

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
RESTRAINT ASSEMBLY, ITEM 107 ----- 0107-82968-15 (1)	2/1R	107FM06 External H2O leakage. Defective Material: Tubing bond tee. Broken/cracked/punctured water manifold or tubing. Separation of tubing from manifold or tee.	END ITEM: Water leakage from tubing into suit vent loop. GFE INTERFACE: Loss of cooling capability. Loss of water, possible fogging of helmet. MISSION: Terminate EVA. Loss of use of one EMU. CREW/VEHICLE: None with single failure. Loss of crewman with loss of SOP. TIME TO EFFECT /ACTIONS: Minutes. Activate the Purge Valve and return to airlock. TIME AVAILABLE: Minutes. TIME REQUIRED: Seconds. REDUNDANCY SCREENS:	A. Design - LCVG restraint tubing, "tees" and manifold fittings are extruded/injection molded from ethylene vinyl acetate (EVA) which is irradiated to improve its physical properties. This material was selected to provide compatibility with the PLSS water loop operating system. It has good crack and puncture resistance with fair compression and cold flow resistance. EVA has excellent reforming characteristics. It can be reworked repeatedly with no reduction in physical properties. Production of these components is controlled by tight tolerancing to ensure correct interface dimensions. Tubing to fitting interfaces are secured by thermal bonding. This thermal process, as well as the solvent cleaning prior to bonding, identifies defective material through deformation or unacceptable melt characteristics. As a result of proper tolerancing and fabrication, defective tubing and fittings are precluded. The thermal bonds produced exceed the strength of the tubing. As a result of correct fabrication and adequate easement, defective bonds are precluded. Additionally, the entire system (tubing, fittings, bonds) is designed to meet a 1.5 factor of safety over the 16.7 +/- 1.0 psi maximum operating pressure. B. Test - Acceptance: See Inspection. PDA: The following tests are conducted at the LCVG Assembly level in accordance with ILC Document 0111-70028J: Initial leakage test to verify no visible leakage at 240 pph minimum flow at 17.7 psig maintained for at least 30 minutes. 1. Proof pressure test to verify no structural damage with cooling tubes charged at 33 psig for not less than 10 minutes. 2. Post proof leakage test to verify no visible leakage at 240 pph minimum flow at 17.7 psig maintained for at least 30 minutes. 3. Water lines pressure drop test at 240 pph. minimum flow at 17.7 psig maintained for at least 5 minutes. The differential pressure is not to exceed 2.4 psi at 60 degree F. 4. Dye flow test to identify any static water condition or loops failing to exhibit a minimum flow rate of 3.0 inch/sec. Certification: The LCVG softgoods were successfully tested (manned) during SSA certification to duplicate operational life (Ref. ILC-EM-98-0008). The following usage reflecting requirements of significance to the LCVG, was documented during certification: Requirement S/AD Actual ----- ----- ----- Don/Doff 98 400 Pressurized Hours 458 916

The LCVG successfully completed the proof load pressure testing to 33 psig for the tubing.

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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 hardware received is 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 LCVG assembly manufacturing process to assure that the failure causes are precluded from the fabricated item:

1. Verify no twisting or kinking of the tubing.
2. Verify that all tube ends are inserted into the tee/manifold to 3/16" minimum and have no delaminations.
3. Visual inspection to verify integrity of bond.
4. Verify no leakage in the tubing network.

PDA:

The following inspection points are performed at the LCVG Assembly level in accordance with ILC Document 0111-70028J:

- Inspection for visible leakage during initial leak test.
1. Inspection for structural damage during proof pressure test.
 2. Inspection for visible leakage during post-proof pressure test.

D. Failure History -

I-EMU-107-A001 (03-10-81)
Water leak at tee. Poor bond of tube to tee (tube came out when pulled).
Changed process to achieve proper bond.

I-EMU-107-A002 (03-17-81)
Water leak at interface between molded fittings and MWC. Changed process to increase fitting compression.

H-EMU-107-D001 (03-26-81)
See I-EMU-107-A001 above.

B-EMU-107-001 (1-8-87) Water leak from tubing. Improper repair procedure. Field cautioned on proper repair procedure. No cert impact.

I-EMU-107-C009 (6/26/90)
The LCVG EVA water tubing was leaking at the repair joint during the certification testing of the repair procedure. The repair entails splicing the EVA tubing with a metal, barbed, coaxial cylinder. The spliced area is then coated with epoxy and covered with another piece of EVA tubing. This repair procedure is unacceptable, therefore, it has been removed from the Maintenance Manual, and will not be used on any flight LCVG's.

E. Ground Turnaround -

Tested per FEMU-R-001, LCVG Pre-Flight Test Requirements, Structural and Leakage test.

F. Operational Use -

Crew Response -

Pre/post-EVA : Trouble shoot problem, if no success, use spare LCVG if

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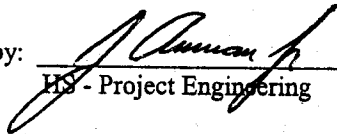
available. Otherwise terminate EVA operations.
EVA : If significant amounts of water detected, deactivate fan, open purge valve, terminate EVA.
Special Training -
Standard EMU training covers this failure mode.

Operational Considerations -
EVA checklist procedures verify hardware integrity and systems operational status prior to EVA.
Flight rules define go/no go criteria related to EMU ventilation. Real time data system allows ground monitoring of EMU systems.

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-107 LIQUID COOLING & VENTILATION GARMENT (LCVG)
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by:


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Approved by:



NASA - SSA/SSM


HS - Reliability

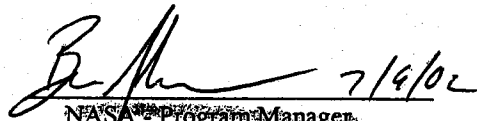

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