

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

103FM01				
SCYE BEARING ASSEMBLY, & DUAL SEAL SCYE BEARING ASSEMBLY ITEM 103 (1) LEFT, (1) RIGHT	1/1	External gas leakage beyond SOP makeup capability.	END ITEM: Suit gas leakage to ambient.	A. Design - Scye bearing races are made from 17-4 PH stainless steel heat treated to a 1050 condition. Ball bearings are made of 440 C stainless steel. Spacer balls are made of Vespel. Analysis shows that S/AD conditions of 5.3 psi pressure and manloading result in a minimum ultimate safety factor of 4.6 due to bending and torsion of the outer race. BTA conditions of 8.8 psi pressure and manloading result in a minimum ultimate safety factor of 3.5 due to bending and torsion of the outer race. Both the inner race and the stainless steel bearing retainer will have a higher ultimate loading capacity. Ball bearing excessive loading will not result in loss of axial restraint.
A/L 10085-03/04 (2)		Loose or missing clamping ring screws or ball port plug retainer screw. Damaged scye bearing to gimbal O-seal or screw sealing O-seals.	GFE INTERFACE: Depletion of primary and SOP O2. Rapid depressurization of SSA beyond SOP makeup capability.	Contamination is precluded from entering the Scye bearing assembly by dual urethane environmental seals, one on each side of the bearing assembly. These seals fit into mating grooves in the inner and outer races and form a seal to preclude introduction of contamination into the pressure seal and ball raceway areas.
OR				
A/L 10135-01/02 (2)			MISSION: Abort EVA.	The possibilities of loose clamping ring screws in the scye bearing assembly is precluded in design by adherence to standard engineering torque requirements for screw installation.
OR			CREW/VEHICLE: Loss of crewman.	The ball port plug retainer screw is prevented from backing out when the arm is pressurized by the bladder fabric restraint which covers this area of the bearing.
A/L 10134-01/02 ()		Defective/cracked inner race, outer race, ball port plug, or helicoil.		A Fluorosilicone O-seal is mounted on the outer race of the scye bearing. The O-seal is in a static condition and is unlikely to be damaged or degraded during usage. Chamfers and radii on mating components preclude damage to O-seal during installation.
			TIME TO EFFECT /ACTIONS: Seconds.	
			TIME AVAILABLE: N/A	The Fluorosilicone screw sealing O-seals are installed on each clamping ring screw to prevent a pressure leakage path around the screw head and threads to the outside of the scye bearing. The O-seal is protected from damage by a retaining washer, which prevents the clamping ring screw from crushing the O-seal during screw installation and torquing.
			TIME REQUIRED: N/A	
		REDUNDANCY SCREENS: A-N/A B-N/A C-N/A		Design requirements for proper installation of the helicoils are specified in the assembly procedures. Analysis, during the screw thread engagement study, showed that axial restraint clamping ring screws have a minimum thread shearout yield factor of safety of 1.5.
				B. Test - Acceptance: The scye bearing is subjected to testing per Airlock ATP 10085 at Airlock with ILC source verification. The primary and secondary seals are proof pressure tested with the bearing in the test fixture. The fixture is pressurized to 8.0 (+0.2-0.0) psig and held for 5 minutes. Following proof pressure testing, the bearing is pressurized to 4.3 +/- 0.1 psig, testing the primary and secondary seals separately, and subjected to cycle rotation. Leakage is verified to be less than 4 scc/min. With both seals pressurized separately and together in the operating condition, bearing torque is measured with the bearing pressurized between plates and verified to be less than 18 in-lbs.

PDA:

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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.
5. Scye bearing (in arm assembly) torque to be less than 32 in-lb at 4.3 +/- 0.1 psig which is an indication that the pressure seals are acceptable.

Certification:

The dual seal scye bearing successfully passed SSA certification testing to duplicate operational life. Reference "15 year Certification Report for the Dual Seal Scye Bearing", ILC Document 0111-710464.

Requirement	S/AD	Actuals
Pressure Hours	458	1270
Pressure Cycles	300	1080
Scye Flex/Ext.	10142	25355
Scye Rotation	10142	25355
Don/Doff Cycles	98	360

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 provides traceability information.

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

1. Visually inspect pressure seals and environmental seals for gouges, nicks, tears and mold imperfections.
2. Verification of presence of ball port plug and retainer screw.
3. Visual inspection of the clamping ring screw O-seals for gouges, nicks, tears and degradation.
4. Helicoil installation is verified during source inspection at the supplier.
5. Visual inspection of the scye bearing to gimbal O-seal for gouges, nicks, tears, and degradation.

During PDA, the following inspection points are performed at the arm assembly level in accordance with ILC Document 0111-70028J:

1. Inspection for cleanliness to VC level.
2. Visual inspection for damage after proof-pressure test.

D. Failure History -

No history of this failure mode for the dual seal scye bearing to date (leakage

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		103FM01		beyond SOP makeup capability). E. Ground Turnaround - Tested for non-EET processing per FEMU-R-001, Pre-Flight Final SEMU Gas Structural and Leakage. None for EET processing. F. Operational Use - 1. Crew Response - Pre EVA: Trouble shoot problem. If available consider use of third EMU. EMU is no go for EVA. EVA: When CWS data confirms SOP activation, abort EVA. 2. Training - Standard training covers this failure mode. 3. Operational Considerations - Flight rules define go/no go criteria related to EMU pressure integrity and regulation. EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Real Time Data System allows ground monitoring of EMU systems.

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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