

**MB 6172/12**

## **Investigation of the disinfectibility of textile flooring Flotex® with use of different cleaning machines**

### **Commissioned by**

Forbo Flooring GmbH  
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### **Investigation period**

02.10.2012 – 09.11.2012

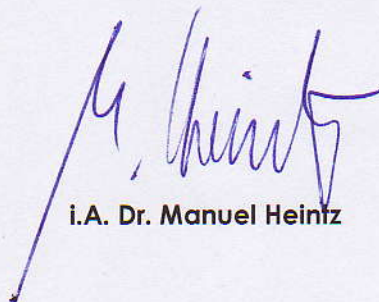
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Krefeld, January 10, 2013

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A handwritten signature in blue ink, appearing to read 'M. Heintz', with a long, sweeping horizontal stroke extending to the left.

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## **1 COMMISSION**

The disinfectibility of a textile flooring was investigated according to our offer from July 12, 2011. Therefore the textile flooring (Flotex®) was contaminated at different positions with test organisms. The disinfection agents were worked in the textile flooring by the means of different cleaning machines (2 spray-extraction and an one-disc-machine, all Cleanfix). After application time of 30 min the priviously contaminated positions were scrubed by sterile cotton swabs and the recovery rate of the test organisms determined.

## **2 SUMMARY OF RESULTS**

The results show that a reduction of the test organisms by  $> 5 \log_{10}$  units could be achieved with different machines and disinfection agents. The combined use of the spray-extraction machine TW-412 and the one-disc-machine R44-180 with in this investigation used products and applied procedures within 30 minutes achieved germ reduction of more than  $5 \log_{10}$  units, whereas the solely use of the spray-extraction machine TW 412 no sufficient germ reduction achieved. The treatment of the Flotex flooring with the spray-extraction machine TW Compact yield also with in this investigation used products and applied procedures within 30 minutes germ reductions of more than  $5 \log_{10}$  units. Consequently it can be confirmed that the Flotex® textile flooring is disinfectible with the conditions used in this investigation using mechanical action.



### 3 TEST CONDITIONS

#### 3.1 Test products

The Flotex® flooring (lot: 76231058, Forbo Flooring GmbH, Paderborn, Germany) was provided by the commissioned party. The flooring was stored vertically without specific climate conditions.

As disinfection agents Incidin® Plus (lot: 4121MS1609, best before 03.2015) and Kohrsolin® FF (lot: 313825, best before 2014.3) in a concentration of 3.0 % (Incidin) or 1.5 % (Kohrsolin) were used, respectively. The dilution of the disinfection agents was performed with normal tap water with a water hardness of 2.5 mmol/L  $\pm$  0.1 mmol/L alkaline earth metals with drinking water quality. With the TW Compact spray-extraction machine only the Kohrsolin FF disinfection agent was used.

As cleaning machine the TW412 spray-extraction machine (Cleanfix Reinigungssysteme AG, Henau-Uzwill, Switzerland, serial number: 9126 021), the R44-180 one-disc-machine (Cleanfix Reinigungssysteme AG, Henau-Uzwill, Switzerland, serial number: 9234 036) as well as the TW Compact spray-extraction machine (Cleanfix Reinigungssysteme AG, Henau-Uzwill, Switzerland, serial number: 9225005) were used. All machines were provided by Cleanfix Reinigungssysteme.

#### 3.2 Desinfection procedure

TW412 spray-extraction + R44-180 one-disc machines

The disinfection agents were applied to the textile flooring by the means of the spray-extraction and partially the one-disc-machine. Therefore the disinfection agent was filled in the tank of spray-extraction-machine and the pump action of the machine activated for 1 – 2 minutes. As brush for the one-disc-machine the shampooing brush PPN 0.3 was used. The brush was before and after each use disinfected with the disinfection agent which was used in the next test. The brush was twisted regularly during the treatment, disinfected according to the disinfection time and afterwards cleaned with water. After the insert of the brush in the machine the rotation of the brush was activated shortly to remove the excessive liquid.

