Executive summary

In addition to hygiene rules, keeping a distance and wearing community masks, measures for stopping the rapid increase in corona infections include airing out rooms and the use of portable air purifiers.

Portable air purifiers can be very effective in minimizing the risk of indirect infection. But there are several things to consider that are important for the effectiveness of an air purifier in the context of a pandemic.

The Blue.care+ has therefore undergone close examination. Including practical tests at the Münster university clinic, which were carried out by Hybeta GmbH, an accredited independent test lab.

Conclusion: Blue.care+ passes the test.

Introduction

During the past weeks, new analyses and recommendations for controlling corona infections have appeared almost daily. Extensive studies are published, sometimes leading to controversial discussions. Various experts publish reports to analyze what is happening around us and to derive remedial measures. Portable air purifiers play a central part in the measures under discussion.

The flood of information on this subject is not easy to digest, and it is even more difficult to draw correct and appropriate conclusions. But many decision-makers are wondering what they can or must do to reduce the risk of infection within their area of responsibility.

The goal of this white paper is to summarize the most important aspects concerning portable air purifiers.

Background – Why do we need a portable air purifier?

The transmission of SARS-CoV-2 viruses is attributed primarily to droplets exhaled by infected people. The smallest of these droplets, which contain infectious viruses, form so-called aerosols, which can remain in suspension for a very long time. It is astounding how many viruses there can be in the air exhaled by a “spreader”. If there is a spreader in the room, the infectious aerosols accumulate in the indoor air.

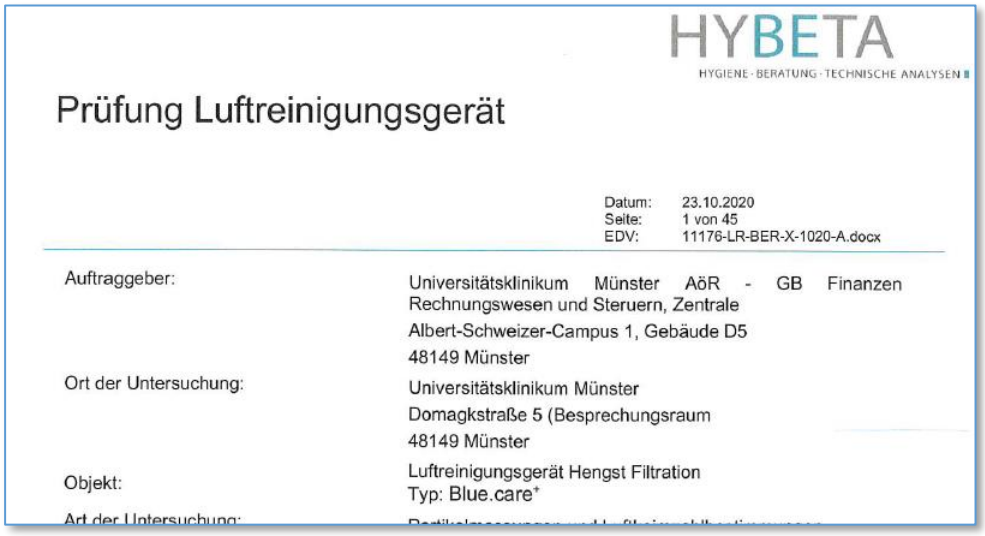
Inhaling such infectious aerosols is currently considered the most important cause of indirect infection with the corona virus and its rapid spreading. The decisive factors for such a possible infection are the viral load – the concentration of viruses in indoor air – and the duration of one’s stay in that atmosphere.

If the viral load cannot be reduced sufficiently by frequent airing out or a central ventilation system, the use of portable air purifiers is recommended. The goal of an air purifier in this case must be to

effectively reduce the concentration of aerosol droplets in the air. If that is successful, then one can also minimize the risk of indirect infection with the corona virus.

What is important here, and what can Blue.care+ do?

