

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
O2 PRESSURE REGULATOR 2ND STAGE, ITE 213D ----- SV799042-3 (1)	1/1	213D/FMD1A: Internal gas leakage, falls open.  CAUSE: Contamination, seal failure, ball return plunger or actuator plunger jams, static seal leakage at demand valve, tip seals or balance stem O-ring. Bellows failure, leakage from the sensing cavity to ambient.	END ITEM: Accelerated depletion of SOP oxygen supply to suit; and in the event of a bellows failure, to ambient.  GFE INTERFACE: Rapid loss of emergency oxygen supply. Also, may increase suit pressure above 4.7 psid (5.5 psid max.). Positive pressure relief valve 146 prevents suit over- pressurization.  MISSION: Abort EVA. Less than 30 minutes available while on SOP.  CREW/VEHICLE: Possible loss of oxygen with accelerated consumption of SOP oxygen.	A. Design - If the actuator plunger jams, the actuator cannot be moved to EM which means the second stage could not be brought on line. The demand valve stem is protected with a 25 micron filter. Sliding parts are harder than their mating bores to prevent galling. The lip-seals have metal to metal fit on both sides and the pressure increases the load on the sealing lip. The balance stem seal is sized to provide squeeze under all load conditions. The balance stem seal has a back-up ring on both sides. The sensing chamber is sealed by a radial silicone O-seal. The dimensional control and inherent rigidity of the radial configuration assure sealing. The bellows structural integrity is assured by a 25 psid proof test which gives a margin of 5 over the normal operating pressure of 4.3 psid. The bellows and spring are designed such that interference will not occur to impede valve closing.  B. Test - Vendor Component Acceptance Test - The vendor, CFI, performs the following tests to assure the second stage regulator does not internally leak: 1) Contamination is reduced/minimized by cleaning all the regulator internal details and oxygen passageways to NS 3150 EM SQA. The test facility hardware and gases also meet this requirement. 2) The regulator internal leakage is tested during acceptance test at 7400 psi inlet.  PBA Testing - This item is internal leakage tested on the SOP. With the SOP bottles pressurized to 5800-6200 psig and the SOP shutoff feature actuated to the ON position, the outlet pressure on the regulator is set to 4.05-4.20 psid. The maximum allowable leakage is 18 scc/min O2 as measured with a laminar flowmeter from the regulator outlet. All test fixtures, interfacing hoses, and test rigs that connect to either high or low pressure circuits are cleaned to NS 3150 level EMSQA. The item is protected from contamination by placing 15 micron absolute inlet filters upstream of the test item.  Certification Test - Item completed the following cycle tests during 5/RS; ON/OFF

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ANALYST:

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	1/1	213DPA01A:		Actual 1025, Spec 1011; No Flow Hours Actual 904, Spec 18; Blowdown Actual 112, Spec 35. No Class I Engineering Changes have been incorporated since this configuration was certified.

**C. Inspection -**

All details, gages and test facilities are cleaned and inspected to H3150 EN50A to preclude contamination clogging. The O-ring and lip seals are 100% inspected for surface characteristics by the regulator vendor. Details, including the O-ring grooves and sealing surfaces, are 100% inspected per drawing dimensions and surface finish characteristics. Details are manufactured from material with certified physical and chemical properties. The running and final torque of all threaded connections are verified by Vendor and BOM inspectors. A trial assembly is run on all details and then they are visually inspected. The demand valve plunger and balance stem are manually depressed during assembly to assure free motion.

**D. Failure History -**

H-EMU-213-A001 (7-11-80) Internal leakage due to unmasked balance stem bore. Assembly procedures were changed to include a trial assembly.  
H-EMU-213-A004 (2-12-81) Internal leakage due to incorrect backup ring material. Unit was further damaged by over pressure due to lack of relief valves in the test facility. The regulator drawings and procedures were changed to incorporate the proper backup ring. The test facility was changed to incorporate relief valves.  
H-EMU-213-A005 (2-24-81) Internal leakage due to rough demand valve bore sealing surface finish. All critical sliding and sealing surfaces are inspected at 2X magnification.  
J-EMU-213-008 (10-8-82) Internal leakage due to flashing on the balance stem O-ring. O-ring and seal mold were replaced.  
H-EMU-213-0002 (11/6/89). Excessive second stage regulator flow of 7.63 lb/hr O2 was recorded at Hamilton Standard. Specification requirement is 7.49 lb/hr O2 max. The vendor, C11, recorded a flow of 6.4 lb/hr O2. It was determined that C11 used different Acceptance Test Procedures than Hamilton. Hamilton used a 7400 psia inlet pressure while C11

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	1/1	213DFM01A:		<p>used 1000 psia. CII performed the test at maximum lever displacement of greater than 0.168 inches while Hamilton set the displacement at .199 inches. The fully stroked lever allows the demand stem to move farther into the seat changing the effective area as a result of variations in the demand stem diameter. The test procedures at HS and CII were revised to make them identical.</p> <p>E. Ground Turnaround - Tested per FEMU-R-001, SOP Servicing for Flight, Shutoff Valve Internal Leakage.</p> <p>F. Operational Use - Crew Response - EVA: Since EVA termination is required as soon as SOP is flowing, crew would abort EVA when excessive SOP rate is detected. Special Training - Standard EMU training covers this failure mode. Operational Considerations - EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Flight rules define go/no go criteria related to EMU pressure integrity and regulation. Flight rules define EMU as test for loss of operational SOP. Real Time Data System allows ground monitoring of EMU systems.</p>