

CIL
 EMU CRITICAL ITEMS LIST

12/24/91 SUPERSEDES 08/31/90

ANALYST:

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NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
CO2 TRANSDUCER, ITEM 122 ----- SV767790-1 (3)	2/180	122FH03; Slow response. CAUSE: Piece part failure of the sensor glass bulb allowing electrolyte to leak out. Contamination of the sensing element membrane or aging of the glass bulb.	END ITEM: CO2 partial pressure reading remains low for an actual elevated CO2 environment. CPE INTERFACE: Unable to quickly detect an increase in EMU CO2 level. CO2 partial pressure higher than sensor reading. MISSION: None. CREW/VEHICLE: None for single failure. Possible loss of crewman with loss of CO2.	A. Design - The material geometry system used for the glass bulb sensing element balances response time and length of time the CO2 sensor is usable before requiring recalibration or refurbishment. The glass bulb is replaced during each refurbishment to ensure long sensor life. The glass bulb is enclosed in a nickel plated aluminum shield to offer mechanical protection. B. Test - Component Acceptance Test (Harder) - The CO2 sensor is subjected to acceptance testing per Sensormatics spec 552066 prior to shipment. This testing includes the following tests which ensure the sensor output voltage stability: a. Insulation resistance is measured across all functional connector pins and case at 100VDC. This ensures there are no low resistance paths which would affect output voltage stability. b. Sensor response time is measured during calibration checkouts to ensure the sensor will respond to a change in CO2 concentration as required. PDA Test - A CO2 sensor ramp test is run per SEMU-60-010 which subjects powered sensor to a CO2 pressure ramp from 0.5 to 15 mm CO2 over a 30 minute period. This ensures the sensor will respond to a high CO2 condition properly. Certification Testing - The item completed the 15 year structural vibration and shock certification requirement during 10/83. The item completed 10,000 flow cycles during 7/85 to fulfill the cycle certification requirement of 18,000, Class 1 engineering change 42806-120 (revised partial pressure requirements), 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. C. Inspection - The assembly vendor inspects the glass bulb and calibrates

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	2/100	122FMB3:		<p>the sensor. It then is stored for at least 30 days before rechecking. If the sensor output voltage shifts an amount deemed unacceptable by the vendor, it is reprocessed through temperature cycling or readjusted until it becomes stable. The vendor also verifies that the sensor is visibly clean prior to tests and shipment.</p>

O. Failure History -

H-EMU-122-A002 (8-29-81) During PLSS PDA, the CO2 sensor output was below the specified limits for the actual test gas being used. It was concluded that the outage was caused by a foreign particle lodged in the CO2 sensor port preventing flow of gas to the sensor even though no particles were ever found. No corrective action was taken since the condition was considered an isolated occurrence and was found during PDA.

H-EMU-122-A003 (4-5-83) During PLSS PDA, the CO2 sensor output was less than the test gas CO2 concentration being used. The PLSS S/AO was changed per EC42806-120 to change the accuracy requirements below 10 mmHg CO2 partial pressure to insure actual 0mmHg read less than 2mmHg on the sensor readout. (original sensor spec allows 7.6 mmHg reading at 0mmHg actual).

H-EMU-122-D001 (1-10-84) The output voltage of the CO2 sensor was below spec for IX gas during the sensor calibration check. It was determined that the vendor calibration procedure was not compatible with its requirements. The vendor's procedure was revised.

H-EMU-122-A004 (4-24-86) During PLSS PDA CO2 pressure ramp testing, the sensor output was 1.6mmHg under the low limit of 9mmHg at a CO2 level of 15.1mmHg. Subsequent testing verified that the CO2 flow path to the reference CO2 sensor was longer than that of the flight item causing the response time to be too long. This has been corrected and the unit in question has successfully been retested.

H-EMU-122-D002 (2-4-87) - The transient response was 55.3 % compared to the spec requirement of 63% minimum. The cause of this premature reduction in sensor response is rapid aging of the porous glass bulb. The corrective action for this cause is to incorporate EC 363402-102 which requires the installation of a new glass bulb each time the sensor is refurbished. Field units will have their bulbs replaced when they require refurbishment.

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2/1R0 122FH03:

E. Ground Turnaround -
Tested preflight per FEMU-R-001, CO2 Response Time Check.

F. Operational Use -
Crew Response
Pre-EVA: Rn response, single failure undetectable by crew or ground.
Post EVA: N/A
EVA: Rn response, single failure undetectable by crew or ground.
Training
Crewmen are trained to recognize the symptoms of high CO2.
Operational Considerations
Flight rules define go/no-go criteria related to EMU ventilation flow and CO2 control.
EVA checklist procedures verify hardware integrity and systems operational status prior to EVA. Real Time Data System allows ground monitoring of EMU systems.