A portable air purifier draws in the air in a room, filters out any contaminations as thoroughly as possible, and then distributes clean air back into the room. But the machine can fulfill its purpose only if the result can be proven in practice. For this purpose, Blue.care+ was tested in practical operation at the Münster university clinic (UKM) by Hybeta GmbH, an accredited independent test lab; see Figure 1. Hybeta based its test on the DIN EN ISO 14664-1 standard for the design of cleanrooms.



HYBETA
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Prüfung Luftreinigungsgerät

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Auftraggeber:	Universitätsklinikum Münster AöR - GB Finanzen Rechnungswesen und Steuern, Zentrale Albert-Schweizer-Campus 1, Gebäude D5 48149 Münster
Ort der Untersuchung:	Universitätsklinikum Münster Domagkstraße 5 (Besprechungsraum 48149 Münster
Objekt:	Luftreinigungsgerät Hengst Filtration Typ: Blue.care+
Art der Untersuchung:	

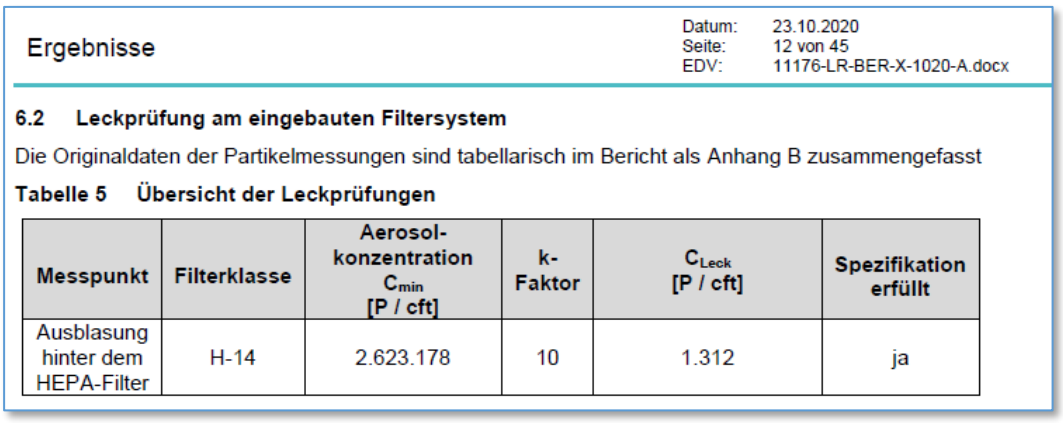
FIGURE 1: EXCERPT FROM THE UKM TEST REPORT

a) Filtration

For especially effective filtration, most experts recommend HEPA filters with a filtration efficiency class of H14. What does that mean? HEPA filters belong to the class of highest-quality air filters and are used for example in hospitals and cleanrooms. Such filters are tested in accordance with the EN 1822-1 standard. H14 stands for a minimum filtration efficiency of 99.995 % for all relevant particle sizes, and therefore also in the especially important range of less than 1 µm. This is the order of magnitude that is relevant for infectious aerosols. And: droplets of this size additionally have the capability of penetrating very deeply into the lungs when inhaled.

How can Blue.care+ help here?

The filter system used in the Blue.care+ passed the test as a HEPA filter with filtration efficiency class H14 according to EN 1822-1. But that is not all: the use of a HEPA filter only makes sense if it seals properly and is installed without being damaged – this is essential for the user, because otherwise the filter capacity of the machine would not be achieved despite the use of a high-quality filter.



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6.2 Leckprüfung am eingebauten Filtersystem

Die Originaldaten der Partikelmessungen sind tabellarisch im Bericht als Anhang B zusammengefasst

Tabelle 5 Übersicht der Leckprüfungen

Messpunkt	Filterklasse	Aerosol-konzentration C_{min} [P / cft]	k-Faktor	C_{Leck} [P / cft]	Spezifikation erfüllt
Ausblasung hinter dem HEPA-Filter	H-14	2.623.178	10	1.312	ja

FIGURE 1: EXCERPT FROM THE UKM TEST REPORT ON THE LEAK TEST OF THE BLUE.CARE+

The practical test at the UKM confirmed that the Blue.care+ also passed the leak test for class H14; see Figure 2.

b) Air exchange capacity and effectiveness in indoor air

In general, it holds that the more clean air the air purifier can supply, the lower are the particle concentrations. In practice, however, this is limited by various factors. For use in classrooms, meeting rooms, etc. it is recommended to optimally have a volume flow rate that corresponds to 6 times the room volume (the so-called “air exchange rate”). Other experts claim that an air exchange capacity of 1,000 m³/h is necessary to achieve sufficient reduction of virus-carrying aerosols from a spreader in the room.

