

| NAME<br>P/N<br>QTY   | CRIT                                    | FAILURE<br>MODE &<br>CAUSES  | FAILURE EFFECT  | RATIONALE FOR ACCEPTANCE  |           |      |        |   |        |                  |
|--|---|--|---|---|-----------|------|--------|---|--------|------------------|
| PRIMARY OXYGEN<br>BOTTLE, ITEM 111<br>-----<br>SV784099-2<br>(2) | 1/1                                     | 111FM01<br>Structural failure, rupture.<br><br>Failure due to material defect, fatigue or weld defect. | END ITEM:<br>Release of tank shrapnel would cause structural damage to the EMU and surrounding equipment.<br><br>GFE INTERFACE:<br>Release of tank shrapnel would cause structural damage to the EMU and surrounding equipment.<br><br>MISSION:<br>Abort EVA.<br><br>CREW/VEHICLE:<br>Possible crew injury or loss of crewman resulting from shrapnel.<br><br>TIME TO EFFECT /ACTIONS:<br>Immediate.<br><br>TIME AVAILABLE:<br>N/A<br><br>TIME REQUIRED:<br>N/A<br><br>REDUNDANCY SCREENS:<br>A-N/A<br>B-N/A<br>C-N/A | A. Design -<br>SV784099-1:<br>The primary oxygen bottle is manufactured from 0.0255 +/- 0.0025 inch thick cryoformed 301 stainless steel. This material provides a high strength to density ratio and therefore a low weight bottle. Cryoformed 301 was used for the Apollo PLSS pressure vessel. This unit is designed for a burst pressure to two times maximum operating pressure and a proof of 1 1/2 times maximum operating. (Maximum operating pressure 1050 psi). The design fatigue cycles are 4 times the use cycles of 375 operating and 25 proof. In addition, a fracture mechanics analysis has been done. This analysis shows that, at operating pressure, a defect which propagates through the wall will cause a leak and not a rupture. In addition, any defect not picked up by radiographic inspection will not propagate through the wall within 4 times the use cycles. Tanks are totally enclosed within cylindrical "wells", which are part of the PLSS structure.<br><br>B. Test -<br>Component Acceptance Test -<br>The PLSS bottle acceptance test procedure is specified in SVHS 9430 Table 1. Tests are performed by vendor and are as follows:<br><br><table border="1"> <thead> <tr> <th>PARA. NO.</th> <th>TEST</th> </tr> </thead> <tbody> <tr> <td>4.2.3C</td> <td>Proof Pressure and Volumetric Expansion</td> </tr> <tr> <td>4.2.3D</td> <td>Helium Leak Test</td> </tr> </tbody> </table><br>PDA Test -<br>The Primary O2 Bottles are tested per SEMU-00-010. The bottles are proof tested to 1155-1180 psia for 5 minutes minimum. The bottles are leak tested by pressurizing to 850-950 psia with a mixture of 98% N2 and 2% He. A helium mass spectrometer is then used to "sniff" for evidence of leakage from the bottles. Throughout PDA testing, data is recorded for the amount of time the bottles are pressurized above 450 psia, the number of pressure cycles on the bottles and the maximum pressure of each cycle. This log allows accurate monitoring of the bottles' life.<br>At final inspection the item is visually inspected for evidence of damage.<br><br>Certification Test -<br>Certified for a useful life of 25 years from date of manufacture (375 charge cycles max). Ref. EMUM-1478.<br><br>C. Inspection -<br>Material or Weld Defect -<br>Fluorescent penetrant inspection is performed to detect any surface defect in the welds and the parent metal of the tank. X-ray inspection is also performed to detect any crack, voids or other irregularities in the welds and parent metal of tank.<br><br>Fatigue -<br>Visual examination of external surfaces to determine if physical damage has occurred due to the tests subjected to the tank. | PARA. NO. | TEST | 4.2.3C | Proof Pressure and Volumetric Expansion | 4.2.3D | Helium Leak Test |
| PARA. NO.  | TEST                                    |  |   |   |           |      |        |   |        |                  |
| 4.2.3C   | Proof Pressure and Volumetric Expansion |  |   |   |           |      |        |   |        |                  |
| 4.2.3D   | Helium Leak Test                        |  |   |   |           |      |        |   |        |                  |

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|--------------------|------|-----------------------------|----------------|--|
|                    |      | 111FM01                     |                | <p>Inspections of proof, leakage, radiographic inspection, and examination of interior surfaces are performed at the vendor and monitored by Hamilton Sundstrand source inspection.</p> <p>D. Failure History -<br/>None.</p> <p>E. Ground Turnaround -<br/>Tested for non-EET processing per FEMU-R-001, High Pressure O2 Leakage. None for EET processing. The number of accumulated cycles and pressurized time are tracked per SEMU-47-001.</p> <p>F. Operational Use -<br/>Crew Response -<br/>PreEVA: No response possible.<br/>PostEVA: No response possible.<br/>EVA: No response possible.</p> <p>Training - No training specifically covers this failure mode.</p> <p>Operational Considerations - Not applicable.</p> |

EXTRAVEHICULAR MOBILITY UNIT  
SYSTEMS SAFETY REVIEW PANEL REVIEW  
FOR THE  
I-111 PRIMARY OXYGEN BOTTLE  
CRITICAL ITEM LIST (CIL)  
EMU CONTRACT NO. NAS 9-97150

Prepared by: *[Signature]* 3/27/02  
HS - Project Engineering

Approved by: *[Signature]*  
NASA ~~SSM~~  
LSS

*[Signature]*  
HS - Reliability

*[Signature]*  
NASA ~~SSM~~

*[Signature]*  
HS - Engineering Manager

*[Signature]*  
NASA ~~SSM~~

*[Signature]*  
NASA ~~SSM~~

*[Signature]*  
NASA ~~SSM~~

*[Signature]*  
NASA ~~SSM~~  
Program Manager