NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
02 PRESSURE REGULATOR 1ST STAGE, (ITEM 213B SV799042-3 (1)	1/1	213BFM01: Rupture of first stage diaphragm. CAUSE: Cyclic fatigue of diaphragm. Overpressurization.	END ITEM: Potential ignition/ combustion of non-metallics in area behind diaphragm, Oxygen fire. SPE INTERFACE: Possible oxygen fire and combustion products at SOP/PLSS interface. MISSION: Abort EVA. CREW/VEHICLE: Possible loss of crewman, EMU and vehicle.	A. Design - The diaphragm is 0.005 inch thick Inconel 718. It is formed with convolutions to minimize stresses due to stroking. Pressure induced stresses are minimized by supporting the diaphragm with a matching molded Teflon cushion backed with a 0.005 inch thick Teflon impregnated fiberglass sheet. This cushioned assembly is supported by a Belleville Spring Assembly. Non-metallic parts (Teflon) in back of the diaphragm are surrounded by low reactive materials. The materials used are stainless steel, Monel K-500, the Inconel 718 diaphragm. If the first stage were to leak, causing the interstage pressure to go to 6000 psi, and fatigue were to occur causing cracks in the diaphragm to grow such that the diaphragm ruptured, the teflon could ignite, potentially causing a fire. During normal operation of the regulator, the pressure at the diaphragm is approximately 230 psid. Were rupture to occur at this time, no fire would occur due to the low oxygen pressure and the materials behind the diaphragm. If the first stage leaked and the pressure became battle pressure, 6000 psi, and if the diaphragm developed a small leak, again no fire would result. The diaphragm would not move from its fully stroked position until the pressure fell to operating pressure of 230 psid at which pressure ignition is improbable. All of the high pressure oxygen drawings have been reviewed to assure proper oxygen cleanliness requirements, inspection for the absence of burrs and sharp corners, and compliance with the electrical bonding requirements. The SOP pressure control module and manifold tubes are made from Monel. There are nickel filters upstream of all high velocity flow areas and all non-metallic areas in the high pressure O2 flow stream to protect against particle migration. The SOP subsystem has batch lot controlled silicone seals. The seals have a teflon protection ring between an elastomer and the high pressure oxygen. The flow analysis of the primary flow control module indicates that compression heating, and O2 downstream of the module shutoff valve are within safe limits. The most vulnerable area of the SOP first stage regulator to particle impact is the sensing chamber diaphragm which is made of Inconel 718. The maximum velocity of a particle striking the Inconel 718 diaphragm during normal operation is 380 feet/second. Since the pressure in the first stage sensing cavity is 180-260

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	1/1	2138FM01:		psia during normal operation. There is no safety hazard, according to the NASA/Referenced Publication 1113, "Design Guide for High Pressure Oxygen Systems," August 1983, which states that as long as the pressure is below 3300 psia for a Inconel 718 diaphragm there is no potential for ignitability. For the case of a stuck open SOP first stage regulator flowing 7.5 pph O2 when the SOP second stage shuts, the maximum particle velocity striking the Inconel 718 diaphragm is 654 feet/second. This occurs at a SOP first stage pressure of 244 psia when initial pressure was 200 psia. From the above reference document. This is not a safety hazard. B. Test - All of the high pressure O2 components have been configuration tested for O2 compatibility at White Sands Testing Facility and each deliverable item is cycled in at 9250-psi O2 (10 times) as part of its acceptance testing. Component Acceptance Test - Testing at CIL, the regulator manufacturer, would detect a ruptured first stage diaphragm or failed Belleville Retainer Housing by a proof test at 11,200 psi and an external leakage test. Also compliance with the 100 milliohm electrical bonding test. PDA Test - The rupture of the first stage diaphragm or failure of the Belleville Retainer Housing at maximum operating pressure (210 psig normal operation or 7400 psia failed first stage regulation) would be detected by proof and leakage testing at 10,980 - 11,300 psig GN2 for 5 minutes minimum, and then visually inspected for evidence of distortion, cracks, or other defects. Sequentially, the item is externally leak tested with a 2% GHe and 98% GN2 mixture at a bottle pressure of 5800-6200 psig in chamber vacuum. The SOP leakage shall not exceed 5.55 x 10-5 scc/sec GHe. During PDA testing the SOP undergoes a minimum of 33 off - on - off cycles and a minimum of 8 fill and drain cycles. The item is flowed over the range of 0.06 - 6.2 lb/hr for a total of approximately 20.6 hours. The item is protected from contamination by placing 15 micron absolute inlet filters upstream of the test item.