

National Personal Protective Technology Laboratory

LTFE Critical Parameters

Pittsburgh PA

Heinz W Ahlers

March 22, 2007

Life Support Criteria for LTFE

Critical Parameters		
Duration	As specified	
Oxygen	15 %	1 Minute average, taken at 1 minute intervals
Carbon Dioxide	4%	See above
Loose Material in Breathing Circuit	< 5mg.	Present in breathing tube or mouthpiece on opening
Breathing Circuit integrity	No punctures, tears or breaks	

Major and Minor Parameters

- **Major Parameter**
 - A non-critical parameter that results in reduced protection for an individual using the SCSR
 - Examples are chemical migration from bed or scrubber in the breathing circuit interfering with donning the respirator; failure of Oxygen starters
- **Minor Parameter**
 - A parameter that is not likely to reduce the usability of the SCSR
- **Classification of observed parameter determined by NIOSH**

Current SCBA Approval Criteria

- 42 CFR 84 Subpart H –Self Contained Breathing Apparatus.
 - 84.70 (a) 91) Closed circuit apparatus

Duration

- 84.96 (a) The closed-circuit apparatus will be classified according to the length of time it supplies adequate **breathing gas** to the wearer during man test No. 4 described in table 4 of this subpart.

Oxygen content

- **84.79: minimum requirements**
 - (a) Breathing gas used to supply apparatus shall be respirable and contain no less than 19.5 (dry atmosphere) volume percent oxygen.

Carbon Dioxide (CO₂) Content

- 84.97(c) maximum 2.0 percent carbon dioxide in inspired air for a one hour device (dead space test)
- 84.97(d) gas samples taken during the man test shall not contain more than more than 1.5 percent CO₂ taken downstream of the sorbent for mouthpiece only devices

Use of the BMS machine

- **BMS is operated at the following conditions:**
 - Oxygen Consumption Rate, $VO_2 = 1.35$ lpm
 - Carbon Dioxide Production Rate, $VCO_2 = 1.15$ lpm
 - Ventilation Rate, $V_e = 30$ lpm
 - Respiratory Frequency, 18 breaths per minute
- **These values have been selected to approximate human performance at an equivalent VO_2**
 - **Steady-state respiratory responses to tasks used in Federal testing of self-contained breathing apparatus.** Eliezer Kamon, Thomas Bernard, and Richard Stein. American Industrial Hygiene Association Journal, December 1975, pp. 886-896.

Critical parameters

- The critical parameters were selected to allow some change from the certification test requirements
 - Oxygen level is greater than or equal to 15.0 percent
 - CO₂ level is less than or equal to 4.0 percent
 - Foreign material loose in the breathing circuit shall not exceed 5 milligrams
 - The breathing circuit shall not contain rips or tears in the breathing bag or breathing tube and nor breach of the breathing circuit integrity in any components

Critical Parameter Failure

- SCSR devices tested must pass a rigorous inspection to manufacturers standards
 - Critical parameters are expected to be related to storage NOT rough handling
- Critical parameter failures will result in the opening of a Certified Product Investigation Process to determine appropriate remedial action

Major or Minor Parameter Failure

- Major and minor parameter failure will be statistically evaluated to the AQL criteria in 42 CFR 84.41 (g)
 - A CPIP will be opened for defects exceeding the applicable AQL .
 - For defects within the acceptable AQL the manufacturer will be informally notified.

Reporting Requirements

- **SCSR Collection Report**
 - Only units meeting a strict application of the inspection criteria are accepted
 - For units not accepted the criteria for not accepting are reported to MSHA, Mine operator, worker
- **Individual mine testing report**
 - Serial number, pass or fail criteria
 - MSHA, mine operator
 - On completion of test
- **Annual Report**