LONG JING TESTING LAB

ilac-MRA IAS ACCREDITED Testing Laboratory
TL-1008

Test Report

Report No.: TL1008-HP2812202101r

Report Issue Date: 28 Dec 2021

Applicant	:	H-PLUS Mask Hong Kong
Address	:	Room 603, Midas Plaza, 1 Tai Yau St, San Po Kong, Kowloon
Sample Received	:	13 Dec 2021
Sample Description	:	H-Plus 3D Mask
Test Period	:	14-23 Dec 2021
Test Standard	:	ASTM F2100-19 & ASTM F2101 VFE
Model No.	:	3D Series

Summary of Test Results

Standard: ASTM F2100-19	**Conclusion for Level 3 Comply**
Particle Filtration Efficiency (PFE%)	**Pass**
Bacterial Filtration Efficiency (BFE%)	**Pass**
Viral Filtration Efficiency (VFE%)	**Pass**
Synthetic Blood Penetration Resistance (160 mmHg)	**Pass**
Different Pressure (H_2O/cm^2)	**Pass**
Flammability	**Pass**

- FOR TEST REPORT DETAILS. PLEASE REFER TO THE ATTACHED PAGE(S) -

Tested By:

Eric W.
Technical Engineer

Approved By:

Lab Manager

Test Completion Date: 23 Dec 2021

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Latex Particle Challenge (PFE) Test Report

Test method

This procedure was performed to evaluate the non-viable particle filtration efficiency (PFE) of the test article. Monodispersed polystyrene latex spheres (PSL) were nebulized (atomized), dried, and passed through the test article. The particles that passed through the test article were enumerated using a laser particle counter.

A one-minute count was performed, with the test article in the system. A one-minute count was performed. Counts were performed to determine the average number of particles delivered to the test article. The filtration efficiency was calculated using the number of particles penetrating the test article compared to the upstream and downstream.

The procedure employed the basic particle filtration method described in ASTM F2299, with some exceptions.

Conditioning Period (At temperature of 21 ± 5 °C and relative humidity of 85 ± 5 %): 4 hours

Test Side: Inside
Area Tested : ~ 100 cm^2
Particle size : ~ 0.1 µm

Results

Test Sample #	Test Article Counts Upstream	Test Article Counts Downstream	Filtration Efficiency (%)
1	41039	244	99.405
2	40225	287	99.287
3	39203	182	99.536
4	37783	234	99.381
5	36436	327	99.103

Bacterial Filtration Efficiency (BFE) Test Report

Test method

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 x 10^3 colony forming units (CFU) with a mean particle size (MPS) of 3.0 ± 0.3 µm. 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.

Conditioning Period (At temperature of 21 ± 5 °C and relative humidity of 85 ± 5 %): 4 hours

Test Side: Inside

Area Tested: ~ 50 cm^2

BFE Flow Rate: 28.3 Liters per minute (L/min)

Mean Particle size : 3.0 µm ± 0.1 µm

Average Plate count Results for positive Controls: 1902

Average Plate count Results for Negative Controls: 01

Results

Test Sample #	Filtration Efficiency (BFE) (%)
1	99.9
2	99.9
3	99.8
4	99.9
5	99.9

The filtration efficiency percentages were calculated using the following equation:

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

C = Positive control average

T= Plate count total recovered downstream of the test article

Remark:

1. The plate count total is available upon request.
2. The sample is tested as received.
3. The analysis was performed by assessed competent subcontractor laboratory.

Viral Filtration Efficiency (VFE) Test Report

Test method

The VFE test is performed to determine the filtration efficiency of test articles by comparing the viral control counts upstream of the test article to the counts downstream. A suspension of bacteriophage ΦX174 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 - 3.3 x 10^3 plaque forming units (PFU) with a mean particle size (MPS) of 3.0 µm ± 0.3 µm. The aerosol droplets were drawn through a six-stage, viable particle, Andersen sampler for collection. The VFE test procedure was adapted from ASTM F2101-19.

