



Mask Testing Services  
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ANALYTICAL REPORT ID 20-PPE-00055  
 PRODUCT ID MLL-1970  
 DESCRIPTION White; 3-ply  
 MATERIAL SMS  
 MANUFACTURER Maple Leaf Laboratories Ltd.  
 LOT IDENTIFICATION n/a  
 DATE RECEIVED 24-Jul-2020  
 REPORT DATE 7-Aug-2020

## MEDICAL MASK TEST SUMMARY

ASTM 2100: Standard Specification for Performance of Materials used in Medical Face Masks

Test Method	AVERAGED RESULT	Not Rated	ASTM F2100		
			Level 1	Level 2	Level 3
<b>Flammability</b> 16 CFR 1610	Class 1	Class 3	Class 1		
<b>Particulate Filtration Efficiency</b> ASTM F2299	99.97	< 95%	≥ 95%	≥ 98%	
<b>Differential Pressure</b> EN 14683 Annex C	2.68	≥ 6.0 mm H <sub>2</sub> O/cm <sup>2</sup>	< 5.0 mm H <sub>2</sub> O/cm <sup>2</sup>	< 6.0 mm H <sub>2</sub> O/cm <sup>2</sup>	
<b>Bacterial Filtration Efficiency</b> ASTM F 2101	100.00	< 95%	≥ 95%	≥ 98%	
<b>Fluid Resistance to Synthetic Blood</b> ASTM F1862	160 mmHg	Failure at 80 mmHg	80 mmHg	120 mmHg	160 mmHg

Highlighted box indicates the performance level of the mask for the given test.

The samples tested meet the acceptance criteria for **ASTM F2100 performance LEVEL 3**

Test results only apply to the samples submitted and tested for analysis. For individual mask results, please see the Analytical Test Report. It is the responsibility of the distributor to ensure the tested batch is compliant to the required sampling methodology as per ANSI/ASQ Z1.4. Additional test information is available upon request.

Reviewed By:

Approved By:

## FLAMMABILITY

**Test Summary** A conditioned mask or test specimen was affixed to a sample holder and placed in a flammability test chamber. The specimen was exposed to a 16 mm flame for 1 second at an angle of 45°. If the material ignited during this exposure, it was noted whether the flame extinguished before spreading, or if it continued to burn. If the specimen continued to burn, the time of flame spread was measured. Any observations of burning behavior were also recorded. The specimen was tested in its original state as directed in 16 CFR Part 1610.6 (a) step 1 - 'Testing in the original state', (2) 'Plain surface textile fabrics'. As medical masks are intended for one-time use 16 CFR Part 1610.6 (b) step 2- 'Refurbishing and testing after refurbishing' was not performed. The tests were performed in accordance with 16 CFR Part 1610 'Standard for the Flammability of Clothing Textiles'

**Date Tested** 28-Jul-2020

**Test Side:** Outside

**Test Type** Original State

**Direction Tested:** Length

**Conditioning Parameters** 105 +/- 3°C for 30 +/- 2 minutes

**Acceptance Criteria** Class 1: Burn time ≥ 3.5s  
Class 3: Burn time < 3.5s

### TEST LOT NUMBER

Article No.	Time of Flame Spread
1	DNI
2	DNI
3	DNI
4	DNI
5	DNI

Article No.	Time of Flame Spread
6	n/a
7	n/a
8	n/a
9	n/a
10	n/a

DNI: Did not ignite

IBE: Ignited, but extinguished

## PARTICULATE FILTRATION EFFICIENCY (PFE)

**Test Summary** Filtered and dried air was passed through an atomizer to produce an aerosol containing suspended polystyrene latex (PSL) spheres. The aerosol was then mixed and diluted with additional preconditioned air to produce a stable, non-neutralized, and dried aerosol of latex spheres. The aerosol was passed through the mask material. An optical particle counter was used to sample upstream and downstream aerosol concentrations to determine the particulate filtration efficiency of the mask. The test was conducted in accordance with Test Method ASTM F2299 with the exception that a non-neutralized particle challenge was used in place of a neutralized challenge as per FDA guidance document on surgical facemasks (FDA-2003-D-0305)

**Date Tested** 29-Jul-2020

**Test Side and Area** Inside, Centre (28.3 cm<sup>2</sup>)

**Conditioning Parameters** 30-50% ± 5% relative humidity and 21 ± 3°C

**Face Velocity** 6 to 7 cm/s

**Laboratory Conditions** 71 % Relative Humidity; 22.5 °C

**Particle Size** 0.1 µm

**Acceptance Criteria** ASTM Level 1: ≥ 95% PFE  
ASTM Level 2,3: ≥ 98% PFE

### TEST LOT NUMBER

Article No.	PFE %
1	99.97
2	99.97
3	99.97
4	99.98
5	99.97

Article No.	PFE %
6	n/a
7	n/a
8	n/a
9	n/a
10	n/a

**Average Filtration Efficiency** 99.97

**Standard Deviation** 0.004

## DIFFERENTIAL PRESSURE

**Test Summary** Differential pressure testing was performed to determine the breathability of the sample material. Air was passed through a prescribed surface area of the sample material at a constant air flow rate of 8 litres per minute, measured by a calibrated flow meter. A manometer was used to measure the differential pressure across the sample.

