

## Bacterial Filtration Efficiency (BFE) GLP Report

Test Article: BTL Respirator  
C-FIT Healthcare Respirator  
Study Number: 1346707-S01  
Study Received Date: 28 Sep 2020  
Testing Facility: Nelson Laboratories, LLC  
6280 S. Redwood Rd.  
Salt Lake City, UT 84123 U.S.A.  
Test Procedure(s): Standard Test Protocol (STP) Number: STP0004 Rev 18  
Deviation(s): None

**Summary:** The BFE test is performed to determine the filtration efficiency of test articles by comparing the bacterial control counts upstream of the test article to the bacterial counts downstream. A suspension of *Staphylococcus aureus* was aerosolized using a nebulizer and delivered to the test article at a constant flow rate and fixed air pressure. The challenge delivery was maintained at  $1.7 - 3.0 \times 10^3$  colony forming units (CFU) with a mean particle size (MPS) of  $3.0 \pm 0.3 \mu\text{m}$ . The aerosols were drawn through a six-stage, viable particle, Andersen sampler for collection. This test method complies with ASTM F2101-19 and EN 14683:2019, Annex B.

All test method acceptance criteria were met.

Test Side: Inside  
BFE Test Area:  $\sim 7.8 \text{ cm}^2$   
BFE Flow Rate: 28.3 Liters per minute (L/min)  
Conditioning Parameters:  $85 \pm 5\%$  relative humidity (RH) and  $21 \pm 5^\circ\text{C}$  for a minimum of 4 hours  
Test Article Dimensions:  $\sim 211 \text{ mm} \times \sim 163 \text{ mm}$   
Positive Control Average:  $2.1 \times 10^3$  CFU  
Negative Monitor Count:  $< 1$  CFU  
MPS:  $3.0 \mu\text{m}$

### Results:

Test Article Number	Percent BFE (%)
1	$>99.9^a$
2	$>99.9^a$
3	$>99.9^a$
4	$>99.9$
5	$>99.9^a$

<sup>a</sup> There were no detected colonies on any of the Andersen sampler plates for this test article.



Christopher Acker electronically approved  
Study Director

Christopher Acker

19 Nov 2020 23:21 (+00:00)  
Study Completion Date and Time

The filtration efficiency percentages were calculated using the following equation:

$$\% BFE = \frac{C - T}{C} \times 100$$

C = Positive control average  
T = Plate count total recovered downstream of the test article  
Note: The plate count total is available upon request

**Test Article Preparation:** The test articles were conditioned for a minimum of 4 hours at  $21 \pm 5^\circ\text{C}$  and  $85 \pm 5\%$  RH, prior to BFE testing.

**Test Method Acceptance Criteria:** The BFE positive control average shall be maintained at  $1.7 - 3.0 \times 10^3$  CFU.

The MPS control average of the challenge aerosol shall be maintained at  $3.0 \pm 0.3 \mu\text{m}$ .

**Procedure:**

**BFE:** A culture of *S. aureus*, ATCC #6538, was diluted in peptone water (PEPW) to yield challenge level counts of  $1.7 - 3.0 \times 10^3$  CFU per test article. The bacterial culture suspension was pumped through a nebulizer at a controlled flow rate and fixed air pressure. The constant challenge delivery, at a fixed air pressure, formed aerosol droplets with a MPS of approximately  $3.0 \mu\text{m}$ . The aerosol droplets were generated in a glass aerosol chamber and drawn through a six-stage, viable particle, Andersen sampler for collection. Test articles, positive controls, and reference material received a one minute challenge followed by a one minute vacuum cycle.

The Andersen sampler, a sieve sampler, impinged the aerosol droplets onto six soybean casein digest agar (SCDA) plates based on the size of each droplet. The agar plates were incubated at  $37 \pm 2^\circ\text{C}$  for  $48 \pm 4$  hours and the colonies formed by the bacteria laden aerosol droplets were then counted and converted to probable hit values using the positive hole conversion chart provided by Andersen. These converted counts were used to determine the average challenge level delivered to the test articles. The distribution ratio of the colonies on each of the six agar plates was used to calculate the MPS of the challenge aerosol.

## Quality Assurance Statement

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**Compliance Statement:** The test was conducted in accordance with the USFDA (21 CFR Parts 58, 210, 211, and 820) Regulations. This final report reflects the raw data.

Activity	Date
Study Initiation	08 Oct 2020
Phase Inspected by Quality Assurance: Sample Preparation	10 Oct 2020
Audit Results Reported to Study Director	10 Oct 2020
Audit Results Reported to Management	12 Oct 2020

Scientists	Title
Adrienne Sandall	Supervisor
Chris Acker	Study Director

**Data Disposition:** The study plan, raw data and final report from this study are archived at Nelson Laboratories, LLC or an approved off-site location.

Robert De Vargas electronically approved  
Quality Assurance

19 Nov 2020 00:48 (+00:00)  
Date and Time