cycles	432	436	6.0
Don/Off Cycles	144	234	9.0
Pressure Hours	461	683	7.8

The waist restraint was successfully subjected to an ultimate pressure of 10.6 psig during SSA certification testing (Ref. Document 0111-700270). This is two times maximum operating pressure based on 5.3 psi. Recertification to 5.5 psi was by test and analysis (ref. ILC EM 84-1102).

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.

NIP's are performed for inspection of seam seams during the waist restraint manufacturing process to assure that the failure causes are precluded from the fabricated item.

During PDA, the following inspection points are performed at the lower torso assembly or separable component level in accordance with ILC Document 0111-70028J:

1. Visual inspection for fabric or material degradation. Seams are inspected for broken stitches or fraying.
2. Visual inspection for structural damage following proof pressure test.

CIL
EMU CRITICAL ITEMS LIST

Page: 3
Date: 12/02/93

12/24/93 SUPERSEDES 12/24/91

ANALYST:

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
	2/100	104FH10:		

D. Failure History -
None.

E. Ground Turnaround -
During ground turnaround, in accordance with FEMU-R-001, the waist restraint and bladder is visually inspected (with TNG's removed), pressurized and unpressurized for material damage or degradation. Additionally, the waist restraint and bladder is structural and leakage tested at LTA and SEMU level.

Every 56 hours of manned pressurized time, the waist restraint and bladder assembly is separated from the LTA and subjected to a complete visual inspection (interior and exterior surfaces) for material damage and degradation. Following reassembly to the LTA, structural and leakage tests are performed.

F. Operational Use -
1. Crew Response -

Pre/post-EVA : Single failure not detectable, no response.
EVA : Single failure not detectable, no response.

2. Special Training -

No training specifically covers this failure mode.

3. Operational Considerations -

Not applicable.