After the disinfection time of 30 minutes the disinfection agent was vacuumed up from the flooring with the spray-extraction-machine. To avoid excessive foam building in the collecting tank of the spray-extraction-machine approximately 50 ml of a special anti-foaming product (Cleanfix Reinigungssystem AG) was dosed in the collecting tank. Between the tests the collecting tank of the spray-extraction-machine was emptied, with new water refilled and by means of the pump function emptied. This was performed twice to guarantee that rests of the disinfectant agents were completely diluted. The brush was disinfected by laying down in fresh made disinfectant solution and relevant areas of the one-disc-machine were cleaned.

TW Compact spray-extraction machine:

The disinfection agent Kohrsolin FF was applied by the means of the spraying function on the Flotex flooring and simultaneously worked in with the brush (standard soft brush, Cleanfix article number 420.472). The Flotex flooring was treated in this manner once. After an application time of 30 minutes the disinfection agent was removed with the drawing function of the machine and following sampling of the test areas.

#### 3.3 Contamination and treatment of the textile flooring

The following test organisms were used:

- *Escherichia coli* K12 NCTC 10538
- *Staphylococcus aureus* ATCC 6538
- *Enterococcus hirae* ATCC 10541
- *Pseudomonas aeruginosa* ATCC 15442

The test organisms were grown over night in CASO-broth at 36°C, afterwards plated on CASO nutrient agar and again incubated for further 24 h at 36°C. The cells were washed down, centrifuged and resuspended in 0.9 % NaCl. 2 ml of this sell suspension was used to contaminate the app. 5 cm x 5 cm positions of the textile flooring. Therefore the 2 ml were put on the positions, rubbed in and dried with not specified climate conditions over night. Per disinfection agent 2 positions per test organism as test fields, 1 field per test organism as negative control



(not contaminated but treated) and 1 field per test organism as positive control (contaminated but untreated) were contaminated. The positive controls were shortly before the tests scrubbed of to determine the initial concentration of the bacteria.

For treatment of the flooring with the disinfectant agents the machines were used. The following experimental set-up was used for this treatment:

