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**Laboratory #:** 850569-2-20  
**Report Date:** December 17, 2020  
**Received Date:** December 8, 2020

**Attention:** Lee Mornan  
**Specimen:** #2: Altor Safety, 4ply Mask. Lot#: Q12130

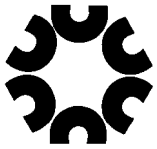
### TEST REPORT

One specimen, consisting of face masks, was submitted to be tested for bacteria filtration efficiency, differential pressure, particle filtration efficiency, synthetic blood penetration and flame spread to determine acceptability with level barrier classification under ASTM F2100-19 requirements.



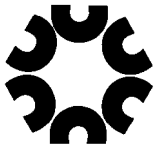
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Per Steve Brown  
Authorized By Stephen Brown  
Per Anomaria Rojas Pineda  
Technician, Anamaria Rojas-Pineda



Medical Face Mask Material Requirements

<b>Characteristic</b>	<b>Level 1 Barrier</b>	<b>Level 2 Barrier</b>	<b>Level 3 Barrier</b>	<b>Summary Results</b>
Bacterial Filtration Efficiency, %	≥95	≥98	≥98	<b>Pass any Level</b>
Differential Pressure, mm H <sub>2</sub> O/cm <sup>2</sup>	<5.0	<6.0	<6.0	<b>Pass any Level</b>
Sub-Micron Particulate Filtration Efficiency at 0.1 micron, %	≥95	≥98	≥98	<b>Pass any Level</b>
Synthetic Blood Penetration minimum pressure in mmHg for pass result	80	120	160	<b>Pass Level 3</b>
Flame Spread	Class 1	Class 1	Class 1	<b>Pass any Level</b>
<b>OVERALL PERFORMANCE LEVEL</b>	<b>Complete - Level 3</b>			



**DIFFERENTIAL PRESSURE**

EN 14683:2019 edition Annex C

Each specimen was conditioned for 4 hours minimum at 21+/-5 C and 85+/-5 % R.H.

Requirements ASTM F2100-19:

Differential Pressure (mmH<sub>2</sub>O/cm<sup>2</sup>)

Level 1 Barrier: <5.0

Level 2 Barrier: <6.0

Level 3 Barrier: <6.0

**RESULTS**

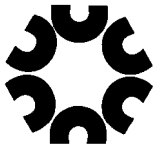
<u>Specimen ID</u>	<u>Area ID</u>	<u>Differential Pressure (mmH<sub>2</sub>O/cm<sup>2</sup>)</u>	<u>Specimen Pass/Fail</u>	<u>FINAL RESULT</u>
2-1	1	3.0	Pass	Pass any Level
	2	2.7		
	3	2.7		
	4	2.7		
	5	3.0		
	AVERAGE	2.8		
2-2	1	2.5	Pass	
	2	2.4		
	3	2.2		
	4	2.2		
	5	2.4		
	AVERAGE	2.3		
2-3	1	2.2	Pass	
	2	2.2		
	3	2.4		
	4	2.4		
	5	2.4		
	AVERAGE	2.3		
2-4	1	3.2	Pass	
	2	2.9		
	3	2.9		
	4	2.7		
	5	2.7		
	AVERAGE	2.9		
2-5	1	3.0	Pass	
	2	3.0		
	3	2.7		
	4	3.0		
	5	2.7		
	AVERAGE	2.9		

Mask Surface Area: 25mm diameter (x5 test areas) (4.9 cm<sup>2</sup>)

Air Flow Rate: 8 L/min

Mask Location Specimen taken from: 5 Areas from each specimen distributed all surface wide

Note: For a test plan of 5 specimens, no failure is allowed for an Acceptable Quality Limit of 4.0%.



**SYNTHETIC BLOOD PENETRATION**

ASTM F1862/F1862M-17 at 160 mmHg pressure

**RESULTS**

Specimen #	Test Pressure (mmHg)	Total Number of Specimens	Number of Pass Specimens	FINAL RESULT
2	160	32	31	<b>Pass for Level 3</b>

Note: Acceptable Quality Limit of 4.0% is met for single sampling plan when 29 or more of the 32 tested specimens show pass results.

<b>Material construction type</b>	PP Spun-bond/melt blown non-woven polypropylene
<b>Supplier</b>	Altor Safety
<b>Lot number</b>	Q12130
<b>Date of receipt</b>	December 8, 2020
<b>Date of test</b>	December 10, 2020
<b>Fluid velocity (cm/s)</b>	648
<b>Volume of impact fluid (ml)</b>	2
<b>Angle of pneumatic valve to horizontal</b>	2°
<b>Description target area mask</b>	Blue ripple area
<b>Distance from tip cannula to mask (in)</b>	12
<b>Technique to enhance visual detection</b>	Cotton swab used to lightly daub on the surface
<b>Conditioning parameters</b>	21±5°C, 85±5% R.H for minimum of 4 hours



**FLAME SPREAD**

The specimen, consisting of 5 masks, was tested in accordance to 16 CFR 1610 (1-1-16 Edition).

