NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		110FM01		
BITE VALVE ASSEMBLY, ITEM 110 --- 0110-24777-07 (1) DISPOSABLE IDB TUBING SUBASSEMBLY ITEM 110 --- 0110-812729-02 (1)	2/1R	External water leakage. IDB Bite Valve: Contamination or foreign matter in valve. Broken/defective O-ring or spring. Hole in diaphragm, defective thread. Damaged cover. DIDB Tubing Subassembly: Damaged or defective bite valve. Contamination or foreign matter in bite valve. Inadvertent actuation of bite valve. Hole in drink tube. Inadequate connection between bite valve/polyurethane tube/D-barb/ elbow port. Damaged or defective ultrasonic weld on D-barb.	END ITEM: Water leakage from bite valve or tubing subassembly into helmet and HUT. GFE INTERFACE: Depletion of potable water and water flowing into vent system. MISSION: Terminate EVA. CREW/VEHICLE: None with single failure. Loss of crewmember with loss of SOP. TIME TO EFFECT /ACTIONS: Seconds. The fan may be shut off in the event an extreme leak is detected to prevent water from entering the vent return duct. After the fan has been shut off, activate purge valve and return to airlock. TIME AVAILABLE: Minutes. TIME REQUIRED:	A. Design - IDB Bite Valve: The bite valve poppet and spring is designed to activate at a minimum vacuum force of 0.15 psid and provide a flow rate of 100 ml/scc at 1.25 + 0.1 psid vacuum. The silicone O-ring and diaphragm cover prevent contamination from entering the bite valve assembly. The bite valve is cleaned with alcohol to remove contamination and foreign matter. The outlet valve is inserted into the bladder and wrapped tightly 7-9 times with polyester thread to prevent the outlet valve from leaking at the interface. The thread is tied off with a surgical knot and then coated with urethane adhesive to cover knot and secure ends. The IDB is worn inside the HUT which protects the valve from damage. DIDB Tubing subassembly: The disposable IDB Tubing subassembly is a 3-part assembly consisting of a silicone bite valve, a polyurethane drink tube, a nylon barb inserted into a polyolefin elbow port which is heat sealed into the bladder film interface to preclude leakage and prevent contamination. The D-barb is a 3 part assembly. A dome valve is inserted between 2 halves of the barb housing. The 2 halves are snap fit together and subsequently ultrasonically welded to retain the dome valve. The dome valve resists releasing water at internal bladder pressure of up to 1.9 psi, into the drink tube. This design feature eliminates the potential for leakage if the bite valve is inadvertently actuated. The drink tube has a 60 degree bend heat set into the tube to position the bite valve close to the crewmember's mouth. All interfaces of the Tubing subassembly are friction fit. The DIDB is contained within a reusable fabric restraint that is attached to the front wall of the HUT and protects the bladder assembly from damage. B. Test - Acceptance: Component - See Inspection. PDA: The following tests are conducted at the IDB/DIDB Assembly level in accordance with ILC Document 0111-70028J (IDB) or 0111-710112(DIDB): IDB: 1. Proof pressure leakage tested in restraining fixture to 2.0 (+0.1 - 0.0) psig. 2. Leak tested to verify no leakage through valve and hose assemblies. DIDB: 1. Proof pressure/leakage tested to 2.2 psid. 2. Visual inspection to verify no leakage through valve or bladder. Certification: IDB: The IDB was successfully tested (manned) during SSA certification to duplicate six year operational usage (Ref. Cert Test Report for the SSA, ILC Document 0111-70027). The assembly was successfully tested to the S/AD ultimate pressure of 2.7 +/- 0.1 psid for 5 minutes with the IDB restrained to a maximum thickness of one inch. DIDB: The DIDB was successfully tested (manned) during certification to duplicate a single usage (with safety factor). (Ref. Cert. Test Report for the DIDB, ILC Doc. 0111-712763). The DIDB assembly successfully passed S/AD requirements

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Seconds.

including 64 actuations of the tubing sub-assembly to ensure proper operation.

REDUNDANCY SCREENS:	Requirements	S/AD	ACTUAL
A-PASS	Fill Cycles (using water)	1	2
B-PASS	Drain cycles (Bite Valve Actuation)	32	64
C-PASS	Installation/Removal into Restraint	1	2
	Don/Doff	1	2

C. Inspection -
IDB/DIDB:
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 MIPs are performed during the IDB manufacturing process to assure that the failure causes are precluded from the fabricated item:
Verify cleanliness to VC level.
Verify threads are securely wrapped, tied and coated (IDB).

PDA:
The following MIPs are performed at the IDB assembly level per ILC Document 0111-70028, and at the DIDB assembly level per ILC Document 0111-710112:
Visual inspection for material degradation and cleanliness to VC level.
Verification of successful completion of leakage test.