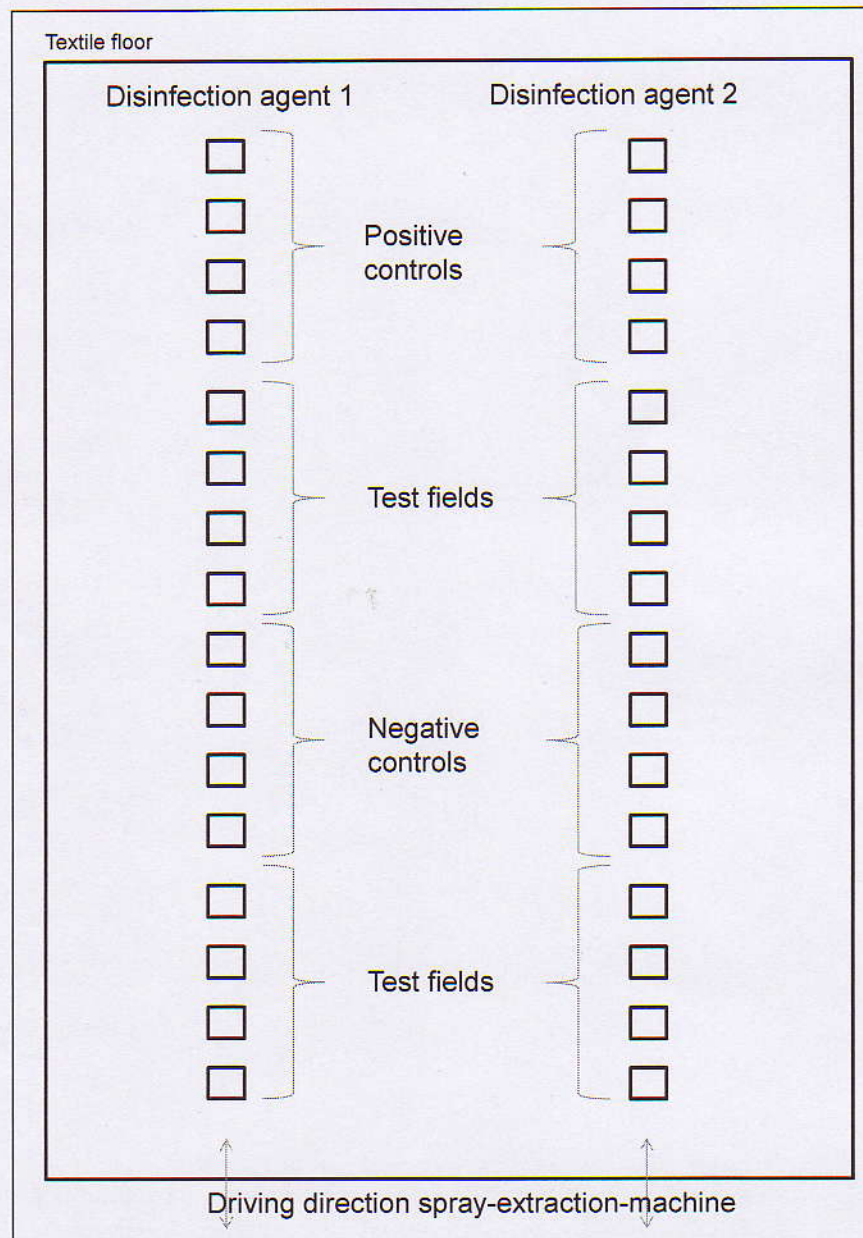


Figure 1: Schematic illustration of the experimental set-up. The figure shows a set-up, which was used for the experiments either only with one of the spray-extraction-machines or with the TW 412 spray-extraction-machine and the one-disc-machine.



The working steps with the machines were as follows:

1. The areas of the textile flooring were sprayed with the pump function of the spray-extraction machine that a concentration of approximately 400 – 600 ml per m<sup>2</sup> was reached. The jets of the TW 412 or TW Compact machines had an output of 2240 or 1850 ml per minute, respectively, so that a calculated spray time of 8 – 10 seconds per m<sup>2</sup> was postulated.
2. The disinfection agent was worked in by the means of the one-disc-machine at the experiments with the TW 412 spray-extraction machine at one half of the experimental set-up. This was done directly after spraying of the disinfection agent. The application time of the one-disc-machine was approximately 30 seconds per m<sup>2</sup>.
3. After 30 minutes disinfection time the disinfection agent was applied again with the spray-extraction-machine and directly vacuumed. The application time was approximately 12 seconds per m<sup>2</sup>.
4. Afterwards the total area of the textile flooring was vacuumed again without spraying the disinfection agent. The application time was approximately 12 seconds per m<sup>2</sup>.

### **3.4 Determination of the bacteria concentration on the textile flooring**

For determination of the amount of bacteria on the contaminated and/or treated fields sterile cotton swabs were used. 2 cotton swabs were used per field. The swabs were scrubbed successively over the fields and afterwards eluted and shaken in 2 ml CASO broth. Adequate volumes were plated on selection media and incubated. Additionally the nutrient media in which the swabs were eluted were incubated to determine qualitatively very low concentrations of bacteria.

Reduction factors were calculated by subtraction of the logarithmic number of bacteria on treated field by the logarithmic number of bacteria on positive controls.

### **3.5 Performance of the tests**

The tests with the TW412 spray-extraction machine and the RW 44-180 one-disc-machine were performed on October 04 and October 11, 2012 as double determination. The experiments with the TW Compact were performed on October 25 and November 08, 2012. The handling of the machines was partially accompanied by an employee of the company Cleanfix Reinigungssysteme.

### **3.6 Comments**

Investigation results apply solely to the samples investigated and their properties at the time of the investigation.

Investigation reports and test results may only be forwarded to third parties in their entirety, including relevant attachments. Publication or use for advertising purposes requires the prior written approval of wfk Institute for Applied Research GmbH.