In addition to the calculated reduction effect, air exchange is also necessary, since turbulent air flow ventilation can also be achieved by using a portable air purifier. This means that the clean air is distributed quickly and evenly, so that the concentration of droplets is reduced to the same level everywhere in the room.

How can Blue.care+ help here?

The machine has a nominal volume flow rate of 1,150 m³/h. According to the above relationship, it is therefore possible to achieve an air exchange rate of 6 times per hour in rooms with a size of up to about 200 m³. In combination with the aforementioned filter class, it is obvious why the Blue.care+ achieved such impressive air purification results in the practical test at the UKM; see Figure 3.

The basic load in the meeting room used for the test, which had a size of 141 m³, was reduced by between 94 and 95 % in 60 minutes of operation. That corresponds to a reduction of the basic load from class 8 to class 7 according to DIN EN ISO 14644-1.

It is important not to confuse the purification effect achieved in the room with the filter efficiency (H14 or ≥ 99.995 %, see above). Because what the filter achieves on its own is more of a theoretical variable for the user. The decisive factor is the effect in the indoor air, which was the focus of the practical test at the UKM.

It is noteworthy that this was achieved in the case of particles with a size of 0.5 µm, which is relevant for the transmission of viruses. In addition, this reduction was confirmed at all 10 measurement points, which proves the consistent efficiency of the Blue.care+ throughout the entire room.

It should also be noted that the fan used in the Blue.care+ operates at only about 2/3 of its air exchange capacity in nominal operation. This design keeps the noise level low in nominal operation (1,150 m³ at about 80m²). Otherwise, there might be a tendency among users to turn down the volume flow rate too far in classrooms or meeting rooms.

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6. Ergebnisse

6.1 Partikelmessungen

Die Originaldaten der Partikelmessungen sind tabellarisch im Bericht als Anhang A zusammengefasst. Die Tabelle berücksichtigt Partikelgrößen von 0,5 µm und 5,0 µm. Die Angaben erfolgen als kumulativ der Gesamtpartikelzahl jeweils von links nach rechts.

Tabelle **4** Mittelwerte der Partikelmessungen

	ohne Luftreinigungsgerät		mit Luftreinigungsgerät 60 min nach der Inbetriebnahme		Reduktion der Belastung [%]
Messpunkte	Ergebnis x̄ [P/m³] je Partikelgröße [µm]				
	0,5	5,0	0,5	5,0	
1	1.716.618	11.169	77.625	1.504	95 / 87
2	1.552.197	7.011	96.030	1.313	94 / 81
3	1.726.339	11.141	83.414	1.680	95 / 85
4	1.557.867	7.095	87.438	1.596	94 / 78
5	1.711.930	9.595	81.077	2.111	95 / 78
6	1.533.863	5.923	88.751	1.574	94 /73
7	1.722.231	9.700	98.127	2.450	94 /75
8	1.701.291	9.227	90.481	1.581	95 / 83
9	1.698.537	9.905	95.719	1.476	94 / 85
10	1.516.326	4.956	80.802	1.645	95 / 67

FIGURE 2: EXCERPT FROM THE UKM TEST REPORT ON PARTICLE REDUCTION

Summary

The Blue.care+ features HEPA filter class H14 and a nominal volume flow rate of 1,150 m³/h. In practical tests by an accredited independent test lab, this achieves particle reduction between 94 and 95 % in reproducible conditions. These tests are based on a relevant particle size of 0.5 µm.

The Blue.care+ is therefore indeed a proven aid in reducing the risk of corona infection.