Conditioning Period (At temperature of 21 ± 5 °C and relative humidity of 85 ± 5 %): 4 hours

Test Side: Inside

Area Tested: ~ 47 cm^2

VFE Flow Rate: 28.3 Liters per minute (L/min)

Mean Particle size : 3.0 µm ± 0.1 µm

Average Plate count Results for positive Controls: 1.1 x 10 PFU

Average Plate count Results for Negative Controls: <1 PFU

Results

Test Sample #	Percent VFE (%)
1	99.8
2	99.9
3	99.9
4	99.9
5	99.8

The filtration efficiency percentages were calculated using the following equation:

$$\% \text{ VFE} = \frac{\text{C} - \text{T}}{\text{C}} x\ 100$$

C = Positive control average

T= Plate count total recovered downstream of the test article

Remark:

1. The plate count total is available upon request.
2. The sample is tested as received.
3. The analysis was performed by assessed competent subcontractor laboratory.

Differential Pressure (Delta P) Test Report

Test method

The Delta P test is performed to determine the breathability of test articles by measuring the differential air pressure on either side of the test article using a manometer, at a constant flow rate. The Delta P test complies with EN 14683:2019, Annex C and ASTM F2100-19.

Conditioning Period (At temperature of 21 ± 5 °C and relative humidity of 85 ± 5 %): 4 hours

Delta P Flow Rate: 8 Liters per minute (L/min)

Results

Test Sample #	Delta P (mm H2O/cm^2)	Delta P (Pa/cm^2)
1	3.11	30.50
2	3.19	31.30
3	2.96	29.00
4	2.99	29.30
5	3.17	31.10

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Synthetic Blood Penetration Resistance Test Report

Test method

This procedure was performed to evaluate surgical facemasks and other types of protective clothing materials designed to protect against fluid penetration. The purpose of this procedure is to simulate an arterial spray and evaluate the effectiveness of the test article in protecting the user from possible exposure to blood and other body fluids. The distance from the target area surface to the tip of the cannula is 30.5 cm. A test volume of 2 mL of synthetic blood was employed using the targeting plate method. This test method was designed to comply with ASTM F1862 (as referenced in EN 14683:2019)

Conditioning Period (At temperature of 21 ± 5 °C and relative humidity of 85 ± 5 %): 4 hours

Test Side: Outside
Number of Test Articles Tested: 32
Number of Test Articles Passed: 32

Results (Test Pressure: 160 mmHg (21.3 kPa)

Test Sample #	Synthetic Blood Penetration
1-32	None Seen

Remark
Per ASTM F1862 and ISO 22609, an acceptable quality limit of 4.0% is met for a normal single sampling plan when ≥29 of 32 test articles show passing results.

Flammability of Clothing Textiles Test Report

Test method

This procedure was performed to evaluate the flammability of plain surface clothing textiles by measuring the ease of ignition and the speed of flame spread. The parameter of time is used to separate materials into different classes, thereby assisting in a judgment of fabric suitability for clothing and protective clothing material. The test procedure was performed in accordance with the test method outlined in 16 CFR Part 1610.

Conditioning Period (At temperature of 21 ± 5 °C and relative humidity of 85 ± 5 %): 4 hours

Article Side Tested: Outside Surface
Orientation: Machine

Results

Test Sample #	Time of Flame Spread
1	IBE (Ignite but extinguished)
2	IBE (Ignite but extinguished)
3	IBE (Ignite but extinguished)
4	IBE (Ignite but extinguished)
5	IBE (Ignite but extinguished)

Remark

The 16 CFR Part 1610 standard specifies that 10 replicates are to be tested if, during preliminary testing, only 1 test article exhibits flame spread and it is less than 3.5 seconds or the test articles exhibit an average flame spread less than 3.5 seconds. Five replicates are to be tested if no flame spread is observed upon preliminary testing, if only 1 test article exhibits flame spread and it is equal to or greater than 3.5 seconds, or if the average flame spread is equal to or greater than 3.5 seconds. In accordance with the standard, 5 replicates were tested for this study.