## 4 RESULTS

### 4.1 Results with the TW412 spray-extraction machine and the RW44-180 one-disc machine

Incidin® Plus (3.0%, 30 min)

Test number	Mechanical work in with one-disc-machine	Amount of the sprayed on disinfection agent	Amount of the residual disinfection agent after vacuuming	Test-germ	Initial germ concentration (positive controls) [cfu/field]	Negative controls [cfu/field]	Test fields [cfu/field]	Reduction factor
1. test	- **	596 ml/m <sup>2</sup>	354 ml/m <sup>2</sup>	E. c.	3.0*10 <sup>5</sup>	0	0*	5.2
				E. h.	3.2*10 <sup>5</sup>	0	3.0*10 <sup>1</sup>	5.0
				S. a.	1.7*10 <sup>8</sup>	0	3.7*10 <sup>4</sup>	3.7
				P. a.	5.9*10 <sup>5</sup>	0	0*	5.5
	+ **	421 ml/m <sup>2</sup>	263 ml/m <sup>2</sup>	E. c.	3.0*10 <sup>5</sup>	0	0*	5.2
				E. h.	3.2*10 <sup>5</sup>	0	0*	5.2
				S. a.	1.7*10 <sup>8</sup>	0	0*	6.9
				P. a.	5.9*10 <sup>5</sup>	0	0*	5.5

\* The limit of detection is 2.0\*10<sup>1</sup> cfu/field. „0“ was used as < 2.0\*10<sup>1</sup> at the calculation of the reduction factor.

E.c. = *Escherichia coli*, E.h. = *Enterococcus hirae*, S.a. = *Staphylococcus aureus*, P.a. = *Pseudomonas aeruginosa*

\*\* „-“ only the TW 412 spray-extraction-machine was used, „+“ the TW 412 spray-extraction-machine was used in combination with the RW 44-180 one-disc-machine

Test number	Mechanical work in with one-disc-machine	Amount of the sprayed on disinfection agent	Amount of the residual disinfection agent after vacuuming	Test-germ	Initial germ concentration (positive controls) [cfu/field]	Negative controls [cfu/field]	Test fields [cfu/field]	Reduction factor
2. test	- **	305 ml/m <sup>2</sup>	78 ml/m <sup>2</sup>	E. c.	6.4*10 <sup>5</sup>	0	0*	5.5
				E. h.	1.8*10 <sup>7</sup>	0	1.0*10 <sup>4</sup>	3.3
				S. a.	2.8*10 <sup>8</sup>	6.0*10 <sup>1</sup>	> 2.0*10 <sup>5</sup>	< 3.1
				P. a.	7.8*10 <sup>7</sup>	2.0*10 <sup>1</sup>	2.3*10 <sup>4</sup>	3.5
	+ **	276 ml/m <sup>2</sup>	96 ml/m <sup>2</sup>	E. c.	6.4*10 <sup>5</sup>	0	0*	5.5
				E. h.	1.8*10 <sup>7</sup>	0	0*	6.0
				S. a.	2.8*10 <sup>8</sup>	0	0*	7.1
				P. a.	7.8*10 <sup>7</sup>	0	0*	6.6

\* The limit of detection is 2.0\*10<sup>1</sup> cfu/field. „0“ was used as < 2.0\*10<sup>1</sup> at the calculation of the reduction factor.

E.c. = *Escherichia coli*, E.h. = *Enterococcus hirae*, S.a. = *Staphylococcus aureus*, P.a. = *Pseudomonas aeruginosa*

\*\* „-“ only the TW 412 spray-extraction-machine was used, „+“ the TW 412 spray-extraction-machine was used in combination with the RW 44-180 one-disc-machine



## Kohrsolin® FF (1.5 %, 30 min)

Test number	Mechanical work in with one-disc-machine	Amount of the sprayed on disinfection agent	Amount of the residual disinfection agent after vacuuming	Test-germ	Initial germ concentration (positive controls) [cfu/field]	Negative controls [cfu/field]	Test fields [cfu/field]	Reduction factor
1. test	- **	734 ml/m <sup>2</sup>	340 ml/m <sup>2</sup>	E. c.	3,0*10 <sup>5</sup>	0	0*	5,2
				E. h.	3,2*10 <sup>5</sup>	0	2,2*10 <sup>4</sup>	2,2
				S. a.	1,7*10 <sup>8</sup>	0	> 4,0*10 <sup>4</sup>	< 3,6
				P. a.	5,9*10 <sup>5</sup>	0	0*	5,5
	+ **	585 ml/m <sup>2</sup>	427 ml/m <sup>2</sup>	E. c.	3,0*10 <sup>5</sup>	0	0*	5,2
				E. h.	3,2*10 <sup>5</sup>	0	0*	5,2
				S. a.	1,7*10 <sup>8</sup>	0	2,1*10 <sup>2</sup>	5,9
				P. a.	5,9*10 <sup>5</sup>	0	0*	5,5

\* The limit of detection is 2.0\*10<sup>1</sup> cfu/field. „0“ was used as < 2.0\*10<sup>1</sup> at the calculation of the reduction factor.

