NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		120BFM03		
DUAL MODE RELIEF VALVE, ITEM 120B ---------- SV785844-17 (1)	2/1R	Internal gas leakage, fails to close (high mode relief). Seat contamination, piece part structural spring fractures, failure due to plunger sticking, housing seal bypass leakage.	END ITEM: Primary oxygen delivery to the suit greater than the metabolic consumption rate. GFE INTERFACE: Increase in suit pressure and venting through the suit relief valve (Item 146). MISSION: Terminate EVA. Loss of use of one EMU. CREW/VEHICLE: None for single failure. Possible loss of crewman with loss of Item 146 or SOP. TIME TO EFFECT /ACTIONS: Seconds. TIME AVAILABLE: Minutes. TIME REQUIRED: Minutes. REDUNDANCY SCREENS: A-PASS B-PASS C-PASS	A. Design - Internal leakage is prevented by elastomeric diaphragms on the high and low mode end of the valve and by a radial O-seal on the low mode end. The diaphragm seats are protected from most contaminants by a 140 Micron filter made from inconel 625 or nickel 201 with an inconel 625 housing. The valve springs are designed for 10E+8 cyclic life to prevent fracture. The high mode plunger is protected by a 38 micron filter. The low mode plunger is protected by a 25 micron filter during normal operation. Test Port"F" does not have filtration but the rig does, thereby minimizing contaminants. B. Test - Component Acceptance Test - A performance test is run per AT-E-120-1 in which the low mode relief valve must crack at 0.26 - 0.80 psid. Crack is defined as a rapid change in flow when water pressure is increased. A failed open high mode relief valve would also be detected during the high mode relief valve crack and reseat test. In this test the high mode relief valve must crack at a minimum pressure of 16.25 psig. Cracking is defined as a minimum flow of 297 scc/min N2. The relief valve must also reseat at a pressure of 16.25 psid. Reseat is defined as a maximum flow of 297 scc/min N2. A failed open high mode relief valve would cause this test to fail. To prevent contamination from entering the item, all rig lines and test fixtures are cleaned to HS3150 EM50A. In addition, a 2 micron filter is installed in the test setup just upstream of the Item. PDA Test - A failed open high mode RV would be detected during the high mode RV reseat pressure test per SEMU-60-010. With the inlet at 16.0 psig and the outlet at 4.2-4.4 psig, the high mode RV must flow a maxiumum flow of 284 scc/min 02. A failed open high mode RV would allow a much greater flow. Certification Test - Certified for a useful life of 25 years (ref EMUM-1418). C. Inspection - Seat Contamination - A cleanliness level of HS3150 EM50A is maintained during assembly and testing of the valve. This cleanliness level requires a mandatory inspection for verification. Spring Fractures - The spring is 100% inspected to meet dimensional and force - displacement requirements. Plunger Sticks - A cleanliness level of HS3150 EM50A is maintained during assembly and testing of the valve. This cleanliness level requires a mandatory inspection for verification. The plunger (high mode) and housing are 100% inspected to meet dimensional and surface finish requirements. The 0-seals are inspected for surface characteristics per SVHS3432; 100% for Classes I and II, at least a 1.5 AQL for Class III. D. Failure History - J-EMU-120--003 (9-19-84) - High internal leakage due to a contaminant on the

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sealing surface of the high mode valve diaphragm. No corrective action. Considered to be a isolated incident, contaminated chip of unknown origin.

J-EMU-120-A002 (1-11-86) - There was a high internal leakage due to contamination on the valve seat amd sleeve/retainer. This contamination restricted the valve from reseating. corrective action is tracked by J-EMU-120-A003. (Refer to 120AFM01A Failure History).

H-EMU-120-A002 (5-27-87) - The high mode relief valve failed to reseat during the component acceptance test. The adjusting screw on the high pressure relief had moved after the original setting. The manufacturing operation sheet was revised to epoxy bond the adjusting screw immediately after the original setting.

B-EMU-120-A003 (6-28-88), B-EMU-120-A005 (10/10/88) B-EMU-120-A007 (1/6/89) - The high mode relief valve failed to reseat. Contamination discovered on valve details prevented reseat. EC's 163402-261 and 163402-262 change sleeve retainer and orifice screen assemblies to reduce corrosion due to humidity. EC 163402-190 creates a new configuration water tank (fluorel) bladder which limits corrosive elements caused by diffusion.

