Safety Cabinets: The influence of dynamic interference factors on the safety function

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Introduction

Fig. 1: Microbiological testing of personal protection based on EN 12469.

The most fundamental properties of a safety cabinet (SC) are the protective functions in terms of personal, product and cross-contamination protection.
The safety functions need to be verified using microbiological tests (see fig. 1).
In accordance with the state of the art technology [1, 2] testing of the protective functions at the SC is carried out without any human interference or influence.

Materials & Methods

Fig. 2: Static interference „Person in front of SC“.

As part of a research project the performance capability was determined in the form of a „Performance Envelope“ [3-6] of SC using microbiological testing of personal and product protection in accordance with DIN EN 12469. The aim was to determine the specific performance limits by varying the air flow conditions and at the same time introducing static and dynamic interference such as “Person in front of SC“ (fig. 2), “Moving arm“ (fig. 3) and “Moving person“ (fig. 4).

Fig. 3: Dynamic interference „Moving arm“.

Fig. 4: Dynamic interference „Moving person“.

Results

The detailed results can be taken from table 1 and fig. 5.

Table 1: Performance limits of a BERNER FlowSafe® safety cabinet

	Inflow	Downflow
Operating point	0,44 m/s	0,35 m/s
Without interference	0,19 m/s	0,09 m/s
Potential reduction	57 %	74 %
With Interference: **Person**	0,19 m/s	0,13 m/s
Potential reduction	57 %	63 %
With interference: **Moving arm - right**	0,24 m/s	0,15 m/s
Potential reduction	45 %	43 %
With interference: **Moving arm - left**	0,28 m/s	0,19 m/s
Potential reduction	36 %	46 %
With interference: **Moving person**	0,38 m/s	0,25 m/s
Potential reduction	14 %	29 %

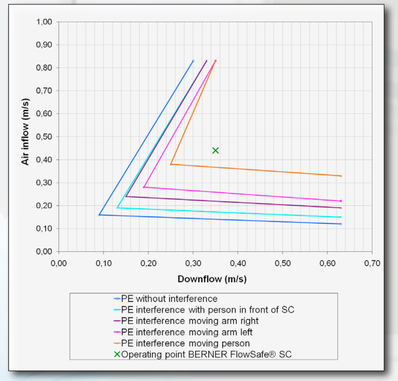

Fig. 5: Results of the microbiological tests of personal protection in relation to air inflow and downflow and interference factors.

Without interference the air inflow can be reduced up to 0,19 m/s and the downflow up to 0,09 m/s from the specific operating point, so that personal as well as product protection is present. This corresponds to a theoretically possible reduction potential of 57% (inflow) and 74% (downflow). With **static interference “Person in front of the SC“** the air inflow can be reduced up to 0,19 m/s and the downflow up to 0,13 m/s, which corresponds to a theoretically possible reduction potential of 57% (inflow) and 63% (downflow). With **dynamic interference “Moving arm“** the air inflow can be reduced up to 0,24 or 0,28 m/s and the downflow up to 0,15 or 0,19 m/s, which corresponds to a theoretically possible reduction potential of 45% or 36% (inflow) and 43% or 46% (downflow). With **dynamic interference “Moving person“** the air inflow can be reduced up to 0,38 m/s and the downflow up to 0,25 m/s, which corresponds to a theoretically possible reduction potential of 14% (inflow) and 29% (downflow).

References

[1]DIN EN 12469; Biotechnology – Performance criteria for microbiological safety cabinets; Beuth Verlag GmbH; Berlin; 09.2000.

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Discussion

The determination of the performance limits of a SC, while taking into consideration the human interference factor, has shown that with an increase in the dynamic interference factors, the performance capacity of the SC in form of the performance envelope declines continuously (Table 1 and fig. 5). The greatest potential for interference in the laboratory is the moving person. It can be observed that the current state of technology of testing the safety functions and static positions is insufficient and does not match up with the reality in a laboratory. There is clearly a need for new requirements to be set up for the testing of safety functions.

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