NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		106FM11		
GLOVE ASSEMBLY, 4000, ITEM 106 ---------- 0106-111723-15/-16 (2) GLOVE ASSEMBLY, PHASE VI, ITEM 106 ---------- 0106-110106-09/-10, -11/-12 (2)	2/1RB	Loss of axial restraint attachment to wrist disconnect. Missing or loose screw. Defective thread lock adhesive or helicoil.	END ITEM: Loss of one of two screws on axial restraint bracket. GFE INTERFACE: Load is transferred to second attachment screw. MISSION: None for single failure. With second failure loss of primary O2 supply and SOP. CREW/VEHICLE: None for single failure. Loss of crewmember with loss of second attachment screw. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Hours. REDUNDANCY SCREENS: A-PASS B-FAIL C-PASS	A. Design - The wrist disconnect/bearing glove side primary bracket is fabricated from 17-4 stainless steel casting or bar stock. The glove axial load restraining attachment to the wrist disconnect is made up of an upper and lower bracket. An upper bracket is provided in order to loop the primary webbing around to obtain a strength of 789 lbs with a corresponding safety factor of 3.7 against a S/AD limit load of 214.5 lbs. The wrist tether bracket shares a single screw from the dual bracket system. The brackets are machined and passivated. The attachment screws are fabricated from A-286 stainless steel and are procured to MS or NAS specifications. Loss of bracket screws are precluded in design by adherence to standard engineering torque requirements for screw installation and the use of thread lock adhesive. Analysis has shown that the thread shearout ultimate safety factor meets the S/AD minimum of 2.0. Analysis of the bracket system has demonstrated a minimum safety factor of 2.0 against a S/AD limit load of 214.5 lbs. B. Test - Acceptance: Component - see inspection. PDA: The following test is conducted at the glove assembly level in accordance with ILC Document 0111-70028 for the 4000 Series glove or 0111-710112 for the Phase VI glove: Proof pressure test at 8.0 + (.2 - 0.0) psig for a minimum of 5 minutes conducted with the TMG removed to verify no structural damage. Certification: 4000: The glove axial restraint bracket was successfully tested (manned) during SSA certification testing to duplicate operational usage (Ref: ILC Engineering Memorandum EM83-1083). The following usage, reflecting requirements of significance to the glove restraint brackets, was documented during certification: Per EM # 93-1131: Secondary Axial Restraint Requirements: ----------

Requirements	S/AD (15yr)	Actual
Wrist Cycles	53,038	61,830
Pressurized Hours	1,153	1,182
Pressurized Cycles	1,080	1,080
Don/Doff Cycles	360	602

Requirement	S/AD	Actual
Flex/Ext(Fingers)	8372	56420
Flex/Ext(Wrist)	4186	16120
Add/Abd(Wrist)	4186	21700

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
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Rotation 4186 25420
Pressure Cycles 32 196

The glove restraint brackets were successfully subjected to an ultimate pressure of 13.2 psig during SSA certification testing. 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).

4000 (10088-01):
The Glove Axial Restraint Bracket was successfully tested (manned) during SSA certification testing to duplicate 458 hours operational usage (Ref. ILC Report 0111-711330). The following usage, reflecting requirements of significance to the Glove Restraint Brackets, was documented during certification:

Requirement	S/AD	Actual
Rotation	40224	82000
Engage/Disengage	300	1080
Don/Doff	98	400
Pressure Hours	458	916

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
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 -
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

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		106FM11		

information.

The bracket castings are radiographically inspected to detect the presence of flaws prior to machining and magnetic particle inspected after machining. The brackets that are machined from plate stock are magnetic particle inspected to detect the presence of flaws.

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. The restraint brackets are visually inspected upon completion of the primary restraint webbing pull test for signs of defective material.
2. Verification of Loctite application and torquing of the restraint bracket screws.
3. Helicoil installation is verified during source inspection at the supplier.

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):
1. Visual inspection for material degradation.
2. Visual inspection for structural damage following the proof pressure test.

D. Failure History -
None.

E. Ground Turnaround -
4000/Phase VI:
During ground turnaround in accordance with FEMU-R-001, para. 7.1.4.6.3.2, the gloves are visually inspected (pressurized and unpressurized) with TMGs removed for structural integrity, material damage/degradation and loose or missing screws. Every 63 hours of manned pressurized time (disconnects P/N 9807 and 9808) or 229 hours of manned pressurized time (disconnect P/N 9924) or every 229 hours of manned pressurized time (wrist bearing 10088) during disconnect maintenance, screw torque and loctite application is verified.

F. Operational Use -
4000/Phase VI:
Crew Response -
Pre/post-EVA : No response, single failure not detectable.
EVA: No response, single failure not detectable.
Special Training - No training specifically covers this failure mode.
Operational Considerations - Not applicable.

EXTRAVEHICULAR MOBILITY UNIT

SYSTEMS SAFETY REVIEW PANEL REVIEW

FOR THE

I-106 GLOVE ASSEMBLY

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: _____
HS - Project Engineering

_____
HS - Reliability

_____
HS - Engineering Manager

Approved by: _____
NASA – SSA/SSM

_____
NASA – EMU/SSM

_____
NASA – S&MA

_____
NASA – MOD

_____
NASA – Crew

_____
NASA – Program Manager