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Procedure No. CVB-APR-STP-0088

Revision: 0.0

Date: 23 March 2020

DETERMINATION OF LOW FLOW WARNING DEVICE  
ACTIVATION FOR POWERED AIR-PURIFYING RESPIRATORS, SERIES PAPR100,  
STANDARD TESTING PROCEDURE (STP)

1. PURPOSE

This procedure establishes the method for ensuring that the level of protection provided by the low flow warning device requirement for powered air-purifying respirators, series PAPR100, meet the requirements set forth in 42 CFR Part 84, Subpart K, 84.171(j).

2. GENERAL

This procedure describes the Determination of Low Flow Warning Device Activation for Powered Air-Purifying Respirators, Series PAPR100, test procedure in sufficient detail that a person knowledgeable in the appropriate technical field can select equipment with the necessary resolution, conduct the test, and determine whether or not the product passes the test.

3. EQUIPMENT/MATERIAL

- 3.1. Air-tight chamber – approximately 24 inches by 24 inches by 16 inches with a bolt on door, a 3-inch diameter inlet for accepting breathing tubes and adapter, a 1 inch diameter outlet, and a ¼ inch outlet for a manometer probe.
- 3.2. Setra Datum 2000 Model 239 digital manometer with an accuracy of  $\pm 0.023$  in-H<sub>2</sub>O or better, or equivalent.
- 3.3. Teledyne Hastings L-25S Laminar Mass Flow Meter, or equivalent.
- 3.4. Spencer 075-1/3 Centrifugal Blower vacuum source, or equivalent.
- 3.5. Anthropometric Headform, in accordance with ISO 16900, size medium, or equivalent.

4. TESTING REQUIREMENTS AND CONDITIONS

- 4.1. Prior to beginning any testing, confirm that all measuring equipment employed has been calibrated in accordance with the testing laboratory's calibration procedure and schedule. All measuring equipment utilized for this testing must have been calibrated using a method traceable to recognized international standards when available.
- 4.2. Testing shall be conducted on as-received respirators at  $25 \pm 2.5$  degrees Celsius ( $^{\circ}\text{C}$ ) and adhere to User's Instructions.

- 4.3. Three complete respirator systems will be evaluated for low flow warning device activation.
- 4.4. Determination of Low Flow Warning Device Visibility will be completed for any respirator with a visual warning device. The standard testing procedure is described in CVB-APR-STP-0087.
- 4.5. Determination of Low Flow Warning Device Sound Level on Series PAPR100 will be completed for any respirator with an audible warning device, where the warning provided is audible only, or other warnings are not readily apparent. The standard testing procedure is described in CVB-APR-STP-0085.

## 5. PROCEDURE

- 5.1. Prior to any testing, the respirator shall be evaluated per the user check instructions in the User's Manual to ensure that the low flow warning(s) activate as designed.
- 5.2. Test setup for low flow warning device activation for continuous flow powered air-purifying respirators
  - 5.2.1. The test chamber outlet is connected to the mass flow meter inlet. The mass flow meter outlet is connected to the vacuum blower inlet. A flow control valve is placed between the mass flow meter and vacuum blower. The vacuum blower vents to atmosphere. Ensure that all pipe lengths are sufficient to maintain laminar flow.
  - 5.2.2. Mount the respirator to the headform in the as-worn configuration following all pertinent User's Instructions.
  - 5.2.3. Connect the headform and respirator to the chamber.
    - 5.2.3.1. On units with breathing tubes, the breathing tube is placed through the chamber inlet port and the blower is placed outside of the chamber. The headform and respirator are placed inside the chamber. Seal the chamber inlet around the breathing tube.
    - 5.2.3.2. On units without breathing tubes, the headform trachea outlet tube is placed through the chamber inlet port and the headform and respirator are placed outside the chamber. Seal the chamber inlet around the headform outlet tube.
      - 5.2.3.2.1. Loose fitting respiratory inlet coverings may be adjusted to capture air-flow that would otherwise exit the respirator.
  - 5.2.4. Connect the digital manometer to the pressure tap on the headform. Pressure is measured at a pitot ring positioned 25 mm inside of the trachea inlet.
    - 5.2.4.1. Ensure the manometer has a reading of zero at ambient conditions, and adjust if necessary.

- 5.2.5. Close the chamber door and ensure the chamber is sealed.
- 5.2.6. Turn on the PAPR and the vacuum blower. Ensure that no air flow warnings are present on the respirator.
- 5.2.7. Adjust the flow control valve until manometer has a reading of zero.
- 5.2.8. Restrict the flow to the respirator. This is done by incrementally adding restriction to the inlet of the respirator, such as attaching small pieces of adhesive tape or a similar flow restricting item.
  - 5.2.8.1. While restricting flow to the respirator, adjust the flow control valve to ensure that the manometer continuously reads zero.
- 5.2.9. Add increased flow restriction to the respirator inlet until the low flow warning device activates. Record the maximum airflow which activates the low flow warning device.
- 5.2.10. Turn off the PAPR100 and vacuum blower.

## 6. PASS/FAIL CRITERIA

- 6.1. The criterion for passing this test is set forth in 42 CFR Part 84, Subpart K, Section 81.171(j).
  - 6.1.1. The low flow warning must actively and readily indicate when flow inside the respiratory inlet covering falls below the minimum required air flow. The minimum air flow shall be 115 LPM for tight-fitting PAPR100 and 170 LPM for loose-fitting PAPR100.
  - 6.1.2. Any warning must be detectable by the wearer without any intervention by the wearer.
  - 6.1.3. Warning devices must be configured so that they may not be de-energized while the blower is energized.
  - 6.1.4. Any warnings which require different reactions by the wearer must be distinguishable from one another.

## 7. RECORDS/TEST SHEETS

- 7.1. Record the test data in a format that shall be stored and retrievable.

### Revision History

<b>Revision</b>	<b>Date</b>	<b>Reason for Revision</b>
0.0	23 March 2020	Original Release