The test was conducted as directed in EN 14683:2019 Annex C

**Date Tested** 31-Jul-2020

**Test Side and Area** Inside, Centre (4.9 cm<sup>2</sup>)

**Conditioning Parameters** 85 ± 5% relative humidity and 21 ± 5°C for a minimum of 4h

**Flow Rate** 8 L/min

**Acceptance Criteria** Flow rate must be maintained at 8 L/min throughout testing

ASTM Level 1: < 4.0 mm H<sub>2</sub>O/cm<sup>2</sup>

ASTM Level 2,3: < 5.0 mm H<sub>2</sub>O/cm<sup>2</sup>

### TEST LOT NUMBER

Article No.	Delta P (mm H <sub>2</sub> O/cm <sup>2</sup> )
1	2.77
2	2.7
3	2.67
4	2.78
5	2.5

Article No.	Delta P (mm H <sub>2</sub> O/cm <sup>2</sup> )
6	n/a
7	n/a
8	n/a
9	n/a
10	n/a

**Average Delta P** 2.68

**Standard Deviation** 0.113

## BACTERIAL FILTRATION EFFICIENCY (BFE)

**Test Summary** The mask was clamped between a six-stage cascade impactor and an aerosol chamber. A bacterial suspension of *Staphylococcus aureus* was introduced into the aerosol chamber using a four-Jet atomizer. The aerosol was drawn through the sample material using a vacuum pump attached to the cascade impactor. The cascade impactor collects aerosol droplets that penetrate the mask material onto agar plates and sorts them by particle size. Positive control samples were also collected with no test specimen clamped in the test apparatus to verify the bacterial challenge rate (upstream counts). Following the incubating period, the colony forming units (CFU) on the agar plates were counted (downstream counts). The ratio of the upstream counts from the positive control, to the downstream counts collected for the test specimen, was calculated and reported as the bacterial filtration efficiency (BFE). This test was conducted in accordance with Test Method ASTM F2101.

**Date Tested** 06-Aug-2020

**Test Side and Area** Inside, Centre (40 cm<sup>2</sup>)

**Conditioning Parameters** 85 ± 5% relative humidity and 21 ± 5°C for a minimum of 4h

**Flow Rate** 28.3 L/min

**Mean Particle Size (MPS)** 3.03 µm

**Negative Control Count** 0 CFU

**Positive Control Average** 2517 CFU

**Acceptance Criteria** Control average must be 1.7 to 3.0 x 10<sup>3</sup> CFU

MPS of aerosol must be 3.0 ± 0.3 µm

ASTM Level 1: ≥95% BFE

ASTM Level 2 and 3: ≥98% BFE

### TEST LOT NUMBER

Article No.	BFE %
1	100
2	100
3	100
4	100
5	100

Article No.	BFE %
6	n/a
7	n/a
8	n/a
9	n/a
10	n/a

**Average Filtration Efficiency** 100

**Standard Deviation** 0



## BLOOD PENETRATION RESISTANCE

**Test Summary** A volume of synthetic blood was disbursed at the mask to simulate the impact (splatter) of blood or other body fluid onto the specimen. Any evidence of synthetic blood penetration on the inner facing of the mask (side contacting the wearer's face) constitutes a failure. Samples are evaluated at one or more velocities of 450, 500, and 635 cm/s, corresponding to the velocity of blood exiting a small arterial puncture at human blood pressures of 80, 120, and 160 mmHg. The distance from the target area to the tip of the cannula is 30.5 cm, with the impact of the spurt normal to the target area. Test results are reported at each tested velocity or corresponding pressure, and the medical face mask is rated at the highest corresponding blood pressure for which the mask demonstrates an acceptable quality limit of 4.0. The test was conducted in accordance with Test Method ASTM F1862.

**Date Tested** 27-Jul-2020

**Test Side and Area** Outside, Centre

**Conditioning Parameters** 85 ± 5% relative humidity and 21 ± 5°C for a minimum of 4h

**Laboratory Conditions** 65.6 % Relative Humidity; 24.1 °C

**Acceptance Criteria** The output of synthetic blood before and after 16 articles must be within 2% of theoretical output  
 29 of 32 tests must show passing result  
 ASTM Level 1: Pass at 80 mmHg  
 ASTM Level 2: Pass at 120 mmHg  
 ASTM Level 3: Pass at 160 mmHg

**TEST LOT NUMBER**

Article No.	80 mmHg	120 mmHg	160 mmHg	Article No.	80 mmHg	120 mmHg	160 mmHg
1	n/a	n/a	Pass	17	n/a	n/a	Pass
2	n/a	n/a	Pass	18	n/a	n/a	Pass
3	n/a	n/a	Pass	19	n/a	n/a	Pass
4	n/a	n/a	Pass	20	n/a	n/a	Pass
5	n/a	n/a	Pass	21	n/a	n/a	Pass
6	n/a	n/a	Pass	22	n/a	n/a	Pass
7	n/a	n/a	Pass	23	n/a	n/a	Pass
8	n/a	n/a	Pass	24	n/a	n/a	Pass
9	n/a	n/a	Pass	25	n/a	n/a	Pass
10	n/a	n/a	Pass	26	n/a	n/a	Pass
11	n/a	n/a	Pass	27	n/a	n/a	Pass
12	n/a	n/a	Pass	28	n/a	n/a	Pass
13	n/a	n/a	Pass	29	n/a	n/a	Pass
14	n/a	n/a	Pass	30	n/a	n/a	Pass
15	n/a	n/a	Pass	31	n/a	n/a	Pass
16	n/a	n/a	Pass	32	n/a	n/a	Pass

**Passes at 80 mmHg** n/a

**Passes at 120 mmHg** n/a

**Passes at 160 mmHg** 32/32

## NOTES

This section is to provide general comments on observations and/or exceptions that were noted during analysis.

No observations or exceptions to report.



