

| NAME<br>P/N<br>QTY   | CRIT | FAILURE<br>MODE &<br>CAUSES   | FAILURE EFFECT   | RATIONALE FOR ACCEPTANCE  |
|--|------|---|--|---|
| WATER PRESSURE<br>REGULATOR, ITEM<br>113E<br>-----<br>SV778873-15<br>(1) | 2/1R | 113EFM01<br>Fails open.<br>Contamination.<br>Bellows<br>failure,<br>spring<br>fracture,<br>external<br>leakage in the<br>reference<br>cavity, ball<br>actuator<br>return plunger<br>jams. | END ITEM:<br>Increase in<br>water tank<br>pressure above<br>15.55 psid.<br>GFE INTERFACE:<br>Item 120B<br>controls<br>pressure 16-20<br>psid max. Flow<br>is vented to<br>the suit.<br>Increase in<br>suit pressure<br>above 4.7 psid<br>(5.5 psid<br>max.) Suit<br>relief valve<br>Item 146<br>prevents suit<br>over-<br>pressurization.<br>The flow to<br>the suit is<br>restricted by<br>Item 113B to<br>7.6 lbs./hr.<br>Primary 02<br>vented<br>overboard.<br>MISSION:<br>Terminate EVA.<br>Loss of use of<br>one EMU.<br>CREW/VEHICLE:<br>None for<br>single<br>failure.<br>Possible loss<br>of crewman<br>with loss of<br>Item 146 or<br>SOP.<br>TIME TO EFFECT<br>/ACTIONS:<br>Immediate.<br>TIME<br>AVAILABLE: | A. Design -<br>Stem clearance is 0.001-0.0015. Material combination resists galling and wear (Stem is Inconel 718, Body is Al-Bronze). Valve and sense cavity are protected by a 25 micron filter upstream and downstream and a redundant filter in the shutoff valve.<br>Oxygen system cleanliness precludes any significant amount of contamination clogging the filters. A drop in regulator pressure of 9.5 psi results in a 4 lb load to open the valve stem. The springs are operating at a stress below yield point.<br>Leakage paths are through two silicone lip seals in the seat assembly, a static radial seal on the balance stem plug, and the ball and seat interface. The lip seals have a metal to metal loaded fit downstream and are configured so that the pressure increases the sealing load on the lip. The static o-seal design configuration, dimensions and rigidness of assembly provide squeeze under all load conditions. The seal has backup rings to prevent extrusion.<br>B. Test -<br>Vendor Component Acceptance Test -<br>The manufacturer, CTI, performs a sea level performance test to assure that the regulator has not failed open.<br>Contamination is reduced/minimized by cleaning all of the internal details and oxygen passageways to HS3150 EM50A. The test facility and gases also meet the requirement.<br>PDA Test -<br>Performance tests per SEMU-60-010 verify proper feedwater regulator function. With the oxygen bottles pressurized to 850-950 psia, the regulator must regulate to 14.6 - 15.7 psig at flowrates of 0.01 - 0.02 lb/hr and 0.03 - 0.05 lb/hr 02. With the bottles pressurized to 75-85 psia, the regulator must regulate to 14.6 - 15.7 psig at a flow rate of 0.03 - 0.05 lb/hr 02. For bottle pressures of 850-950 psia and 75-85 psia, the regulator must regulate to 13.6 - 16.7 as monitored on the 132A transducer.<br>An internal leakage test is performed on the feedwater regulator per SEMU-60-010. With the oxygen bottles presurized to 850-950 psia and the pressure downstream of the regulator maintained at 15.8-16.0 psig, the maximum internal leakage shall be from 20-23 scc/min oxygen depending on actual bottle pressure.<br>All rig lines and test fixtures are cleaned to HS3150 EM150A to prevent contamination from entering the item.<br>Certification Test -<br>Certified for a useful life of 20 years (Ref. EMUM-0083).<br>C. Inspection -<br>Details are 100% inspected per drawing dimensions and surface finish characteristics. Details are manufactured from material with certified physical and chemical properties. All details, gases and test facilities are cleaned and inspected to HS3150 EM50A to preclude contamination clogging. The running and final torque of all threaded connections are verified by Vendor and DCAS inspection. A trial assembly is run on all details and then they are visually inspected. The demand valve pintle is manually depressed to assure free motion. |

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|----------|---------|--|--|
| P/N      | MODE &  |  |  |
| QTY      | CAUSES  |  |  |
| 113EFM01 |         | Minutes.<br>TIME REQUIRED:<br>Minutes.<br>REDUNDANCY<br>SCREENS:<br>A-PASS<br>B-PASS<br>C-PASS | D. Failure History -<br>EMU-113-H004 (1-2-80)<br>High feedwater pressure due to leaking Demand Valve seal. The seal was redesigned to allow sufficient volume for the elastomeric material when it is squeezed.<br><br>E. Ground Turnaround -<br>Tested for EET and non-EET processing per FEMU-R-001, V1103 Performance Data and Item 113 Regulator Check.<br><br>F. Operational Use -<br>Crew Response -<br>PreEVA: Trouble shoot problem, if no success consider EMU 3 if available. EMU no go for EVA.<br>EVA: When CWS data confirms loss of suit pressure regulation coupled with an accelerated primary O2 use rate, terminate EVA.<br>Training - Standard EMU training covers this mode.<br>Operational Considerations -<br>Flight rule A15.1.2-2 of "Space Shuttle Operational Flight Rules", NSTS-12820, defines go/no-go criteria related to EMU suit pressure regulation. 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-113 PRIMARY PRESSURE CONTROL MODULE  
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: *[Signature]* 3/20/02  
HS - Project Engineering

Approved by: *[Signature]* 6/25/02  
NASA - ~~SEA/SSM~~  
LSS

*[Signature]*  
HS - Reliability

*[Signature]*  
NASA - EMU/SSM

*[Signature]* for KMC  
HS - Engineering Manager

*[Signature]* 6/26/02  
NASA - S & MA

*[Signature]* 6/27/02  
NASA - MOD

*[Signature]* 7/1/02  
NASA - Crew

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NASA - Program Manager