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TESTING PER ASTM F2101-19 (ASTM F2100) STANDARD TEST METHOD FOR EVALUATING THE BACTERIAL FILTRATION EFFICIENCY OF MEDICAL FACE MASK MATERIALS, USING A BIOLOGICAL AEROSOL OF STAPHYLOCOCCUS AUREUS

Efofex, Inc.
Attn: Pradeep Srivastava
1300 Dixieland North
Rogers, AR 72756

Date:	3/25/2021
Author:	Mike Olszewski
Project Number:	ESP035414P.1R0
Purchase Order Number:	Prepaid

REVISION NOTES

Revision	Page #, Section, Description	Date
0	Original Version	3/25/2021

Respectfully submitted,

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Reviewed By,

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INTRODUCTION

This report presents the results of testing per ASTM F2101-19 conducted on face masks. Pradeep Srivastava of Efofex, Inc. submitted the samples to our laboratory for testing on March 22, 2021. Testing and data analysis were completed on March 25, 2021.

Testing was subcontracted to and completed by LMS Technologies.

OBJECTIVE

The scope of work was limited to submitting the face mask samples to testing per the methods of ASTM F2101-19.

SAMPLE IDENTIFICATION

Submitted by	Efofex, Inc.
Sample Description	Disposable Face Mask
Samples Received	March 22, 2021
Quantity Tested	QTY 5 Samples

Table 1: Sample Identification

TEST METHOD

Report from LMS Technologies included as addendum.

MICROBIOLOGY REPORT

LMS Technologies, Inc.

6423 Cecilia Circle
Bloomington, Minnesota 55439 U.S.A.

Tel: (952)-918-9060
Fax: (952)-918-9061

Date: March 25, 2021
Requested by: Element

Test Type: BFE (Bacterial Filtration Efficiency)

Scope: Customer submitted 5 face masks with code E5P035414P for BFE testing. Testing was done based ASTM F2101 - 19 Standard Test Method for Evaluating the Bacterial Filtration Efficiency (BFE) of Medical Face Mask Materials, Using a Biological Aerosol of Staphylococcus aureus.

Method: Aerosolize organism into glove box and collect sample for 1 minute with a SKC Biostage Impactor. Pump is set 28.3 L/M. Samples were tested with air flow entering the inside of the mask. The test area is dependent on the type of mask and it could be ~ 20-70 cm^2.
Data:

LMS Mask #	Upstream	Hole Corrected Downstream Cfu	BFE%
#1	3.47E+04	33.4	**99.904**
#2	3.40E+04	7.1	**99.979**
#3	3.33E+04	21.6	**99.935**
#4	3.26E+04	6.0	**99.982**
#5	3.19E+04	6.0	**99.981**

Microbiologists
John Cherne,James Cherne,Autumn Stivers-Biscuso

Testing Approval
Al Vatine, CEO

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TESTING PER EN 14683:2019 ANNEX C (ASTM F2100)
TEST METHOD FOR DETERMINATION OF BREATHABILITY (DIFFERENTIAL PRESSURE)

Efofex, Inc.
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Date:	3/25/2021
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Project Number:	ESP035414P.2R0
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INTRODUCTION

This report presents the results of differential pressure testing conducted on face masks. Pradeep Srivastava of Efofex, Inc. submitted the samples to our laboratory for testing on March 22, 2021. Testing and data analysis were completed on March 25, 2021.

OBJECTIVE

The scope of work was limited to measuring the differential pressure of the face mask material submitted for testing. Testing was conducted per EN14683:2019 Annex C as specified in ASTM F2100.

SAMPLE IDENTIFICATION

Submitted by	Efofex, Inc.
Sample Description	Disposable Face Mask
Samples Received	March 22, 2021
Quantity Tested	QTY 5 Samples

Table 1. Sample Identification

SUMMARY OF RESULTS

Sample	**Average Differential Pressure per Area** (mmH2O/cm2)	**Flow Rate** (lpm)
Sample 1	3.8	8.0
Sample 2	3.8	8.0
Sample 3	3.8	8.0
Sample 4	4.0	8.0
Sample 5	3.9	8.0

Table 2. Summary of Results

PHOTOGRAPHS

Figure 1. Sample Test Specimen (typical)

TEST METHOD

Test standard EN14683:2019 Annex C measures the differential pressure through the material at a constant flow rate. Fabric is cut into circular samples and is clamped to the fixture with diameter of 25mm. Flow rate is adjusted to 8 liters per minute, measured with a mass flow meter.

