

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
4000 PALM RESTRAINT ASSY, ITEM 106 (1) LEFT (1) RIGHT ----- 0106-88936-09/10 (2) OR PHASE VI RESTRAINT, ITEM 106 (1) LEFT (1) RIGHT ----- 0106-812146-03/04 (2)	2/2	106FM15 Failure of palm restraint strap or buckle. Defective thread, strap, or buckle.	END ITEM: Loss of palm restraint circumferential ly. GFE INTERFACE: Hampered hand mobility, due to ballooning. Difficulty interfacing with tools. Crewman discomfort due to pressure points. 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 - 4000: The palm restraint is a separate component of the glove assembly. The strap is fabricated from 5/8" wide polyester webbing having a minimum tensile strength of 600 lbs. The strap retains the buckle and is attached to the palm bar restraint webbing with box stitch using size "E" polyester thread conforming to V-T-285D type II, class I. Stitching is terminated by backtacking and searing of thread ends. Phase VI: The palm restraint system is composed of a strap stitched directly to the restraint to form a tunnel and stainless steel bar that resides in the tunnel. The bar is annealed 17-4 SS that is heat treated after shaping. 4000/Phase VI: The palm restraint buckle is made entirely of 302/304 stainless steel. A knurled sliding bar retains the restraint strap in position. The restraint strap is further secured by mating with velcro attached to the strap with size "E" polyester thread. The glove restraint assembly is completely covered by a TMG which serves to protect the palm restraint assembly webbing and stitching from abrasion. B. Test - 4000/Phase VI: PDA: A proof pressure test of the glove assembly is conducted at 8.0 (+2.0 - 0.0) psig for five minutes to verify no structural damage per ILC Document 0111-70028 for the 4000 Series gloves or 0111-710112 for the Phase VI gloves. Certification: 4000: The glove assembly was successfully tested (manned) during SSA Certification to duplicate operational life. The following usage, reflecting requirements of significance to the 4000 glove restraints, was documented during certification 5/13/99 (Ref. ILC Document 0111-79241). 4000: Requirements S/AD Actual ----- ---- ----- Finger Cycles 56550 56726 Pressurized Hours 615 615 Pressurized Cycles 376 576 4000: Hardware Requirements S/AD Actual ----- ---- ----- Glove Cycles 106076 136716 Pressurized Hours 1153 1153

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106FM15

Pressurized Cycles 1080 1080
 Don/Doff Cycles 360 432

The glove was successfully subjected to an ultimate pressure of 13.2 psig. during SSA certification. This represents 1.5 times the BTA maximum operating pressure of 8.8 psig. Recertification was by test and analysis (Ref. ILC EM 84-1108).

Phase VI:

The glove restraint assembly was successfully tested (manned) during certification testing to duplicate operational usage (Ref. Certification Test Report for the Phase VI Glove, ILC Doc. 0111-712701). The following usage, reflecting requirements of significance to the glove restraint assembly, was documented during certification testing. The S/AD applies 229 hours in certification while the actual indicates 198 hours toward the Phase VI glove restraint in the Hamilton Sundstrand Limited Life Items list (EMU1-19-001).

Requirements	S/AD	Actual
Glove Joint Cycles		
Flex/Ext (fingers)	45142	39169
Wrist Joint Cycles		
Add/Abd	17104	14830
Flex/Ext	12646	10830
Rotations	20112	17393
Pressurized Hours	229	198
Pressurized Cycle @ 4.3 psig	97	99
5.3 psig	37	63
6.6 psig	16	18
Don/Doff Cycles	49	49

The glove assembly was successfully subjected to an ultimate pressure of 13.2 psig during Certification Testing (Ref. ILC doc 0111-712701). This is 1.5 times the maximum BTA operating pressure based on 8.8 psig.

C. Inspection -
 4000/Phase VI:

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 glove assembly manufacturing process to assure that the failure causes are precluded from the fabricated item.

1. Visual inspection of the box stitching of the glove assembly, retaining the buckle on the strap, to insure it is free from damage.
2. Visual inspection of the completed glove assembly to insure it is free from damage.

During PDA, the following inspection points are performed at the Glove Assembly level in accordance with ILC Document 0111-70028 (4000 glove) or 0111-710112 (Phase VI glove):

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		106FM15		<p>1. Visual inspection for material degradation. 2. Visual inspection for structural damage to the buckle and strap following proof pressure testing.</p> <p>D. Failure History - J-EMU-106--014 (3/17/89) - The right glove palm strap webbing broke due to abrasion with the sharp points on the buckle assembly knurl. ECO's 891-0278 and 901-0344 incorporate a screening test to detect sharp knurling. The screening test cycles the palm restraint buckles on mock-up palm restraint straps. Buckles that do not fail the mock-up restraint straps after 45 cycles are acceptable for flight use.</p> <p>Phase VI: None.</p> <p>E. Ground Turnaround - 4000/Phase VI: Checked per FEMU-R-001, Complete Visual Inspection.</p> <p>F. Operational Use - 4000/Phase VI: Crew Response - Pre/post-EVA : Troubleshoot problem, if no success, consider spare gloves if available. Otherwise continue EVA operations. EVA : If hand dexterity is reduced appreciably, stop hand intensive work or 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-106 GLOVE ASSEMBLY
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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