

CIL  
EMU CRITICAL ITEMS LIST

12/24/91 SUPERSEDES 01/02/90

ANALYST:

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NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
FAN/SEPARATOR/ PUMP/MOTION ASSEMBLY, ITEM 123 ----- SV707994-B (1)	2/IR	123PROZ: Structural failure, fan blade fractures.  CAUSE: vibration, defective material.	END ITEM: Loss or reduction of vent flow to the helmet.  E/E INTERFACE: Reduction in CO2 and moisture removal capability. Increase in suit temperature, humidity and CO2 level. Possible freeze-up of the sublimator (item 140) coolant passages.  MISSION: Terminate EVA. Loss of use of one EMU.  CREW/VEHICLE: None for single failure. Possible loss of crew with loss of vent flow sensor output or SOP.	A. Design - Fan hub stresses from centrifugal loads result in a calculated factor of safety of 40. The blades on the outer half of the hub are short and stiff (.03 wide x .07 high). Balancing material is not removed near blades. Fan Rotor material is AMS 4027 Aluminum (6061-T6 condition).  B. Test - Component Acceptance Test - A performance test is performed at EVA and IVA conditions to verify the integrity of the fan. At IVA the fan inlet pressure is set to 3.89-3.95 psia, with a flow of 6.37-6.57 ACFM O2, the differential pressure across the fan must be a minimum of 3.22 inches H2O. At IVA the fan inlet pressure is set to 18.35-18.4 psia, with a flow of 7.43-7.33 ACFM O2, the differential pressure across the fan must be a minimum of 13.56 inches H2O. The item is subjected to a burn-in cycle test where it must operate for 24 hours. It is cycled 3 times at 3 hours IVA and 3 hours EVA conditions. The item is performance tested again in the EVA condition, as per above.  CEI PDA Test Per SEMU-44-010 - The item is cycled (on for two (2) hours, then off) then (10) times in the IVA mode to give 20 hours minimum of run time. The item is then performance tested in the IVA and PRESS mode. At IVA the fan outlet pressure is 0.4-1.4 psig and a flow of 6.72 ACFM O2, the differential pressure across the fan must be a minimum of 3.56 inches H2O. At PRESS the fan outlet pressure is 4.2-4.4 psig and a flow of 6.5 ACFM O2, the differential pressure across the fan must be a minimum of 3.56 inches H2O. The test fixtures and interlocking hoses are cleaned to MS3150 level EM150. The test facility O2 circuit is cleaned to MS3150 EMSQA.  Certification Test - The item completed 18,000 hours of operation and 8,400 on/off cycles exceeding the 15 year certification requirement by more than a factor of three. The 15 year structural vibration, electrical vibration, and design shock was completed 12/84. The following engineering changes have been incorporated and certified since this configuration was certified: 42806-342-35 (change power consumption

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	2/1R	125FM02:		<p>requirement more snps), 42006-406 (incorporate Nitronic 60 Retaining Nut), 42006-624 (seal cup change to assure a good weld), 42006-810 (Water pump changes 10X inspection in areas that are susceptible to contamination, move break edges and deburring and operations to class RBN J-EMU-123-010), 42006-936 (change bearing limited life requirements).</p> <p>c. Inspection - SV787994-B Assembly Level - Balance on the rotative assembly is done at 50% of spec allowances (force and moment) to achieve a vibration free and smooth running fan. The assembly is balanced to a max force imbalance of 100 micro ounce inches and a max moment imbalance of 150 micro ounce inches squared. After balance, a fan flow IPT is performed to verify baseline spec flow in both EYA and IVA nodes. Any fan damage would be detected here.</p> <p>SV769460-200 Fan Rotor Machining Level - After machining is completed, a "Zygo" check is performed per NS 447. Both the rotor ID and bushing (SV769450-2 and SV769419-2) ID's are inspected for correct size prior to pressing bushings into fan rotor at the next level of assembly (SV769460-2). These inspections verify proper press interference fit-up between rotor and bushings. Excessive pressure interference could cause rotor cracks.</p> <p>SV769460-2 Fan Rotor Assembly Level - Bushing press operation calls for heating rotor to 200 +/- 25 degrees F, and cooling the bushings to -320 degrees F, before pressure bushings to reduce press stresses on rotor. A 20,000-30,000 RPM for (2) minutes spin test is done on the rotor after final machining at the -2 level (but prior to balance) followed by an NS 447 "Zygo" check. After balance of the fan rotor, another "Zygo" check is performed. The fan rotor is packaged in bubble wrap to absorb shock in the event that the packaged item is accidentally dropped.</p> <p>d. Failure History - None.</p>

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	2/10	123W02:		<p>e. Ground Turnaround - Tested per FEMU-R-DD3, Water Servicing, Leakage and Gas Removal Test, Para. 7.3.3.2.1.1.2.</p> <p>f. Operational Use - Crew Response Pre EVA: Trouble-shoot problem, if no success, consider EMU 3 if available. EMU go for SCU ops without fan. EVA: When CUS data confirms loss of ventilation flow, terminate EVA. Training Standard EMU training covers this failure mode. Operational Considerations - Flight rules define go/no go criteria related to ventilation flow and CO2 control. Flight rules define EMU go to remain on SCU (available for rescue if required). EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Real Time Data System allows ground monitoring of EMU systems.</p>