Each test specimen was conditioned at 21C and 85% relative humidity for a minimum of 4 hours.

Differential pressure per area was calculated by dividing by the cross-sectional area of the 25mm diameter test section (4.9 square centimeters).

CALIBRATED TEST EQUIPMENT

Description	Asset ID#	Calibration Date	Calibration Due Date
Manometer	PT-167-164	13-APR-2020	13-APR-2021
Mass Flow Meter	PT-166-078	05-FEB-2021	05-FEB-2022
Chamber	MM-190-036	08-APR-2020	08-APR-2021
12” Caliper	PT-167-139	29-JUN-2020	29-JUN-2021

Table 3. Calibrated Test Equipment

TEST DATA

Sample	Differential Pressure (mmH2O)	Pressure Drop per Unit Area (mmH2O/cm2)	Average Pressure Drop (mmH2O/cm2)	Flow Rate (lpm)
1-1	15.7	3.2	3.8	8.0
1-2	15.2	3.1		8.0
1-3	20.7	4.2		8.0
1-4	20.4	4.2		8.0
1-5	21.2	4.3		8.0
2-1	14.5	3.0	3.8	8.0
2-2	15.7	3.2		8.0
2-3	18.4	3.8		8.0
2-4	21.5	4.4		8.0
2-5	22.1	4.5		8.0
3-1	15.8	3.2	3.8	8.0
3-2	15.4	3.1		8.0
3-3	18.8	3.8		8.0
3-4	20.9	4.3		8.0
3-5	21.9	4.5		8.0
4-1	15.5	3.2	4.0	8.0
4-2	15.9	3.2		8.0
4-3	20.3	4.1		8.0
4-4	23.7	4.8		8.0
4-5	22.4	4.6		8.0
5-1	14.6	3.0	3.9	8.0
5-2	15.8	3.2		8.0
5-3	19.6	4.0		8.0
5-4	22.9	4.7		8.0
5-5	23.1	4.7		8.0

Table 4. Test Results

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TESTING PER 16 CFR 1610 (ASTM F2100)
STANDARD TEST METHOD FOR THE FLAMMABILITY OF CLOTHING TEXTILES
MASK FLAMMABILITY TESTING

Efofex, Inc.
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Date:	3/29/2021
Author:	Mike Olszewski
Project Number:	ESP035414P.5R0
Purchase Order Number:	Prepaid

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INTRODUCTION

This report presents the results of flammability testing conducted on face masks. Pradeep Srivastava of Efofex, Inc. submitted the samples to our laboratory for testing on March 22, 2021. Testing and data analysis were completed on March 29, 2021.

The scope of work was limited to conducting flammability tests per 16 CFR Part 1610 as specified in ASTM F2100 section 9.5 on the submitted samples and reporting the results.

CONCLUSIONS

The specimens passed as a preliminary class 1 plain surface textile fabric. Specimens exhibited DNI (did not ignite) test results. No refurbishing was performed, therefore classification is only preliminary.

SAMPLE IDENTIFICATION

Submitted by	Efofex, Inc.
Sample Description	Disposable Face Mask
Samples Received	March 22, 2021
Quantity Tested	QTY 5 Samples

Table 1. Sample Identification

TEST RESULTS

Sample Identification	Specimen	Burn Time, sec
Disposable Face Mask	1	DNI
	2	DNI
	3	DNI
	4	DNI
	5	DNI

Table 2. Test Results (DNI = Did Not Ignite)

