

CIL  
EMU CRITICAL ITEMS LIST

12/24/94 SUPERSEDES 12/24/91

ANALYST:

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NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
CHECK VALVE/VEHT FLOW SENSOR, ITEM 121 ----- 6V771036-29 (1)	Z/1RB	121FMOF: falls out of tolerance, lower sensor trip point (reads high).  CAUSE: Bellows leak, spring relaxes or hook yields. Contamination (corrosion) causes increase in friction in the switch roller assembly or flapper bearings. Loss of input due to switch contact weld, electrical short in switch. Loose adjusting screw. Loose adjusting screw.	END ITEM: Fails to detect a drop in ventilation flow.  CREW INTERFACE: Unable to warn crewman of inadequate CO2 warning across face.  MISSION: None for single failure.  CREW/VEHICLE: None for single failure. Possible loss of crewman from high CO2 with double failure (sensor and reduced fan vent flow).	A. Design - The spring used in this item is selected from three springs with different spring rates. The choice of a high, medium or low spring rate spring is required to establish the correct switch setpoint during assembly. These springs are made from 17-7 material as is the hook of the pivot block assembly. The minimum factor of safety is at the hook pivot weld attachment. The factor of safety is 1.0 with a nominal load of 0.93 lbs for the strongest spring. This spring will cause the hook to yield at the extreme end of its adjustment range when the spring load will be 1.54 lbs. The hook will bend and the pivot block will rotate, relieving the overstressed condition. The configuration of existing Item 121 valves were evaluated to see if the strongest spring was assembled into any units. The evaluation revealed that the strongest spring is not assembled into any of the Item 121 valves. The bellows has a pressure rating of 105 psig, an operating max delta P of 20.2, for a pressure safety margin of 5. The bellows extension and compression strokes are controlled to provide a minimum life expectancy of 10*6 stroke cycles. The bellows is helium leak checked to 1 x 10 <sup>-9</sup> scc/sec. The roller bearings are selected for long life, packed with lubricant and shielded to minimize the chance of contamination entering them. Vent air flow is filtered by the CCC. The bearings are located away from the vent air stream. The vent flow sensor materials are selected to minimize the possibility of corrosion. The frame and counter weight is nickel plated malleory 1800 with a karocon coating. This area of the assembly is then talien coated. The switch is hermetically sealed and the amperage through the contacts is 1/1000 of the allowable to prevent the contacts from welding together.  A test run in 1984 indicated the hook sustained a load of 6.6 lbs without fracture or pulling off the pivot. This is 4.3 times the maximum load.  B. Test - The item completed 3,655 flow and 1,983 check cycles which fulfilled the 15 year life requirement during 5/85. No engineering changes have been incorporated since this time.

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2/1RB 121FH01

C. Inspection -  
Flapper Bearings Due to Corrosion - Switch roller and flapper bearings are vendor supplied lubricated (Verillube F-50 per MIL-S-81087A Type I) ball bearings monitored by N.S. source inspection. Cleanliness level of switch roller and flapper bearings are maintained to H.S. 1550 CL2. To minimum particulate contamination, all other details are maintained to H.S. 3150 EN 150.  
Spring Relaxes - Spring is 100% visually and dimensionally inspected. A force and displacement test is performed to insure proper load and spring rate is obtainable prior to assembly. Further verification is provided by in-process testing to insure proper performance before final spring adjustment bonding. Electrical short in Switch or Connecting Leads - Switches (by sampling) are tested by the vendor per MIL-S-8805 to verify that there will be no short circuiting (welding or sticking of contacts); breakage, loosening or rotation of terminals; or damage to the switch which will interface with the electrical or mechanical performance of the switch. 100% inspected assembly of electrical wires between microswitch and frame connector.

D. Failure History -  
H-EMU-121-A001 (3-25-89) - the valve actuated at an incorrect flow because the adjusting screw (used to set the operating flow level of sensor) was not locked with epoxy bond as required by the S/P and the Op sheets. The locking of the adjustment screw became a mandatory inspection point. Added a total of 50 flow cycles to the in-process test to verify repeatability of performance and stability on all future assemblies.

E. Ground Turnaround -  
None.

F. Operational Use -  
Crew Response - PreEVA: trouble shoot problem, if no success, consider the spare EMU if available, otherwise continue. EVA: No response, single failure undetectable.

Training - Standard EMU training covers this failure mode.

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	2/100	1Z1FN01:		Operational Considerations - Flight rules define go/no go criteria related to EMU vent flow sensor. EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Real Time Data system allows ground monitoring of EMU systems.