B-EMU-120-A008 (06/15/89), H-EMU-120-A003 (4/12/89) - Item 120 high mode relief valve failed to reseat and orifice failed to flow due to contamination blockage caused by corrosion products leaching from the gas side of the Neoprene water tank bladders. EC's 163402-261 and 163402-262 change sleeve retainer and orifice screen assemblies to reduce corrosion due to humidity. EC 163402-190 creates a new configuration water tank (Fluorel) bladder which limits corrosive elements caused by diffusion.

H-EMU-120-D008 (8/29/89) - Problem 1: Flow through the 120C Check Valve was blocked by an inverted silicone check valve flapper which sealed off the filter. EC 163402-261-003 adds a blocking plate to prevent silicone check valve inversion and flow blockage.

Problem 2: Item 120B High Mode Relief Valves failed to reseat due to Class 3B Grade 30 silicone diaphragms taking the set of the valve seat, allowing the plunger to contact the stop and leak. EC 163402-514 changes the diaphragm material to Class 2B Grade 50 silicone which has demonstrated higher resistance to compression setting than the class 3B Grade 30.

B-EMU-120-A014 (10/11/90) - The Item 120 High Mode Relief Valve failed to reseat due to the Class 3B Grade 30 silicone diaphragm taking a permanent set, allowing the plunger to contact the stop. This reduces the squeeze between diaphragm and valve seat, and leakage occurs. E.C. 163402-523 incorporates the Class 2B Grade 50 silicone valve compression set resistance.

H-EMU-120-C001 (4/8/94) - The DMRV redesign to include the 120C check valve preload washer failed the minimum reseat pressure test during cert due to drift in the test rig pressure transducer. The transducer was recalibrated and the valve was then found to be in specification. The pressure transducer was routinely calibrated every 60 days. Its calibration period has been changed to 30 days for 3 months to determine if it has a tendency to drift.

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		120BFM03		H-EMU-120-D012 (12/15/94) - The 120B Dual Mode Relief Valve S/N 019 failed minimum reseat pressure requirement due to metallic and silicone grease particles on check valve flapper and diaphragm from an unknown source. A probable source could be the backwards installation of the test fixture inlet filter. A 2 micron inlet filter has been permanently attached to the fixute to prevent the filter from being installed backwards or used on other test rigs. H-EMU-120-D013 (06/04/96) - Dual Mode Relief Valve S/N 012 failed high mode relief reseat during acceptance testing. Reseat pressure was 16.10 psid vs. spec of 16.25 psid. Test data analysis showed a downward shift in reseat pressure and full flow pressure. Most probable cause was valve spring shift due to spring wind-up. OP Sheets revised to preclude spring wind-up during adjustment, also full flow spec tightened to ensure sufficient poppet spring reseat force. H-EMU-120-D014 (05/28/97) - During high pressure relief testing, the reseat pressure was 16.18 psid vs. spec of 16.25 psid. Engineering review centered on practice of adjusting valve with a plug in place of the parallel flowing orifice (item 120) with no reduction in flow as being the cause of the low reseat pressure. Testing revised to reduce allowable flow at reseat pressure when orifice is plugged. E. Ground Turnaround - Tested for non-EET processing per FEMU-R-001, Item 120A Orifice Flow and Item 120B Relief Valve/Relief and Reseat Check. None for EET processing. F. Operational Use - Crew Response - PreEVA: Trouble shoot problem, if no success consider EMU 3 if available. EMU go to remain on SCU. PostEVA: N/A EVA: Terminate EVA when CWS data confirms loss of suit P regulation coupled with an accelerated primary 02 use rate. Training - Standard EMU training covers this failure mode. Crew trained for one man EVA scenario. Operational Considerations - Flight rules define no/go go criteria related to EMU suit pressure regulation. Flight rules define EMU as go to remain on SCU (available for rescue if required). EVA checklist and FDF procedures verify hardware integrity and operational status prior to EVA. Real Time Data Systems allows ground monitoring of EMU systems.

EXTRAVEHICULAR MOBILITY UNIT

SYSTEMS SAFETY REVIEW PANEL REVIEW

FOR THE

I-120 DUAL MODE RELIEF VALVE

CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: _____ 3/27/02
HS - Project Engineering

Approved by: _____
NASA - SR&QA/SSM

_____
HS - Reliability

_____
NASA - EMU/SSM

_____
HS - Engineering Manager

_____
NASA - S&MA

_____
NASA - MOD

_____
NASA - Crew

_____
NASA - Program Manager