	Specimen #	RESULT	CONCLUSION
<b>Specimen #2</b>	1-1	IBE	<b>Classified as Class 1 PASS for ANY LEVEL</b>
	1-2	IBE	
	1-3	IBE	
	1-4	IBE	
	1-5	IBE	

IBE: Ignited but extinguished

- Test:** Flame Resistance 45° angle test. One-Second Flame Impingement.
- Type of fabric:** Without a raised fiber surface
- Surface tested:** Face
- Type of test:** Original State
- Direction tested:** Length
- Testing Conditioning:** Specimens conditioned at 105°C for 30 min, then placed in desiccator
- Requirements:** The flame spread time for textile products without a raised fibre surface must be greater than 3.5 seconds.

Note: For a test plan of 5 specimens, no failure is allowed for an Acceptable Quality Limit of 4.0%.



**PARTICLE FILTRATION EFFICIENCY**

Particles: Monodispersed polystyrene latex spheres (PSL)  
 Particles Counter: TSI scanning mobility particle sizer spectrometer 3082 and CPC  
 Tested as per ASTM F2299, non-neutralized aerosol challenge measured over 3 minutes (test specimen / control counts before and after test specimen and averaged)

Test Side: Inside  
 Area Tested: 21.7 cm<sup>2</sup>  
 Particle Size: 0.1 µm  
 Laboratory Conditions: 24°C, 41% relative humidity (RH)

Requirements ASTM F2100-19:  
 Particle filtration efficiency at 0.1 micron (%)  
 Level 1 Barrier: ≥95  
 Level 2 Barrier: ≥98  
 Level 3 Barrier: ≥98

**RESULTS**

Specimen #	Average Control Counts	Specimen Counts	Filtration Efficiency (%)	Specimen (Pass/Fail)	FINAL RESULT
2-1	62,573	766	99	Pass	<b>Pass any Level</b>
2-2	42,346	594	99	Pass	
2-3	53,694	570	99	Pass	
2-4	67,182	797	99	Pass	
2-5	70,465	943	99	Pass	

Note: The PFE equipment was outsourced and located at University of Toronto, 223 College Street, Toronto, ON, M5T 1R4.



**BACTERIAL FILTRATION EFFICIENCY**

A Bacterial Filtration Efficiency (BFE) test was completed according to the procedure in ASTM F2101-19 to determine the filtration efficiency of test articles by comparing the bacterial control counts upstream of the test article to the bacterial counts recovered downstream. A suspension of *S. aureus* was aerosolized using a nebulizer and delivered to the test article at a constant rate with a target delivery rate of  $1.7 \times 10^3 - 3.0 \times 10^3$  colony forming units (CFU) per test article with a mean particle size of  $3.0 \pm 0.3 \mu\text{m}$ . The aerosolized suspension was drawn through the test article which was clamped in a six stage Andersen air sampler, at a constant flow rate of 28.3 liters per minute (LPM), for collection on bacteriological agar plates.

Challenge Microbe: *Staphylococcus aureus* ATCC 6538  
Test Side: User side facing challenge  
Area Tested:  $\sim 38.5 \text{ cm}^2$   
Flow Rate: 28.3 LPM  
Test Article Conditioning:  $85 \pm 5\% \text{ RH}$  at  $25.0 \pm 0.5^\circ\text{C}$  for a minimum of 4 hours  
Challenge Level:  $1.7 \times 10^3 \text{ CFU}$   
Mean Particle Size:  $2.9 \mu\text{m}$

Requirements ASTM F2100-19:  
Bacterial filtration efficiency (%)  
Level 1 Barrier:  $\geq 95$   
Level 2 Barrier:  $\geq 98$   
Level 3 Barrier:  $\geq 98$

**RESULTS**

Specimen #	Total CFU Recovered	Percent BFE (%)	Specimen (Pass/Fail)	FINAL RESULT
2-1	4	99.8	Pass	Pass any Level
2-2	9	99.5	Pass	
2-3	12	99.3	Pass	

The filtration efficiency percentages were calculated using the following equation:

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

C = Challenge Level  
T = Total CFU recovered downstream of test article

Note: Testing performed by GAP EnviroMicrobial Services Ltd., 1020 Hargrrieve Road, Unit 14, London, Ontario, Canada, N6E 1P5