

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
-----				
DUAL SEAL SCYE BEARING ASSEMBLY, ITEM 103 (1) LEFT (1) RIGHT ----- A/L 10085-03/04 (2) OR ----- A/L 10135-01/02 (2) OR ----- A/L 10134-01/02 (1)	2/1R	103FM01Z Scye bearing seal gas leakage.  Contamination wear or deterioration of the pressure seal. Inadequate seal squeeze.	END ITEM: Suit gas leakage past primary lip seal to bearing ball/race cavity.  GFE INTERFACE: Suit gas leakage into bearing ball/race cavity. Suit pressure maintained by redundant lip seal, test port O-seal and ball port O-seal.  MISSION: None for single failure. For dual seal failure depletion of primary O2 supply and SOP. Rapid depressurization of SSA beyond SOP makeup capability.  CREW/VEHICLE: None for single failure. Loss of crewperson with loss of both primary and secondary pressure seals.  TIME TO EFFECT /ACTIONS: Seconds.	A. Design - Contamination is precluded from entering the scye bearing assembly by two 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 barrier to preclude introduction of contamination into the pressure seals and ball raceway areas.  The pressure seals are made from polyester polyurethane and are lightly lubricated with Brayco 814Z oil to preclude wear. Vespel balls act as a ball separator/spacers. Each seal cross section provides minimum of 0.0075 and maximum of 0.0325 of seal squeeze to maintain positive operational pressure. When pressurized, the seals expand to seal firmly against the bearing races to ensure a maximum bearing leak of 4 sccm and a torque that will not exceed 18 in-lbs.  B. Test - Component Acceptance Test: 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: 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 40 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 -----

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		103FM01Z		
		TIME		
		AVAILABLE:	Pressure Hours	458 1270
		Minutes	Pressure Cycles	300 1080
			Scye Flex/Ext	7430 25355
		TIME REQUIRED:	Scye Rotation	10142 25355
		Immediate.	Don/Doff Cycles	98 360
		REDUNDANCY		
		SCREENS:		
		A-PASS		
		B-N/A		
		C-PASS		
		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 has 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. Visual inspection of pressure seals and environmental seals for gouges, nicks, tears and mold imperfections.		
		2. Verification of cleanliness to VC level.		
		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 -		
		B-EMU-103-A027 (2/6/92), B-EMU-103-A028 (2/14/92) - The Dual Seal Scye Bearing exhibited excessive leakage due to an inverted primary lip seal. The inversion occurred during assembly by failure to maintain the inner and outer races in plane, resulting in the seal lip catching on the ball groove edge and inverting when the races were returned to the proper position (reverse direction). A high intensity light inspection of the assembled Dual Scye Bearing lip seals has been implemented. In addition, all suit bearings will be leak tested at a minimum of two positions while rotating the bearings through one revolution.		
		B-EMU-103-A050 (7/19/00)		
		(P/N 10134)		
		Primary seal on scye bearing leaked during flight prep. testing. Failure probably caused by insufficient lubrication of lip seals due to differences in USA/FCE and Air-Lock lubrication procedures. ECOS 002-0276 and 002-0277 revise baseline and maint. manuals to clarify application of Brayco oil to lip seals of all dynamic seals in the suit.		
		E. Ground Turnaround -		
		Tested for non-EET processing per FEMU-R-001, Final Gas Structural and Leakage. None for EET processing.		
		F. Operational Use -		
		Crew Response -		
		PreEVA: No response. Single failure not detectable.		
		EVA: No response. Single failure not detectable.		

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		103FM01Z		Training - No training covers this failure mode. Operational Considerations - Flight rules define go/no-go criteria related to EMU pressure integrity and regulation.

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

EMU CONTRACT NO. NAS 9-97150

Prepared by: *J. Chumley* 3/27/02  
HS - Project Engineering

Approved by: *SRE* 12/04/02  
NASA-SSA/SSM

*M. Snyder*  
HS - Reliability

*R. Blaw* 5/14/02  
NASA-EM/SSM

*Alan H. Poyel for PM*  
HS - Engineering Manager

*J. Funt* 5/17/02  
NASA-SSM

*A. H. Huber* 5/23/02  
NASA-MOD

*Joe Turner* 6/04/02  
NASA-EM/SSM

*B. Ahn* 6/04/02  
NASA-Program Manager