

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

		103FM19		
WRIST DISCONNECT, ITEM 103 (1) LEFT (1) RIGHT ----- A/L 9813-05/9814- 05 (2)	1/1	External gas leakage beyond SOP makeup capability. Wear or deterioration of the lip seal. Damaged O-ring. Impact. Missing or loose screws. Defective helicoils. Cracked cover or housing, defective latch pins.	END ITEM: Suit gas leakage to ambient. GFE INTERFACE: Depletion of primary O2 supply and SOP. Rapid depressurization of SSA beyond SOP makeup capabilities. MISSION: Abort EVA. CREW/VEHICLE: Loss of crewman. TIME TO EFFECT /ACTIONS: Seconds. TIME AVAILABLE: N/A TIME REQUIRED: N/A REDUNDANCY SCREENS: A-N/A B-N/A C-N/A	A. Design - The arm wrist disconnect housing is designed with a groove in the inner diameter to allow for the fit of a polyurethane lip seal which acts as the pressure seal between the glove side and arm side wrist disconnect. Design selected a polyurethane lip seal which exhibits material characteristics that limit wear and deterioration. The lip seal is lubricated lightly with Krytox grease to further preclude wear. The leading edge of the mating half to this disconnect is ramped to prevent damage to the lip seal during mating. Once mated, the seal becomes static and is not subjected to wear from relative motion. A fluorosilicone "O" ring is mounted on the housing of the wrist disconnect to preclude leakage between the wrist disconnect and lower arm flange. The "O" ring is in a static condition and is unlikely to be damaged or degraded during usage. Proper lead-in, chamfers and radii on mating hardware components preclude damage to o-ring during installation. The wrist disconnect housing is made of 7075-T73 aluminum and is designed to preclude damage due to impact via structural geometry and cross-sectional thickness. Loss of wrist disconnect clamping ring screws is precluded in design by adherence to standard engineering torque requirements for screw installation (7-9 in-lb). Testing, during the screw thread engagement study, showed that the thread shear out ultimate safety factor for the axial restraint/clamping ring screws is 9.6. Design requirements for proper installation of helicoils are specified in the assembly procedures when the helicoils are installed in the wrist disconnect. Analysis of the wrist disconnect housing, latch pins, and latch pin landing on the glove portion of the disconnect, show that for compressive, bending, tensile, and shear stresses the lowest ultimate strength safety factor is 2.26 due to bending of the aluminum housing above the latch pin holes. B. Test - Acceptance: The wrist disconnect is subjected to testing per ATP 9813 or ATP 9814 at airlock with ILC source verification. The assembly is pressurized in the test fixture to 8.0 (+0.2 - 0.0) psig for a 5 minute duration and leakage tested at 4.3 +/- 0.1 psig. The following tests are conducted at the Arm Assembly level in accordance with ILC Document 0111-70028J. 1. Initial leak test at 4.3 +/- 0.1 psig to verify leakage less than 24 scc/min. 2. Proof pressure test at 8.0 + 0.2 - 0.0 psig to verify no structural damage. 3. Post-proof pressure leak test at 4.3 +/- 0.1 psig to verify leakage less than 24 scc/min. 4. Final leak test at 4.3 +/- 0.1 psig to verify leakage less than 24 scc/min. Five wrist disconnect plug engagements, lock-lock actuations and disengagements are performed prior to the pressure tests to ensure that the lip seal is installed correctly and that normal disconnect mating does not damage the lip seal.

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Certification:

The wrist disconnect was successfully tested (manned) during SSA certification to duplicate operational life. Ref. Cert Test Report for the SSA, ILC Document 0111-70027 and ILC Document EM 82-1038.

The following usage, refelecting requirements of significance to the arm assembly, was documented during certification.

Requirement	S/AD	Actual
Pressure Hours	458	1,190
Pressure Cycles	300	1,080
Disconnect Cycles	300	1,080

The arm assembly was successfully subjected to an ultimate pressure of 10.6 psig during SSA Certification testing. Ref. ILC Document 0111-70027. 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 84-1108).

The Wrist Disconnect has successfully passed shock, vibration and acceleration testing (Ref HSD TER 30667, 3048 and 3071)

Two acceptable alternate materials for the lip seal of the wrist disconnect were developed and certified (Ref. Certification Report 0111-712694). Each material is a polyurethane rubber, however, each is of a different compound. The lip seal design envelope is identical for each of the materials used in the wrist disconnect lip seal.

Requirement	S/AD	Actual
Engagement Cycles	300	600
Pressure Hours	458	916
Pressure Cycles	194 @ 4.3 psid	388
	74 @ 5.3 psid	148
	32 @ 6.6 psid	64

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 certification have been received which provides

Inspection (Continued) traceability information.

The following MIP's are performed during the arm assembly manufacturing process to assure the failure cause is precluded from the fabricated item:

1. Visual inspect of the lip seal for gouges, nicks, tears, or degradation.
2. Visual inspection of the wrist disconnect to lower arm "O" ring for gouges, nicks, tears and degradation.
3. Verification of the presence of screws during torquing of wrist disconnect clamping ring screws.
4. Helicoil installations verified during source inspection at the supplier.

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		103FM19		<p>5. Verification of cleanliness to VC level. 6. Verification after proof and leakage testing of no deformation, defects or damage.</p> <p>During PDA, the following inspection points are performed at the Arm Assembly level in accordance with ILC Document 0111-70028J: 1. Verification of cleanliness to VC level and no material degradation. 2. Verification of correct installation of lip seal and no damage to lip seal during disconnect mating prior to pressure tests. 3. Inspection for damage after proof pressure test.</p> <p>D. Failure History - None.</p> <p>E. Ground Turnaround - Tested for non-EET processing per FEMU-R-001, Pre-Flight Test Requirements, Arm Structural and Leakage Tests. None for EET processing. Every four years or 229 hours of manned pressurized time, the wrist disconnect is disassembled, cleaned, inspected, lubricated, reassembled, and subjected to subjective engagement evaluations and structural and leakage tests.</p> <p>F. Operational Use - Crew Response - PreEVA/PostEVA: Trouble shoot problem. Consider use of third EMU if available. If no success, terminate EVA prep. EMU is no go for EVA. EVA: When CWS data confirms SOP activation, abort EVA. Training - Standard EMU training covers this failure mode. Operational Considerations - Flight rules define go/no go criteria related to EMU pressure integrity and regulation. EVA checklist procedures status prior to EVA. Real Time Data System allows ground monitoring of EMU systems.</p>

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-103 ARM ASSEMBLY
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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