NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
CO2 TRANSDUCER, ITEM 122 --- SV767798-3 (1) OR --- Y SV809145-1 (1) OR IR CO2 TRANSDUCER, --- 2 SV809286-4 (1)	2/2	122FM01: Erroneous output voltage, drifts high or full scale. CAUSE: P/Ns SV767798-3 and SV809145-1: Voltage shift in the sensor element, electronics, or output from the signal conditioner. P/N SV809286-4: Electronics failure in the microcontroller power supply, A/D converter, multiplexer, PWM, internal clock, UV PROM, or EE PROM, amp, thermocouple, thermopiles, IR Filament. Dirty or fogged windows.	END ITEM: P/Ns SV767798-3 and SV809145-1: False indication of an increase in EMU CO2 partial pressure. SV809286-4: DRIFTS HIGH: Microcontroller increases CO2 output signal above actual vent loop gas CO2 partial pressure, FAILS FULL SCALE: Sensor input signal (REFIN, IRBIT, CO2BIT, 5VREF, TEMP) drifts high or low outside monitor limits. Microprocessor fault monitor detects out of limit signal, shuts IR filament off and maintains CO2 output at full scale (30 mmHg). GFE INTERFACE: P/Ns SV767798-3 and SV809145-1: CWS issues CO2 HIGH failure warning. SUBSYSTEM: P/N SV809286-4: Elevated CO2 reading at CO2 removal canister outlet. CWS	A. Design - P/N's SV767798/SV809145: The electronics components are operating within the power derating requirements of SVHS7804. Established reliability capacitors and resistors are qualified to the requirements of MIL-R-39XXX and thermal shocked per condition B of test method 107 of MIL-STD-202. Microcircuits are qualified to the requirements of MIL-M-38510 and receive the burn in of class B parts per method 5004 of MIL-STD-883. Transistors, diodes are qualified to the requirements of MIL-S-19500 and receive the burn-in of JANTXV level parts per the applicable methods, 1038, 1039, 1040, of MIL-STD-750. Electronics and electrical assemblies designed and assembled per NASA solder spec NHB 5300. 4 (3A-1). P/N SV809145: Sensing element and electronics interface incorporates a gold plated spring/gold plated button (electrical) connector, and a KEL-F-800 coating over electrolyte sealing surfaces to minimize corrosion. P/N SV809286: The electronic components are operating within the power derating requirements of MIL-STD-975. Established reliability capacitors (Level P minimum) are qualified to MIL-C-123, MIL-C-39014, MIL-C-55365, or MIL-C-55681. Established reliability resistors (Level P minimum) are qualified to MIL-R-55342 or MIL-R-55182. Microcircuits are surface mounted DESC controlled components which are MIL-STD-883 compliant and PIND tested (cavity devices). Transistors and diodes are qualified to the requirements of MIL-S-19500, Level JANTXV as a minimum and PIND tested (cavity devices). Electronics and electrical assemblies are designed and assembled per NASA solder Spec. NHB 5300.4 (3A-1). B. Test - P/N's SV767798/SV809145: Component Acceptance Test (Vendor) - The CO2 sensor is subjected to acceptance testing per Sensormetics spec 551866 prior to shipment by the assembly vendor. This testing includes the following tests which insure the sensor output voltage stability: a) The sensing element is subjected to a vacuum (1-2 inches of Mercury) for

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	2/2	122FM01:	Issues false "CO2 HIGH, OPEN PURGE V" warning. MISSION: Terminate EVA. Loss of use of one EMU. CREW/VEHICLE: None.	16 hours to check for electrolyte leakage, moisture, or salt residue. b) Insulational resistance is measured across all functional connector pins and case at 100 VDC. This insures there are no low resistance paths which could effect output voltage stability. c) Calibration is checked to see that the unit is within specified limits. This insures the unit has not shifted after being subjected to random vibration testing (6.1 grms). PBA Test - A CO2 sensor ramp test is run per SEMU-60-010 This test subjects a powered sensor to a CO2 pressure ramp from .5 to 15 mm CO2 over a 38 minutes period. This insures the sensor will respond to a high CO2 condition properly. Certification Test - The item completed the 15 year structural vibration and shock certification requirement during 10/83. The item completed 10,084 flow cycles during 7/85 to fulfill the cycle certification requirement of 10,084. Class I. Engineering changes 42806-120 (revised partial pressure requirement), 42806-168 (new sensor cover), 42806-192 (new filter), 42806-264-1 (revised output graph), and 42806-292 (calibration test change) have been incorporated and certified by analysis/similarity since this configuration was certified. P/N SV809286: Component Acceptance Test - The CO2 transducer is subjected to the following acceptance tests per SVH613466 to ensure CO2 measurement accuracy: a) The transducer is subjected to CO2 concentrations in Oxygen of 2.5, 12, 24 and 30 mmHg at 8.0 +/- .2 psia. The transducer output accuracy must be +/-1, +/-1.2, +/-2 and +/-2 mmHg respectively. b) Sensor response time is measured for a step change in CO2 concentration from 2.5 to 24 mmHg. The sensor output must reach 90% of the 24 mmHg within 15 seconds. PBA Test - A CO2 transducer ramp test is run per SEMU-60-010. This test subjects a powered transducer to six 2.5 mmHg CO2 step increases from 0 to 15 mmHg CO2. The six IR CO2 sensor readings are verified two minutes after each step change.

