NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM04		
BODY SEAL CLOSURE, ITEM 104 --- A/L 9787-07 (1)	2/2	Physical jamming in open position. Contamination or foreign matter in latch. Defective lock/spring, ring or latch spring bent or broken latch pin. Loose alignment button screw. Impact. Missing or loose BSC cover screw.	END ITEM: Unable to lock BSC. GFE INTERFACE: Unable to assemble SSA. MISSION: Terminate EVA prep. Loss of use of one EMU. CREW/VEHICLE: None. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: N/A TIME REQUIRED: N/A REDUNDANCY SCREENS: A-N/A B-N/A C-N/A	A. Design - The disconnect operates by direct mechanical actuation of the locking latches through the external lock assembly. The design specifies tight tolerances at the disconnect interface to reduce the possibility of foreign material getting into the mated interface. The LTA is stowed in the orbiter mated to the HUT reducing the possibility of contamination prior to EVA. The BSC disconnect requires simultaneous manual actuation in three planes in order to effect a separation of the HUT and LTA sides: Downward depression of the locking button, pulling the lock subassembly forward, and pushing the subassembly to the crewman's left to release the latches. The BSC housing is machined from 7075-T73 Aluminum. The latch and latch pin are machined from 17-4 PH stainless steel, heat treated to the 1050 condition. Springs are stainless steel. High strength material and heat treated condition of the latch and latch pin preclude wear and breakage. During shock, vibration, and acceleration certification testing, the BSC, while pressurized as a part of the SSA, was struck by a 2 inch diameter spherical ball moving at a rate of 2 feet/second. No visible or performance degradation was observed. During bench shock testing, the LTA was dropped from a height of 4" on to a wooden surface with out visible degradation. Incidence of loose screws in the BSC is precluded by adherence to standard engineering torque requirements for screw installation. The stainless steel alignment button screw uses loctite thread locking adhesive and is torqued to 5-7 in.-lb. A stress analysis has been performed to verify the structural integrity of the BSC. The analysis identifies the most likely failure modes and locations. Maximum bending stress occurs at the restraint bracket. Maximum torsional stress occurs at approximately 40 degrees from the bracket. The safety factors over ultimate bending and torsion are 14.4 and 14.1, respectively, compared to a S/AD requirement of 2.0. Location / Failure Mode / Maximum Stress(psi) / Safety Factor / S/AD Safety Factor Req'd Restraint Bracket / Bending / 4712 / 14.4 / 2.0 Interface Front / Bending / 3820 / 17.8 / 2.0 40 Deg From Bracket / Torsion / 2920 / 14.1 / 2.0 Latch Interface / Bearing / 4180 / 16.3 / 2.0 Thirteen (13) screws retain the BSC cover. Two of these screws also anchor the doffing aid. The BSC cover is an elliptical ring with an "L" shaped cross section, the horizontal surface of which faces the flat surface of the mating HUT BSC. The two doffing aid screws are torqued to 7 to 9 in.-lb. The 11 cover screws are torqued to 3 in.-lb. Loss of more than one screw would be required to allow the BSC cover to move enough to cause an interference or latch malfunction that would prevent BSC locking. B. Test - Acceptance:

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		104FM04		

The body seal closure is subjected to engagement testing per Airlock ATP 9787-05 prior to acceptance by ILC to verify proper assembly and operation.
The body seal closure is subjected to engagement cycling at the LTA level in accordance with ILC Document 0111-70028J, to verify proper assembly and operation.

Certification:
The body seal closure was successfully tested (manned) during SSA certification to duplicate operational life (Ref. ILC Engineering Memorandum EM 83-1083).
The following usage, reflecting requirements of significance to the body seal closure, was documented during certification.

Requirement	S/AD	Actual
BSC Actuation Cycles	300	1080

The BSC disconnect successfully passed the shock, vibration and acceleration tests without loss of screw torque. Ref. ILC EM 84-1097.

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 information.

The following MIP's are performed during the LTA manufacturing process to assure the failure causes are precluded from the fabrication process.
Inspection of cleanliness to VC level. Verify presence of screws during torquing operations. Inspection after proof and leakage testing for deformation, defects or damage.

During PDA, the following inspection points are performed at the LTA assembly level in accordance with ILC Document 0111-70028J:
Inspection for cleanliness to VC level.
Verification of proper engagement and operation.

D. Failure History -
B-EMU-104-A026 (9/27/88) - Excessive force required to actuate BSC due to incorrectly seated latch springs. ECO 891-029 adds step to maintenance manual to verify correct installation of springs.
B-EMU-104-A031 (9/10/90) - The Vespel BSC alignment button was free to spin when its capture screw backed out, due to lack of loctite to secure the capture screw in place. Changed Airlock procedures to verify loctite application to the BSC button screw prior to assembly. Field experience indicates that the button will loosen even when loctite is used. Therefore, the button will also be bonded to the BSC housing with Hysol EA934 to increase button break-away torque from 6 in-lbs to 47 in-lbs.

B-EMU-104-A032 (12/2/91) - The Hysol-bonded Vespel BSC button fractured in

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM04		several locations due to an externally induced load which exceeded the Vespel's stength during donning or doffing of the LTA. The button material was changed to stainless steel and bonded to the BSC housing with Loctite instead of Hysol. B-EMU-104-A041 (8/25/95) - Body Seal Closure S/N 114 lock subassembly was pulled radially outward; it did not return inward after release of lock buttion. Investigation found that an interference condition existed between the lock cover and lock housing. The interference condition was corrected on the drawing and hardware in 1984. A second lock assembly exhibited sluggish operation due to sticky lubricant which occurred with use. No corrective action taken for this condition. E. Ground Turnaround - Inspected for non-EET processing per FEMU-R-001, Verify proper function of BSC. FEMU-R-001 Para 8.2 EMU Preflight KSC Checkout for EET processing. Every 4 years, or 229 hours of manned pressurized time, the BSC is removed from the LTA and disassembled, cleaned, inspected, lubricated, and reassembled. Proper operation, and LTA level structural and leakage tests are also accomplished. F. Operational Use - Crew Response - Pre-EVA : Troubleshoot problem, if no success, consider using third LTA if available. Otherwise terminate EVA operations. Special Training - Standard training covers this failure mode. Operational Considerations - EVA checklist procedures verify hardware integrity and systems operational status prior to EVA.

EXTRAVEHICULAR MOBILITY UNIT

SYSTEMS SAFETY REVIEW PANEL REVIEW

FOR THE

I-104 LOWER TORSO ASSEMBLY (LTA)

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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