National Personal Protective Technology Laboratory

LTFE Critical Parameters

Pittsburgh PA

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## Life Support Criteria for LTTE

<table>
<thead>
<tr>
<th>Critical Parameters</th>
<th>Duration</th>
<th>Oxygen</th>
<th>Carbon Dioxide</th>
<th>Loose Material in Breathing Circuit</th>
<th>Breathing Circuit integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>As specified</td>
<td>15 %</td>
<td>4%</td>
<td>1 Minute average, taken at 1 minute intervals</td>
<td>See above</td>
</tr>
<tr>
<td>Oxygen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Present in breathing tube or mouthpiece on opening</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No punctures, tears or breaks</td>
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</table>
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
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 (CO$_2$) 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 CO$_2$ taken downstream of the sorbent for mouthpiece only devices
Use of the BMS machine

- BMS is operated at the following conditions:
  - Oxygen Consumption Rate, VO2 = 1.35 lpm
  - Carbon Dioxide Production Rate, VCO2 = 1.15 lpm
  - Ventilation Rate, Ve = 30 lpm
  - Respiratory Frequency, 18 breaths per minute

- These values have been selected to approximate human performance at an equivalent VO2

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
  - CO$_2$ 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 breech 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