E. c. = *Escherichia coli*, E. h. = *Enterococcus hirae*, S. a. = *Staphylococcus aureus*, P. a. = *Pseudomonas aeruginosa*

\*\* „-“ only the TW 412 spray-extraction-machine was used, „+“ the TW 412 spray-extraction-machine was used in combination with the RW 44-180 one-disc-machine

Test number	Mechanical work in with one-disc-machine	Amount of the sprayed on disinfection agent	Amount of the residual disinfection agent after vacuuming	Test-germ	Initial germ concentration (positive controls) [cfu/field]	Negative controls [cfu/field]	Test fields [cfu/field]	Reduction factor
2. test	- **	220 ml/m <sup>2</sup>	89 ml/m <sup>2</sup>	E. c.	6.4*10 <sup>5</sup>	0	4.7*10 <sup>3</sup>	3.1
				E. h.	1.8*10 <sup>7</sup>	0	> 2.0*10 <sup>5</sup>	< 2.0
				S. a.	2.8*10 <sup>8</sup>	0	> 2.0*10 <sup>5</sup>	< 3.1
				P. a.	7.8*10 <sup>7</sup>	0	3.5*10 <sup>4</sup>	3.3
	+ **	432 ml/m <sup>2</sup>	144 ml/m <sup>2</sup>	E. c.	6.4*10 <sup>5</sup>	0	0*	5.5
				E. h.	1.8*10 <sup>7</sup>	0	0*	6.0
				S. a.	2.8*10 <sup>8</sup>	0	6.6*10 <sup>2</sup>	5.6
				P. a.	7.8*10 <sup>7</sup>	0	0*	6.6

\* The limit of detection is 2.0\*10<sup>1</sup> cfu/field. „0“ was used as < 2.0\*10<sup>1</sup> at the calculation of the reduction factor.

E. c. = *Escherichia coli*, E. h. = *Enterococcus hirae*, S. a. = *Staphylococcus aureus*, P. a. = *Pseudomonas aeruginosa*

\*\* „-“ only the TW 412 spray-extraction-machine was used, „+“ the TW 412 spray-extraction-machine was used in combination with the RW 44-180 one-disc-machine



#### 4.2 Results with the TW Compact spray-extraction machine

##### Kohrsolin FF (1,5%, 30 min)

Test number	Amount of the sprayed on disinfection agent	Amount of the residual disinfection agent after vacuuming	Test-germ	Initial germ concentration (positive controls) [cfu/field]	Negative controls [cfu/field]	Test fields [cfu/field]	Reduction factor
1. test	549 ml/m <sup>2</sup>	111 ml/m <sup>2</sup>	E. c.	$7.8 \cdot 10^5$	0	0*	5.6
			E. h.	$2.1 \cdot 10^7$	0	0*	6.0
			S. a.	$3.1 \cdot 10^8$	0	$1.5 \cdot 10^2$	6.3
			P. a.	$5.4 \cdot 10^7$	0	$2.0 \cdot 10^1$	6.4
2. test	489 ml/m <sup>2</sup>	10 ml/m <sup>2</sup>	E. c.	$5.0 \cdot 10^6$	0	0*	5.4
			E. h.	$2.6 \cdot 10^7$	0	0*	6.1
			S. a.	$1.1 \cdot 10^9$	0	$4.1 \cdot 10^2$	6.4
			P. a.	$2.2 \cdot 10^7$	0	$2.0 \cdot 10^1$	6.0

\*\* The limit of detection is  $2.0 \cdot 10^1$  cfu/field. „0“ was used as  $< 2.0 \cdot 10^1$  at the calculation of the reduction factor.

E.c. = *Escherichia coli*, E.h. = *Enterococcus hirae*, S.a. = *Staphylococcus aureus*, P.a. = *Pseudomonas aeruginosa*