

# Community masks testing

CWA 17553:2020

Tallinn 2021



Air Quality Management Department

Community masks  
testing according to  
CWA 17553:2020

Salesman OÜ

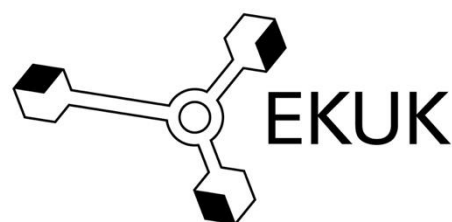
Order no 13.09.2021

Tallinn 2021

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Mask testing according to guide CWA 17553:2020  
Salesman OÜ order 13.09.2021

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**Order no:** Salesman OÜ 13.09.2021  
**Date of the report:** 21.09.2021

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## 1 Methods and instruments and test description

The test method is based on the following guide CWA 17553:2020.

### 1.1 Particle filtration efficiency test

#### Instruments:

Face mask differential pressure tester: Gester GT-RA04

Aerosol generator: TSI model 3076

Aerosol spectrometer: Optical Particle Counter, OPC 3330 TSI

Dryer: TSI filtered air supply 3074B

Silica gel dryer: TSI 3062

Differential-manometer CHY 886U

Aerosol generator TSI model 3475 is used to generate monodisperse aerosol from polystyrene latex (PSL). The resulting aerosol is formed of particles with average diameter of 3  $\mu\text{m}$  (*LB30, Sigma-Aldrich*). The aerosol is dried with silica gel dryer TSI 3062 and it is flowing through the test object with velocity 6 cm/s. During one test aerosol concentration is measured with aerosol spectrometer (Optical Particle Counter, OPC 3330 TSI) three times and the filter material or mask is measured also at least three times. The test is repeated at least with three different masks or filter material from the same lot. The sampling from the system is performed following isokinetic sampling regime. The difference of pressure is measured before and after the test object using differential-manometer CHY 886U.

For each test the filtration efficiency is calculated for each size class by aerosol concentration before the mask/filter and after the mask/filter using following equation:

$$eff = \frac{C_a - C_p}{C_a} \times 100$$



where

$eff$  – filtration efficiency of the test object for given size range in %

$C_a$  – aerosol concentration of the given size range before the test object in  $\#/cm^3$

$C_p$  - aerosol concentration of the given size range after passing the test object in  $\#/cm^3$

Test results are analysed by MS Excel and OriginPro 2020 software. Based on the three tests standard deviation is calculated and shown on the Figure 2.

## 1.2 Breathability

### Instruments:

Face Mask Differential Pressure Tester Gester GT-RA04

For the determination of the breathability, mask is clamped in the test apparatus. Air is drawn through the mask at a constant air flow rate, in order to measure the differential pressure of the mask. Differential pressure per  $cm^2$  characterizes the mask's breathability and is given in units  $\Delta P/cm^2$ .





### 3 Test results

#### 4.1 Cleaning cycle

No visible damage or defects was detected after complete 5 cleaning cycles at 60°C.

#### 4.2 Head harness strength test

No visible damage or defects was detected after 5 cycles of being put on and removing (donning and doffing) on three test subjects with different morphologies.

#### 4.3 Particle filtration test (PFE)

Mean filtration efficiency of the three masks over the entire aerosol size distribution (0,65 – 3,5  $\mu\text{m}$ ) was **91.69%** with the standard deviation of 1.51%. Mean filtration efficiency around 3  $\mu\text{m}$  was **99.27%** with the standard deviation of 0.15% (Figure 2).

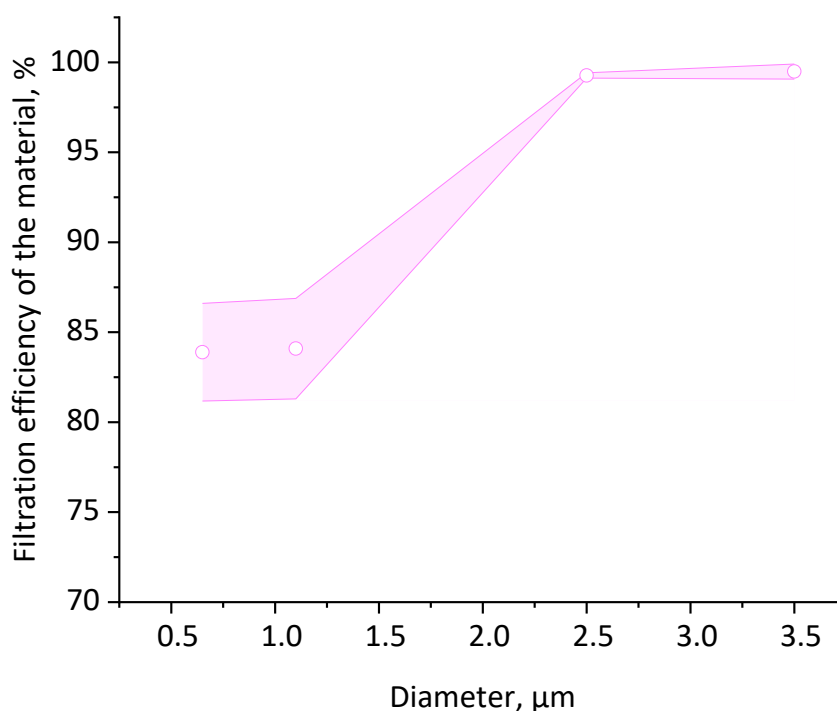


Figure 2. Filtration efficiency of the aerosol particles with different size





#### 4.4 Breathability test

The total average differential pressure was 44.860  $\Delta P$  (Pa/cm<sup>2</sup>) (Table 1).

**Table 1. Breathability test results, Pa/cm<sup>2</sup>**

Mask	Area 1	Area 2	Area 3	Area 4	Area 5	Average
Mask no 1	46.073	43.493	48.335	44.725	46.461	45.817
Mask no 2	45.77	44.346	46.995	44.609	47.523	45.849
Mask no 3	44.129	44.644	43.764	42.98	43.313	43.766
Mask no 4	43.299	44.909	42.669	45.906	46.823	44.721
Mask no 5	44.185	43.111	44.757	45.729	42.94	44.144
<b>Average</b>	<b>44.691</b>	<b>44.101</b>	<b>45.304</b>	<b>44.790</b>	<b>45.412</b>	<b>44.860</b>



## 4 References

A guide CWA 17553:2020 Community face coverings - Guide to minimum requirements, methods of testing and use.

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