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	2/2	122FM01:		This insures the transducer will respond to a high CO2 condition properly. Certification Test - The item completed the 15 year structural vibration and shock certification requirements during 11/94. C. Inspection - P/N's SV767798/SV809145: The assembly vendor calibrates the sensor and then lets it sit for at least 30 days before rechecking. If the sensor output voltage has shifted it is reprocessed through temperature cycling or readjusted until it becomes stable. All compensating resistors solder joints are inspected per MHR-5300-4 (3A-1). The sensory element is visually inspected prior to assembly for workmanship to ensure there are no flaws that could effect performance. P/N SV809286: The sensor head vendor calibrates the sensor head and provides a unique calibration table which is incorporated into the sensor microcontroller. All solder joints are inspected per MHB-5360.4 (3A-1). D. Failure History - P/N SV767798: Related Failure: H-ENU-155-081 (4-22-87) Shield circuit resistance too high. The high resistance was a result of the use of a lubricant on the interfacing connector shell surface. This prevents proper grounding of the mating connector. EC-42807-1239-2 adds a grounding ring, provided by Bendex Corp., to all units. There is no impact on certification. P/N SV809145: B-ENU-122-A001 (3/20/91) - During post flight processing a "CO2 30.0 mmHg" reading was displayed on the OCH. Internal electrolyte leakage from the sensing element most likely caused a relative short between the electrodes causing a high voltage output. The corrective action is to incorporate EC 163402-676 that requires the installation of a gold plated copper disk that is soldered over the center electrode solder ball and a layer of KEL-F-800 barrier coating on the possible electrolyte leakage path intersections.

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	2/2	122FM01:		P/N SV809286: 8-EMU-122-A003 (5/5/94) - The IR CO2 Transducer latched high (30 mmHg or 5.0 volts) when the O2 actuator was moved to the "PRESS" position during pre chamber CO2 functional verification O2 purge sequence. This occurred because the digital/analog circuit didn't have enough time to reach its comanded valve of 0.5 volts (0% CO2) during CO2 partial pressure change from 15 mmHg to 0 mmHg. EC 163402-567-001 extends the software feedback check time which ensures that the digital/analog circuit reaches its commanded value from 10 to 20 seconds. H-EMU-122-C005 (5/9/94) - Upon initial power-up for the cold soak portion of the Thermal Life Cycle Cert Test, the IR CO2 Transducer latched high (30 mmHg or 5.0 volts). When the transducer is turned on, the microprocessor drives the IR source to its maximum current to achieve warm-up and loop control within 10 seconds. This caused the CO2 detector with a higher gain than the reference detector to exceed the software failure limit of 4.99 VDC. Per EC 163402-567-001, the 4.99 VDC over-voltage check for the CO2 detector has been eliminated by increasing the upper voltage limit to 5.0 VDC. J-EMU-122-C001 (2/22/93) - The IR CO2 transducer failed high (30 mmHg) due to water migrating into the sense cell cavity which absorbs the IR energy and prevents the energy from reaching the detectors. Free water can enter the sense cell cavity from either the sublimator water carryover during normal EMU operation or during ground handling from the sensor outlet line during 1-12D dryout operation when the SEMU is inverted. A water barrier (ZITEX) has been added to the sense cell inlet and outlet to preclude water from entering the sense cell. H-EMU-122-A005 (08/12/94) - During testing, IR CO2 sensor S/N 0005 output voltage latched high in air at ambient conditions due to an internal open circuit failure at the flex tape connector (which interconnects the two printed circuit boards) caused by mishandling/improper solder joint. The flex tape connector has been replaced with a pin and socket connector to eliminate solder joint. E. Ground Turnaround -

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	2/2	122FM01:		P/N's SV767798/SV809145/SV809286: Tested per #EMU-R-001, para. 7.3.3.3.2.1, CO2 Response Time Check. F. Operational Use - P/N's SV767798/SV809145/SV809286: Crew Response - PreEVA: Trouble shoot problem, if failure can be determined to be sensor, Continue with EVA prep. EMU no go for EVA. EVA: When CWS data confirms a high CO2 condition exist, trouble shoot problem with helmet purge valve, If failure can be determined to be sensor, continue EVA, otherwise terminate EVA. Training - Crewman are trained to recognize the symptoms of high CO2. Operational Considerations - Flight rules define go/no go criteria related to EMU suit ventilation and CO2 control. EVA checklist procedures verify hardware integrity and sys. operational status prior to EVA. Real time Data system allows ground monitoring of EMU systems.