D. Failure History -
IDB:
I-EMU-110-001 (02/22/82). Drink Valve leaked. Revised concentricity of valve seat.

B-EMU-110-A002 (02/02/87). Drink valve leaked. Extreme care to be employed during handling of screened vent port.

B-EMU-110-A004 (1/18/89). IDB BITE valve assembly poppet stuck open, allowing water to leak out and then sealed properly in further tests. A particle lodged in the poppet seat prior to first test, and then dislodging prior to additional tests, enabling proper poppet seating. No corrective action taken.

B-EMU-110-A005 (7/31/89). The IDB Bite Valve leaked due to a piece of EVA (Ethylene Vinyl Acetate) contaminant lodged under the poppet. The contamination is from the EVA tubing fill lines at Boeing since no EVA is used in the IDB. To preclude this failure from recurring, Boeing is implementing a particulate filter into the IDB fill tool per ECM#905160.

B-EMU-110-A008 (9/10/91) - A visual inspection of the IDB revealed two black fibers and an elastomeric particle from an improperly punched drink tube hole. Per RDR B-EMU-110-A009, a 15 micron filter will be incorporated into the fill tool to preclude foreign particles like the black fibers from entering the IDB. ECO 922-0085 changes the manufacturing procedures to include a 10X inspection of

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the drink tube holes to verify they are smooth and clean of particles.

B-EMU-110-A009 (10/29/91) - The IDB outlet valve exhibited excessive leakage which could not be duplicated at ILC. The leakage could have been caused by particulate contamination lodged in the poppet area which subsequently dislodged and returned the outlet valve to normal operation. BAO has incorporated a 15 micron filter in the IDB fill tools to preclude future contamination. In addition, a flushing procedure and visual inspection has been added to IDB flight processing.

I-EMU-110-A005 (4/30/92) and B-EMU-110-A011 (11/12/92) - IDB bite valve screens debonded due to lack of Hysol adhesive. The bite valve cover/screen was changed to a one piece perforated cover, eliminating the bonded screen.

J-EMU-110-F001 (02/09/95) - External water leakage from bite valve due to corrosion between the valve poppet and housing causing poppet to stick open. Cause was residual water after current drying procedures. Revised IDB drying procedure to add 2 hours drying time beyond point when the bag is visibly dry. Also imposed 4 year bite valve internal part inspection.

B-EMU-110-A012 (3/23/95) - IDB Bite Valve leakage was being caused by a tolerance stackup condition in the poppet/diaphragm area. The current design cover can cause leakage by depressing the diaphragm and poppet under certain tolerance stackups. A new vent cover design with a counterbore to provide additional clearance was implemented.

I-EMU-110-A007 (10/13/97) - During PDA leak testing, continuous flow of bubbles noted from bite valve. Investigation revealed field replacement poppet spring had not been stretched prior to installation to provide adequate poppet sealing force. Requirement for spring adjustment was unknown and, therefore, not performed in field. Maintenance Manual and Bite Valve drawing revised to state that spring is a match fit and can only be removed/replaced at Airlock.

I-EMU-110-C003 (12/11/99) - leakage between drink tube and valve caused subject to draw air from drink bag instead of water during DIDB testing. Piggy backed to I-EMU-110-C004.

DIDB:

B-EMU-110-F003 (4/21/01) - DIDB mouthpiece leaked during STS-100 EVA's 1 & 2. Leak caused by inadvertent actuation of bite valve in conjunction of pressure applied to DIDB bladder. Pressure caused by tight proximity to neck ring. CCBD H7170 authorizes redesign of DIDB drink tube subassembly.

E. Ground Turnaround -
During ground turnaround, in accordance with FEMU-R-001, the IDB is subjected to valve functional testing, structural and leakage tests, and visual inspection for material damage or degradation.

The DIDB is not subjected to ground turnaround since it is a disposable item.

F. Operational Use -
Operation Use -

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		110FM01		IDB/DIDB: Crew Response - Pre/post-EVA : Troubleshoot problem, if no success, replace IDB/DIDB. If no replacement, terminate EVA. EVA : If significant amounts of water detected, deactivate fan, open purge valve, terminate EVA. Special Training - Standard training covers this failure mode. Operational Considerations - Flight rule A15.1.2-2 of "Space Shuttle Operational Flight Rules", NSTS-12820 defines go/no go criteria related to EMU ventilation flow. Generic EVA Checklist, JSC-48023, procedures Section 3 (EMU Checkout) and 4 (EVA prep) 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-110 IN-SUIT DRINK BAG (IDB)

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: _____
HS - Project Engineering

M. Snyder
HS - Reliability

L. Mumford 4/24/02
HS - Engineering Manager

Approved by: _____
NASA - SSA/SSM

5/4/02
NASA - EMU/SSM

Charles J Dargo 5/24/02
NASA - S & MA

See attachment
NASA - MOD

6/4/02
NASA - Crew

6/3/02
NASA - Program Manager

EXTRAVEHICULAR MOBILITY UNIT

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