PHOTOGRAPHS

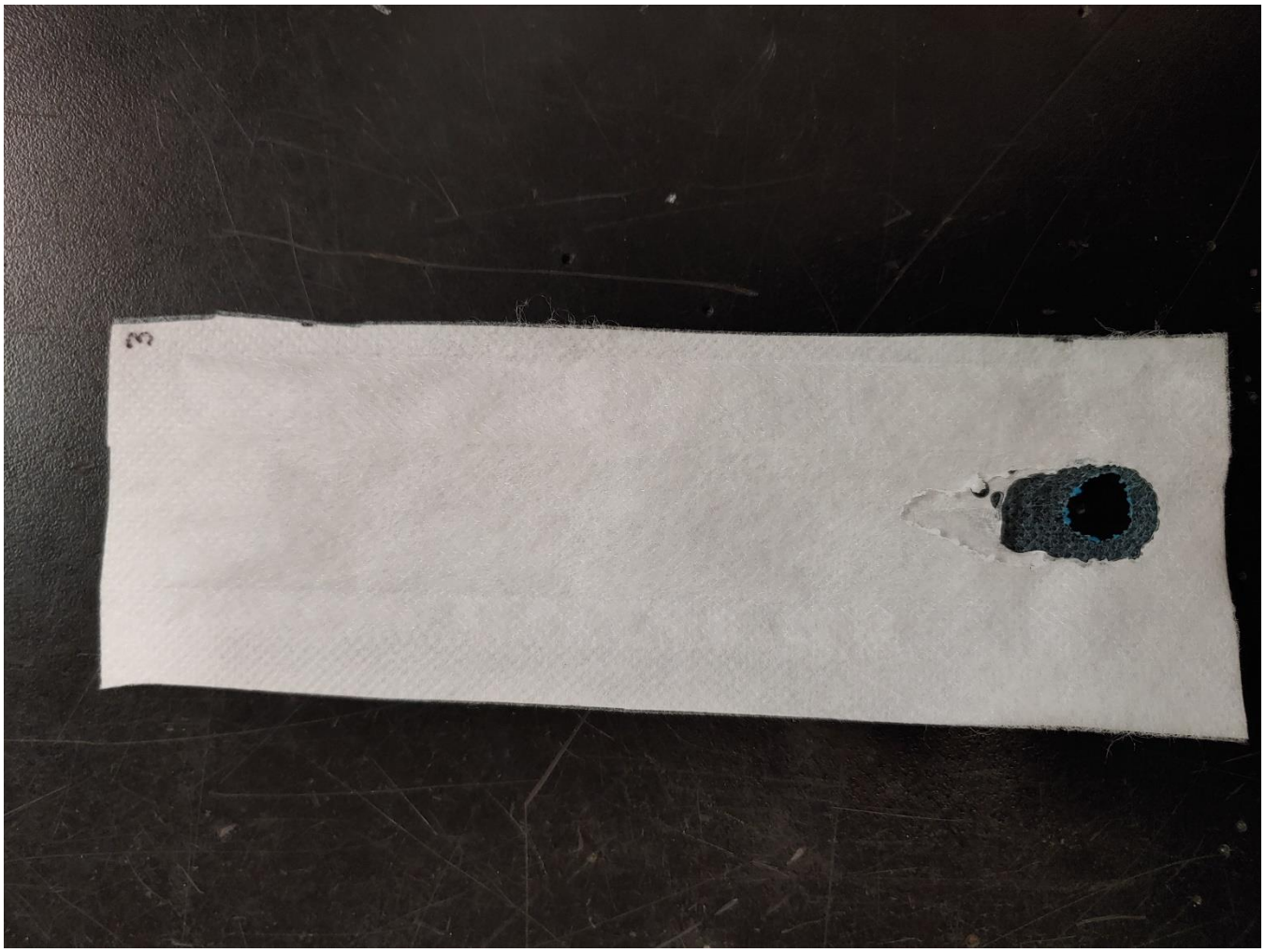

Figure 1. Sample Test Specimen

TEST METHOD

The specimens were sectioned. Each specimen was conditioned for 30 minutes at 105 ± 3 °C and cooled in a desiccator for at least 15 minutes just prior to testing. Testing was performed according to the standard detailed below, with notes of parameters and/or deviations. The standard establishes three classes of flammability and lays out the requirements needed to meet those classifications.

Test Method	Test Method Title	Parameters and/or Deviations from Method
16 CFR 1610 (October 2008)	Standard for the Flammability of Clothing Textiles	Specimen size: 2” x 6” No refurbishing performed

Table 3. Test Standard

CALIBRATED TEST EQUIPMENT

Description	Asset ID#	Calibration Date	Calibration Due Date
Honeywell Temp/RH Chart Recorder	MM190-024	02-JUN-2020	02-JUN-2021
Electronic Flammability Tester (verification of time of flame application to sample)	PT-163-029	22-MAY-2020	22-MAY-2021
Traceable Stopwatch Model 1051	PT-163-047	09-APR-2020	09-APR-2021
Fluke Digital Thermometer	PT-163-057	10-SEP-2020	10-SEP-2021

Table 4. Calibrated Test Equipment

OTHER TEST EQUIPMENT AND MATERIALS

Butane

Fisher Isotemp Oven, Model 630F, S/N 252, ID MM190-013 (monitored externally with calibrated instrument)